PUNCH
consulting engineers

Estuary Way, St. Michael's Drive, Mahon, Cork City

Engineering Planning Report

234139-PUNCH-XX-XX-RP-C-0004

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1 Introduction

This report was prepared to accompany a planning application for the proposed development on a site Estuary Way, located at St. Michael's Drive, Mahon, Cork. The site location is shown in Figure 1-1 below.

The site measures approximately 1 hectare, located in a suburban area in the southeastern part of Cork City. In terms of its specific location, it is located at 572329 Easting, and 570704 Northing to Irish Transverse Mercator (ITM).

The site is bounded by the following road infrastructure:

1. Saint Michael's: This road runs along the southern boundary of the subject site in an east-west direction.
2. Ballinure Cottages Road: Situated to the north of the site, this road forms a cul-de-sac at the northern site boundary.
3. Saint Michael's Close: Located to the east of the site, this road also forms a cul-de-sac at the east site boundary.

The site area has varied elevations. The highest point is in the northwest corner (approximately 11.5mOD) and it slopes down in a southeasterly direction. The lowest point is centrally located on the eastern boundary (approximately 8.5mOD). This slope pattern suggests that water will naturally drain towards the southeast to the eastern boundary. Please refer to Appendix C for the full topographical survey.

Figure 1-1: Site Location of the Proposed Development

1.1 Proposed Development

The proposed works are outlined in a series of architectural drawings prepared by O'Mahony Pike Architect's and engineering drawings prepared by PUNCH Consulting Engineers and supplied as part of the planning documentation.

The proposed development consists of the provision of 38no. single storey semidetached modular units, including:

- 34no. Type 1A: 2 bed units (including provision for optional layouts Type 1B, 1C & 1D)
- 2no. Type 2A: 2 bed accessible units (including provision for optional layout Type 2B), and
- 2no. Type 1B: communal/office space units (including provision for optional layouts Type 1A, 1C & 1D)

And all associated site development, landscape and boundary works, including:

- 12no. car parking spaces
- 2no. disabled parking space
- 2no. set-down space
- Communal open space (c. 780sqm)
- Public open space (c. 1078sqm)
- Relocation of existing bus stop to allow for site entrance and
- 1no. ESB unit substation.

An extract from the architectural site layout is shown in Figure 1-2.

Figure 1-2: Extract from Architect's Site Layout (ref: O'Mahony Pike Architects)

2 Stormwater Drainage Design

2.1 Existing Stormwater Drainage

An underground utility survey conducted by Murphy Geospatial in January 2024 revealed details about the stormwater drainage infrastructure in the vicinity the site. Notably, a 900mm diameter concrete stormwater sewer runs along St. Michael's Drive, flowing in an easterly direction. Please refer to Appendix A for the utility survey illustrating the existing stormwater drainage arrangement.

2.2 Existing Site Hydrogeology

Rainfall data derived from Met Eireann records (refer to Appendix B) indicate the following rainfall parameters are relevant to the site:

- M5-60 = 17.3
- M5-2D = 78.8
- Ratio "R" = 0.22

Ground investigations will be conducted prior to construction. As a basis for the outline design an infiltration rate of 5.1855×10^{-5} m/s has been assumed for the purpose of sizing the soakaway, based on an adjacent site's Ground Investigation Report, which included infiltration testing. Guidance from Table 25.1 of the CIRIA SuDS Manual has also been considered, with typical infiltration rates of 1×10^{-5} m/s to 5×10^{-5} m/s expected for subsoils of a gravelly/sandy/clayey nature. Nonetheless, site-specific soakaway testing will be performed before commencement to provide a more accurate estimation of the available infiltration rate.

2.3 Proposed Stormwater Drainage

The surface water drainage strategy for the proposed park development will adhere to the principles of Sustainable Drainage Systems (SuDS), as detailed in Sections 2.4 and 2.5 of this report. The overall strategy involves collecting runoff from impermeable surfaces using buried pipework, which will direct the water to two soakaway systems located beneath grassed public open spaces, as such the site is split in two sub-catchments, Sub-Catchment 1 (North) and Sub-Catchment 2 (South), as shown below in Figure 2-1.

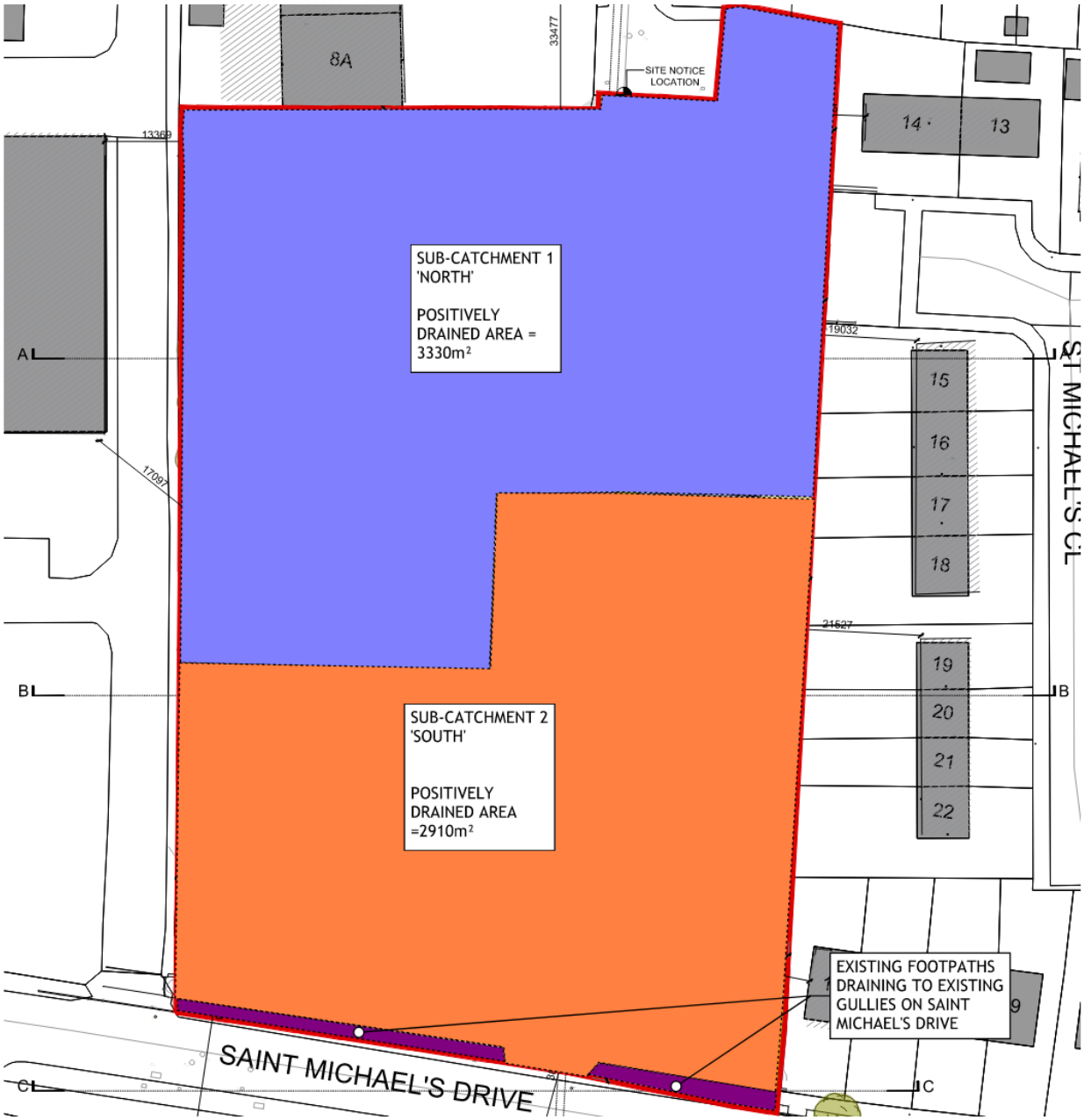


Figure 2-1: Drainage Sub-Catchment Strategy

Due to the southern sub-catchment of the site having provision for car parking spaces, a by-pass petrol interceptor will be installed as a pre-treatment measure before discharging to the southern soakaway. Additionally, each of the two inlet manholes to the soakaway systems will include a 0.5m sump.

All surface water runoff from the proposed development will be managed within the site boundary, infiltrating naturally into the ground without discharging into any existing surface water drainage

networks. This approach ensures a sustainable and self-sufficient means of surface water management, replicating pre-development conditions by returning water to the ground at its source. The existing footpaths on St. Michael's Drive will remain draining to existing gullies on the public carriageway.

The proposed surface water drainage system has been designed using Causeway Flow software, in accordance with the Department of Environment and Local Government's guidance document "Recommendations for Site Development Works for Housing Areas". Further design parameters and guidance were adopted from the following documents:

- Greater Dublin Strategic Drainage Study, 2005
- Greater Dublin Regional Code of Practice for Drainage Works, 2005
- CIRIA Report C753 – The SuDS Manual v6, 2015
- CIRIA Report C768 – Guidance on the construction of SuDS, 2017
- BRE Digest 365 – Soakaway design, 2016
- Flood Studies Report, 1975
- and the Cork City Development Plan, 2022-2028

A new surface water sewer network, entirely separate from the foul water sewer network, will be provided for the development.

Table 2-1 outlines the stormwater drainage design parameters used, and detailed simulation results are included in Appendix D. Additionally, please refer to drawing 234139-PUNCH-XX-XX-DR-C-0101, which shows the proposed drainage plan layout for the development.

Table 2-1: Stormwater Drainage Design Parameters

Description	Value	Standard Reference / Notes
Gross Site Area	1.01 ha	Redline Boundary
Net Site Area	0.624 ha 0.333 ha Sub-Catchment 1 (North) 0.291 ha Sub-Catchment 2 (South)	Positively Drained Site Area
Return period target	Pipe Design 1 in 5 year – no surcharge Network Design 1 in 30 year – surcharge allowed, no flooding Network/Attenuation Design 1 in 100 year – flooding contained on site	GDSDS
Climate Change	20%	GDSDS
M5-60	17.3mm	Met Éireann Rainfall Data (2023 Model)
Ratio R	0.22	Met Éireann Rainfall Data (2023 Model)
SOIL type	4 (clayey)	Adjacent Site SI
Infiltration Rate	5.1855×10^{-5} m/s (0.1866 m/hr)	Adjacent Site SI

Attenuation Storage Volume	Soakaway North 185m^3 Soakaway South 152m^3 Total = 337m^3	BRE365
Flow reduction parameter	N/A	Discharge to ground
Interception Volume	N/A	Discharge to ground via soakaways, hence interception treatment requirement satifisfied by default.
Treatment Volume	N/A	Treatment volume not required as interception criteria satisfied.
Max. velocity at pipe full	3.0 m/s	
Min. velocity	1.0 m/s 0.75 m/s where not practicable	GDSDS Table 6.4
Minimum cover	1.2m under roadways 0.9m elsewhere	GDSDS Table 6.4
Rougness – ks	0.6mm	GDSDS Table 6.4

2.4 Compliance with GDSDS and SuDS Principles

The proposed development is designed in full accordance with the principles of Sustainable Drainage Systems (SuDS) as recommended by the Greater Dublin Strategic Drainage Study (GDSDS). The GDSDS promotes sustainability by requiring designs to comply with specific drainage criteria that aim to minimize the impact of urbanization by replicating the runoff characteristics of the greenfield site. These criteria ensure a consistent approach to managing the increase in both the rate and volume of runoff, as well as protecting the environment from pollution caused by roads and buildings. The drainage design criteria are as follows:

- Criterion 1: River Water Quality Protection
- Criterion 2: River Regime Protection
- Criterion 3: Level of Service
- Criterion 4: River Flood Protection

To satisfy SuDS requirements, developments typically incorporate:

- Interception storage
- Treatment storage (unnecessary if interception storage is adequate)
- Attenuation storage
- Long-term storage (unnecessary if QBAR growth factors are not applied in attenuation storage design)

In this case, surface water discharge will be managed entirely through infiltration via 2 no. soakaways, which are equipped to handle attenuation storage needs for storm events up to the 1% AEP event. This approach negates the need for off-site surface water discharge, ensuring full interception storage and eliminating the requirement for treatment or long-term storage.

2.4.1 Criterion 1 GDSDS – River Water Quality Protection

Natural greenfield areas typically contribute minimal pollution and sediment to rivers, as most rainfall percolates into the ground, preventing direct runoff to rivers during most rainfall events. In contrast, urban areas with pipe drainage systems experience runoff from almost every rainfall event, often carrying higher levels of pollution, especially during the initial phase of runoff, with minimal percolation into the ground. To mitigate this, Criterion 1 mandates the provision of interception storage and/or treatment storage to replicate the runoff characteristics of pre-development greenfield sites.

2.4.1.1 Interception Storage

Interception storage should ensure that at least the first 5mm of rainfall is retained on-site and does not reach receiving waters. For the subject site, surface water discharge will be managed via infiltration through two soakaway systems, ensuring by default compliance with the 5mm interception requirement.

2.4.1.2 Treatment Storage

According to the GDSDS, interception and treatment storage are interchangeable. Since full interception storage is provided through the soakaway systems, additional treatment storage is not necessary.

2.4.2 Criterion 2 GDSDS - River Regime Protection

Unchecked runoff from developed sites through traditional pipe networks discharges into receiving waters at rates significantly higher than pre-development levels, causing flash flows that can lead to scour and erosion in rivers and streams, as such the following requirements are to be met:

1. "Discharge rate equal to 1 – year Greenfield site peak runoff rate or 2 l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume".
2. "Discharge rate equal to 1 in 100 year Greenfield site peak runoff rate or 2 l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume".

No runoff shall be leaving the site with all runoff being collected by proposed stormwater drainage and ultimately infiltrating into the ground, therefore the development meets the requirements of Criterion 2.

2.4.3 Criterion 3 GDSDS - Level of Service (Flooding) for the site

The GDSDS stipulates that no flooding should occur on-site for storms up to and including the 1 in 30-year event. The pipe network and attenuation storage volumes must be sufficient to prevent site flooding, though partial surcharging is acceptable as long as it does not lead to flooding.

For the 1 in 100-year + 20% climate change (CC) event, the pipe network can fully surcharge and cause site flooding, but the peak water level must be at least 500mm below any vulnerable internal floor levels, and floodwaters must be contained within the site. The top water level in any attenuation device during this event must also be at least 500mm below any vulnerable internal floor levels.

Appendix D provides the stormwater drainage calculations, including soakaway volumes, demonstrating that the soakaway systems will not flood during the 1 in 100-year + 20% CC event. The peak volume for this event is as follows for the two sub-catchments:

1. Northern Sub-Catchment - 184m^3 for the northern sub-catchment, corresponding to a depth of 1.76m in the soakaway structure, resulting in a top water level of +7.76m, which is more than 500mm below any adjacent floor levels.
2. Southern Sub- Catchment - 151m^3 for the northern sub-catchment, corresponding to a depth of 1.98m in the soakaway structure, resulting in a top water level of +7.63m, which is more than 500mm below any adjacent floor levels.

Therefore, Criterion 3 is satisfied.

2.4.4 Criterion 4 GDSDS - River Flood Protection

Criterion 4 aims to prevent flooding of the receiving system or watercourse by either limiting the runoff volume to pre-development levels using "long-term storage" (Option 1) or by limiting the runoff rate for the 100-year storm to QBAR without growth factors using "extended attenuation storage" (Option 2).

As the proposed development includes two soakaway systems that manage all surface water on-site, there will be no discharge to river networks. The soakaway have been designed to provide sufficient storage thus meeting design Criterion 4.

2.5 SuDS Proposals

The proposed development has been assessed in relation to Sustainable Urban Drainage Systems (SuDS). A variety of SuDS measures may be adopted to comply with Council recommendations. All SuDS measures are to be implemented with reference to the UK Suds Manual and Cork City Council drainage requirements.

The SuDS processes decrease the impact of the development on the receiving environment by providing amenity and biodiversity in many cases. Regular maintenance of the SuDS proposals is required to ensure they are operating to their optimal level throughout their design life. There are four critical objectives that SuDS seek to meet (refer to Figure 2-2):

1. Quantity: managing flows and volumes to match the rainfall characteristics before development, in order to prevent flooding from outside the development, within the site and downstream of the development.
2. Amenity: enhancing people's quality of life through an integrated design that provides useful and attractive multifunctional spaces.
3. Quality: preventing and treating pollution to ensure that clean water is available as soon as possible to provide amenity and biodiversity benefits within the development, as well as protecting watercourses, groundwater and the sea.
4. Biodiversity: maximising the potential for wildlife through design and management of SuDS.

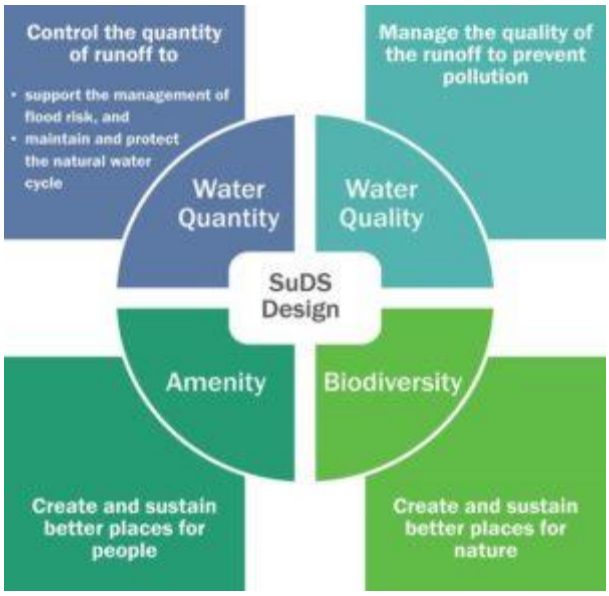


Figure 2-2:The four pillars of SuDS design (ref. CIRIA753 SuDS Manual)

The specific measures adopted for the proposed development have been agreed in principle with Cork City Council and comprise the following:

2.5.1 Rainwater Butts

Runoff from the roof is considered 'clean' and is often reused for facilities such as toilet flushing, landscape irrigation etc. For this development roof runoff from the residential units is being directed to a rainwater butt. The rainwater butt will be equipped with a high-level overspill pipe to connect to the proposed stormwater drainage system.

2.5.2 Soakaways

The soakaways will provide the required level of attenuation storage within the voids in the proprietary cellular storage system. The base and sides of the soakaways will be lined. The proposed soakaways will accommodate the 1% AEP (annual exceedance probability) rainfall event with an allowance for 20% climate change, using an assumed infiltration rate of 5.885 x 10^{-5} m/s. Site-specific soakaway testing will be carried out prior to commencement to establish a more accurate estimation of the available infiltration rate. The proposed soakaways will be proprietary cellular storage crate soakaway systems with the following measurements:

- Soakaway North volume 185m^3 - 13.5m long by 8m wide by 1.8m deep
- Soakaway South volume 152m^3 – 10m long by 8m wide by 2m deep
- Total volume = 337m^3

Both soakaways will have a voids ratio of approximately 95%. Additionally, both soakaways will have a 0.5m sump located upstream of the soakaway inlet.

2.5.3 Petrol Interceptor

It is proposed that all surface water run-off from car park areas will outfall via a Class 1 Bypass Separator located upstream of the proposed southern soakaway. This device will remove hydrocarbons and fine sediment particles from the site runoff and lower the risk of downstream contamination following an oil spillage on site.

Bypass separators fully treat all flows generated by rainfall rates of up to 6.5mm/hr. This covers over 99% of all rainfall events. Flows above this rate are allowed to bypass the separator. These separators are used when it is considered an acceptable risk not to provide full treatment for high flows, for example where the risk of a large spillage and heavy rainfall occurring at the same time is small.

Class 1 devices are designed to achieve a concentration of less than 5mg/l of oil under standard test conditions.

The by-pass separator has been sized in accordance with IS EN 858-2:2003. Please refer to Appendix E for supporting sizing calculations.

2.6 SuDS Maintenance

Regular maintenance of the SuDS is crucial to ensure optimal performance and longevity of the drainage infrastructure. The following maintenance procedures have been incorporated into the overall drainage design for the proposed development:

2.6.1 Water Butts

The water butt should be emptied completely every now to enable scrubbing out the interior and remove the sludge, algae and grime that builds up on the sides and bottom of the container. The water butts should be fitted with an overflow pipe that connects directly to the surface water drainage system.

2.6.2 Underground Modular Soakaway Systems

Inspection of the system should be carried out monthly for the first 3 months, and then anually to ensure that the system is working correctly. Debris should be removed monthly from the catchment surface where it may cause risk to the performance of the system. The inside of the soakaway should be surveyed every 5 years, or as required, if performance is reduced. Sediment build up to be removed if necessary.

As required, sediment from the silt trap manhole prior to the soakaway system should be removed to ensure on going performance of the system.

2.6.3 Petrol Interceptor

Petrol interceptor should be visually inspected for every rainfall event for 30 days after installation and the amount of sediment measured to give the operator an idea of the expected rate of deposition. System should then be inspected every 6 months to verify the appropriate level of maintenance. Floating debris and solids should be removed, and the sump cleaned with a conventional sump vacuum cleaner. Filter media should be replaced, and sediments, oil and grease should be removed where required.

3 Foul Water Drainage Design

3.1 Existing Foul Water Drainage

Irish Water's online records indicate a 300mm diameter foul sewer running along St. Michael's Drive. However, a utility survey conducted by Murphy Geospatial in January 2024 suggests it is a 225mm diameter uPVC pipe. A slit trench will be dug prior to construction to confirm the exact size of the existing foul sewer. For this report, we assume Irish Water's records are accurate, and a 300mm diameter foul sewer will be referenced throughout.

It should be noted that investigations, including tracing and CCTV, are underway to confirm whether the 225mm diameter sewer to the north of the site crosses the site. According to the Uisce Éireann Confirmation of Feasibility letter, if the sewer does traverse the site, it will be diverted during the detailed design works.

Please refer to Appendix A for Utility Survey illustrating the existing foul water drainage arrangement. An extract from the Irish Water online records is shown in Figure 3-1 below.

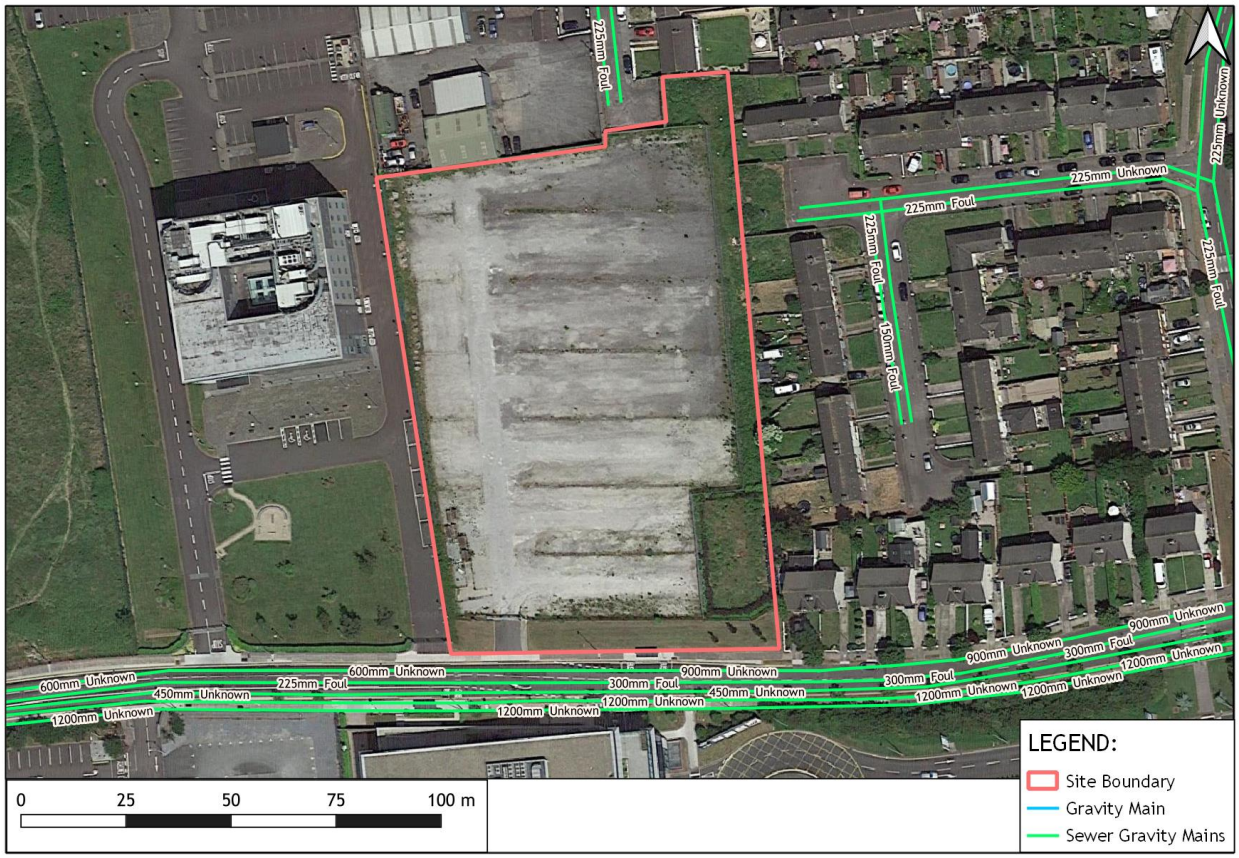


Figure 3-1: Existing foul drainage surrounding the site (Extract from Irish Water online records).

3.2 Proposed Foul Water Drainage

The proposed foul water sewers have been designed using Causeway Flow software in accordance with the DOE's "*Recommendations for Site Development Works for Housing Areas*". The foul loading has been calculated in accordance with "Code of Practice for Wastewater Infrastructure" (particularly clause 36, Appendix C and Appendix D) published by Uisce Éireann.

It is proposed that the foul sewer will discharge by gravity to the existing 300mm diameter public foul sewer on St. Michael's Drive.

Table 3-1 describes the foul water drainage design parameters used and detailed calculations are enclosed in Appendix F.

Table 3-1: Foul Water Drainage Design Parameters

Description	Value
Residential Flow Rate	150 l/per/day
Persons per Dwelling	2.7
Office Flow Rate	90 l/per/day
Persons per Office Unit	5
Infiltration	10%
Peaking Factor	6 DWF (Residential) 4.5 DWF (Commercial)
Minimum Self Cleansing Velocity	0.75m/s
Minimum Pipe Diameter	150mm

Table 3-2: Foul Water Loading Calculations

Category	Quantity	Flow Rate	Daily Flow (l/day)	DWF (l/s)	Design Peak Flow (l/s)
Residential	36 units x 2.7 per/unit =>98 persons	150 l/per/day	14,700 + 10% = 16,170	0.187	1.122
Office	2 units x 5 per / unit = 10 persons	90 l/per/day	900 + 10% = 990	0.012	0.054
Total			**17,160**	**0.199**	**1.176**

A Pre-Connection Enquiry Form has been issued to Uisce Éireann in relation to the proposed development. Uisce Éireann has provided a response, advising that the wastewater connections is feasible without any infrastructure upgrade. Please refer to Appendix G for Uisce Éireann correspondence.

4 Watermain Design

4.1 Existing Watermain

Uisce Éireann record drawings indicate that a 250mm ductile iron watermain runs parallel to the southern boundary of the site, along Saint Michael's Drive. This was subsequently confirmed by a utility survey conducted by Murphy Geospatial in January 2024.

Please refer to Appendix A for Utility Survey illustrating the existing watermain arrangement in the area. An extract from Uisce Éireann online records is shown in Figure 4-1 below.

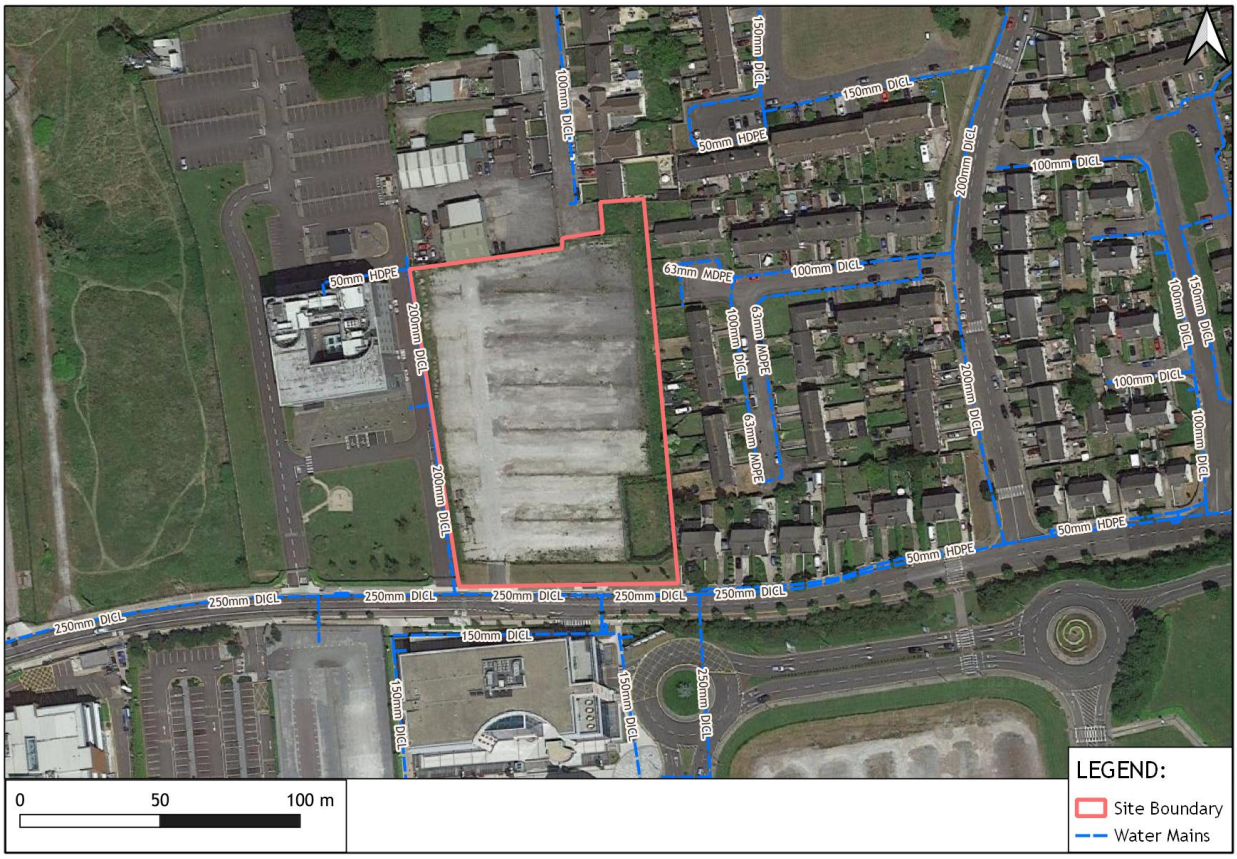


Figure 4-1: Existing watermain surrounding the site (Extract from Uisce Éireann online records).

4.2 Proposed Watermain

It is generally accepted that the design loading for foul drainage can be used to evaluate an approximation of the water demand on the site. With reference to Uisce Éireann's Code of Practice for Water Infrastructure, the average daily flow is calculated as the number of persons multiplied by the flow rate per person. The average day peak week flow is taken to be 1.25 x the average flow, and the peak demand is taken to be the average day peak week flow multiplied by a peaking factor of 5.

Table 4-1 describes the watermain design parameters used, and water demand calculations are described in Table 4-2.

Table 4-1: Watermain Design Parameters

Description	Value
Residential Flow Rate	150 l/per/day
Persons per Dwelling	2.7
Office Flow Rate	90 l/per/day
Persons per Office Unit	5
Residential Flow Rate	150 l/per/day
Persons per Dwelling	2.7
Average Demand	1.25 DWF
Peak Demand	5 Average Demand

Table 4-2: Water Demand Calculations

Category	Quantity	Flow Rate	Daily Flow (l/day)	DWF (l/s)	Average Demand (1.25DWF) (l/s)	Peak Demand (5AVG) (l/s)
Residential	36 units x 2.7 per/unit =>98 persons	150 l/per/day	14,700	0.1700	0.2127	1.0634
Office	2 units x 5 per / unit = 10 persons	90 l/per/day	900	0.0104	0.0130	0.0650
Total			**15,600**	**0.1804**	**0.2257**	**1.1284**

On the basis of the above tables, the development will have an increase in average water demand of 0.2257l/s and a peak water demand of 1.1284l/s.

It is proposed to construct a 100mm diameter watermain to serve the proposed development based on the above calculated demand. The proposed watermain will connect to the existing 250mm diameter ductile iron watermain on St. Michael's Drive.

This feed will provide potable and firefighting water to the proposed development. A bulk water meter shall be provided at the site boundary at the location of the proposed connection to the existing watermain. The watermain layout has been designed in accordance with "Uisce Éireann Code of Practice for Water Infrastructure". All watermains are to be constructed in accordance with Uisce Éireann Code of Practice and the Local Authority's requirements. Fire coverage is to be reviewed and certified by the fire consultant.

To reduce the water demand on Local Authority water supplies and to reduce the foul discharge from the development, water conservation measures will be incorporated in the sanitary facilities throughout the development, e.g. dual flush toilets, monobloc low volume push taps and waterless urinals.

Rainwater harvesting via rainwater butts is also proposed as part of the SuDS design, to service non-potable water supply. This will also serve to improve water reduction.

A Pre-Connection Enquiry Form has been issued to Uisce Éireann in relation to the proposed development. Uisce Éireann has provided a response, advising that water servicing is feasible without any infrastructure upgrade. Please refer to Appendix G for Uisce Éireann correspondence.

5 Flooding

Planning guidelines on flood risk and development have been published by the OPW and Department of Environment, Heritage and Local Government (DoEHLG). The following sections summarise how the development's design adheres to the main principles of the guidelines.

5.1 Sequential Approach

The sequential approach utilizes flood zones for river and coastal flooding, as described below:

- **Zone A** – High probability. This zone defines areas with the highest risk of flooding. For river flooding it is defined as more than 1% probability or more than 1 in 100 year, and for coastal flooding it is defined as 0.5% probability or more than 1 in 200 year.
- **Zone B** – Moderate probability. This zone defines areas with a moderate risk of flooding. For river flooding it is defined as 0.1% to 1% probability or between 1 in 100 and 1 in 1,000 years, and for coastal flooding 0.1% and 0.5% probability or between 1 in 200 and 1 in 1,000 years.
- **Zone C** – Low probability. This zone defines areas with a low risk of flooding less than 0.1% probability or less than 1 in 1,000 years.

The flood zones are then to be looked at with the vulnerability of the building proposed;

- Highly Vulnerable – Hospitals, Garda stations, homes, motorways etc.
- Less Vulnerable – Commercial, retail, offices etc.
- Water Compatible – Marina's, green areas

A sequential approach is then used to determine the most favourable location for the development based on its vulnerability:

- **Zone A** - Water Compatible or Justification Test
- **Zone B** - Less Vulnerable if no other lands are available or highly vulnerable with Justification Test
- **Zone C** - Any development

5.2 Development Sequential Test

5.2.1 Coastal Flood Risk

Coastal flooding results from sea levels which are higher than normal and result in sea water overflowing onto the land. Coastal flooding is influenced by the following three factors which often work in combination: high tide level, storm surges and wave action.

The Catchment Flood risk and Management Study (CFRAMS) is a national programme to assess and manage flood risk. A review of the CFRAM mapping (images ref. Figure 5-1 (ref: CFRAMS Maps)) has revealed that the developed study area is not located in a flood risk area (flood risk is less than 1 in 1000) in any given year. Therefore, there is no risk associated with coastal flooding for the site.

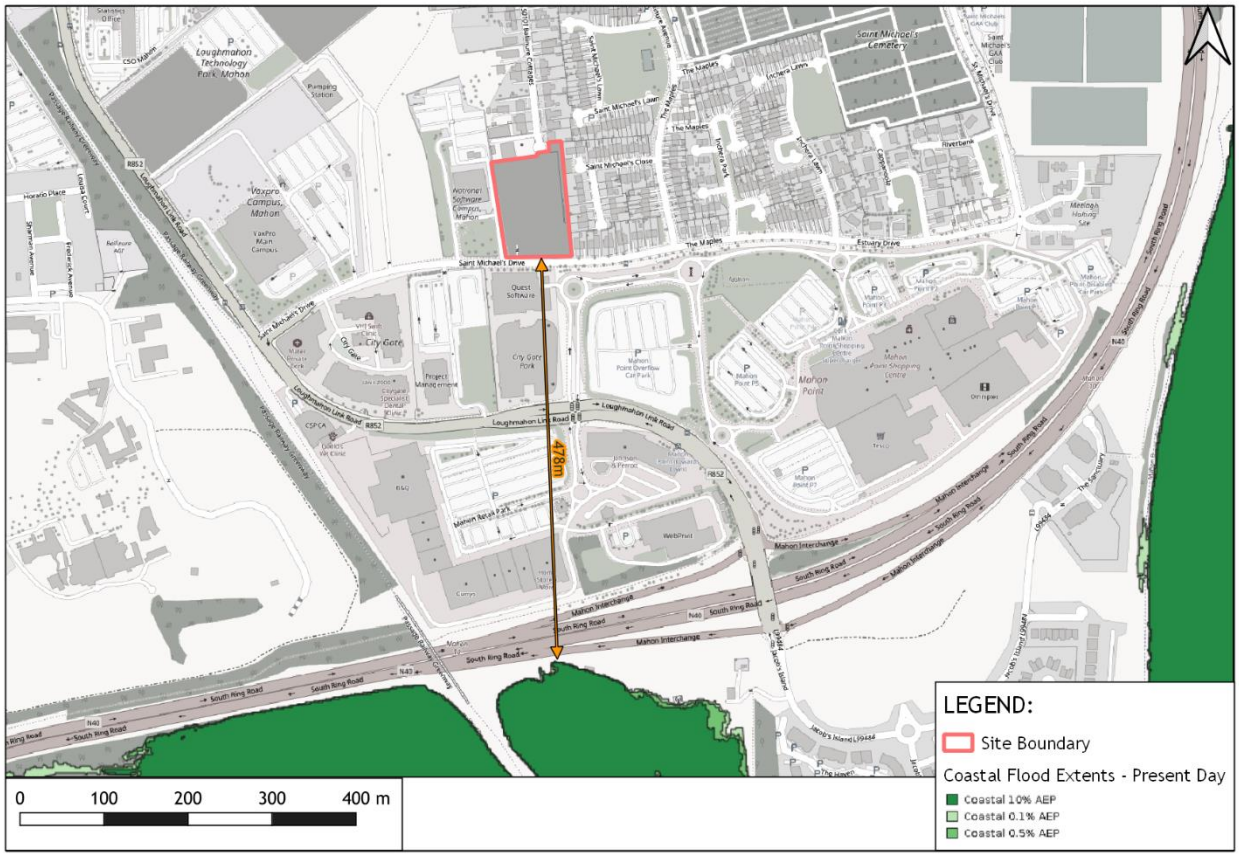


Figure 5-1: Coastal Flooding

5.2.2 Fluvial Flood Risk

Fluvial flooding occurs when a river exceeds its capacity and overflows onto the adjacent floodplain. The proposed development is not located near any rivers, so there is no fluvial flood risk to the site.

5.2.3 Pluvial Flood Risk

Pluvial flooding results from overland flows of rainfall-generated runoff before it can enter any watercourse or sewer, typically associated with high-intensity rainfall. The Preliminary Flood Risk Assessment (PFRA) mapping does not identify pluvial flood risk for this site. Additionally, the proposed drainage network is designed to accommodate a 100-year return period plus a 20% climate change allowance, mitigating pluvial flooding concerns.

5.2.4 Groundwater Flooding

According to the Geological Survey of Ireland (GSI) groundwater flooding probability maps, there is no groundwater flooding risk in this area.

5.2.5 OPW Flood Maps

The OPW Past Flood Event Local Area Summary Report has identified flood events within 2.5 km of the study area, however none of these events directly affect the site area.

5.3 Flood Risk Assessment Conclusions

The site has been assessed in accordance with the "The Planning System and Flood Risk Management" Guidelines. As part of the sequential test, the OPW flood hazard maps have been consulted, as have the Catchment Flood Risk Assessment Maps produced by the OPW.

As the study area is located within Flood Zone C, the justification test is not applicable, and the site is appropriate for the proposed residential development.

6 Roads and Access

6.1 Proposed Roads & Access

Access to the site will be via a new entrance on St. Michael's Drive. The proposed road layout has been designed following the principles outlined in the Design Manual for Urban Roads and Streets (DMURS) and the Recommendations for Site Development Works. DMURS aims to facilitate the creation of safer, more attractive, and vibrant streets that promote and sustain communities and neighbourhoods. This includes accommodating cars, other vehicles, pedestrians, cyclists, and public transport users.

Research indicates that narrow carriageways are highly effective for traffic calming. This principle has been integrated into the development's design, resulting in a proposed internal carriageway with a shared surface width of 4.8 meters, compliant with Section 4.4.1 of DMURS.

Autotrack assessments were performed on the proposed road network to ensure that emergency vehicles, such as fire tenders, can safely navigate the internal road network and turning heads.

6.2 Sightlines

Sightlines for the proposed entrance to the development have been designed in accordance with sections 4.4.4 and 4.4.5 of DMURS. These sightlines were evaluated from a setback distance of 2.4 meters from the road edge, using the Stopping Sight Distance (SSD) Table 4.2, an extract of which is shown in Figure 6-1. The vehicle design speed is based on the existing speed limit of 50 km/h on St. Michael's Drive. Given that the proposed junction is onto a road with existing bus routes, a sightline of 49 meters is required. At a 2.4-meter setback from the road edge, these sightlines ensure safe access and egress to the proposed development, as illustrated in drawing 234139-PUNCH-XX-XX-DR-C-0400.

SSD STANDARDS

Design Speed (km/h)	SSD Standard (metres)
10	7
20	14
30	23
40	33
50	45
60	59

Forward Visibility

Design Speed (km/h)	SSD Standard (metres)
10	8
20	15
30	24
40	36
50	49
60	65

Forward Visibility on Bus Routes

Figure 6-1: Table 4.2 extract from DMURS (SSD Standards within cities towns and villages)

6.3 Traffic Impact Statement

The proposed development is below the threshold set by Transport Infrastructure Ireland (TII) for requiring a Traffic and Transport Assessment (TTA) as per Section 2 of the Traffic and Transport Assessment Guidelines (May 2014). Therefore, no traffic survey has been completed as part of this analysis.

6.4 Parking

The development will include 12 standard car parking spaces and 2 disabled parking spaces, totalling 14 car parking spaces. This is below the maximum permitted number of 36 spaces under the Cork City Development Plan (CCDP) 2022-2028, Table 11.13. See Table 6-1 below for a detailed breakdown.

Table 6-1: Car Parking Breakdown

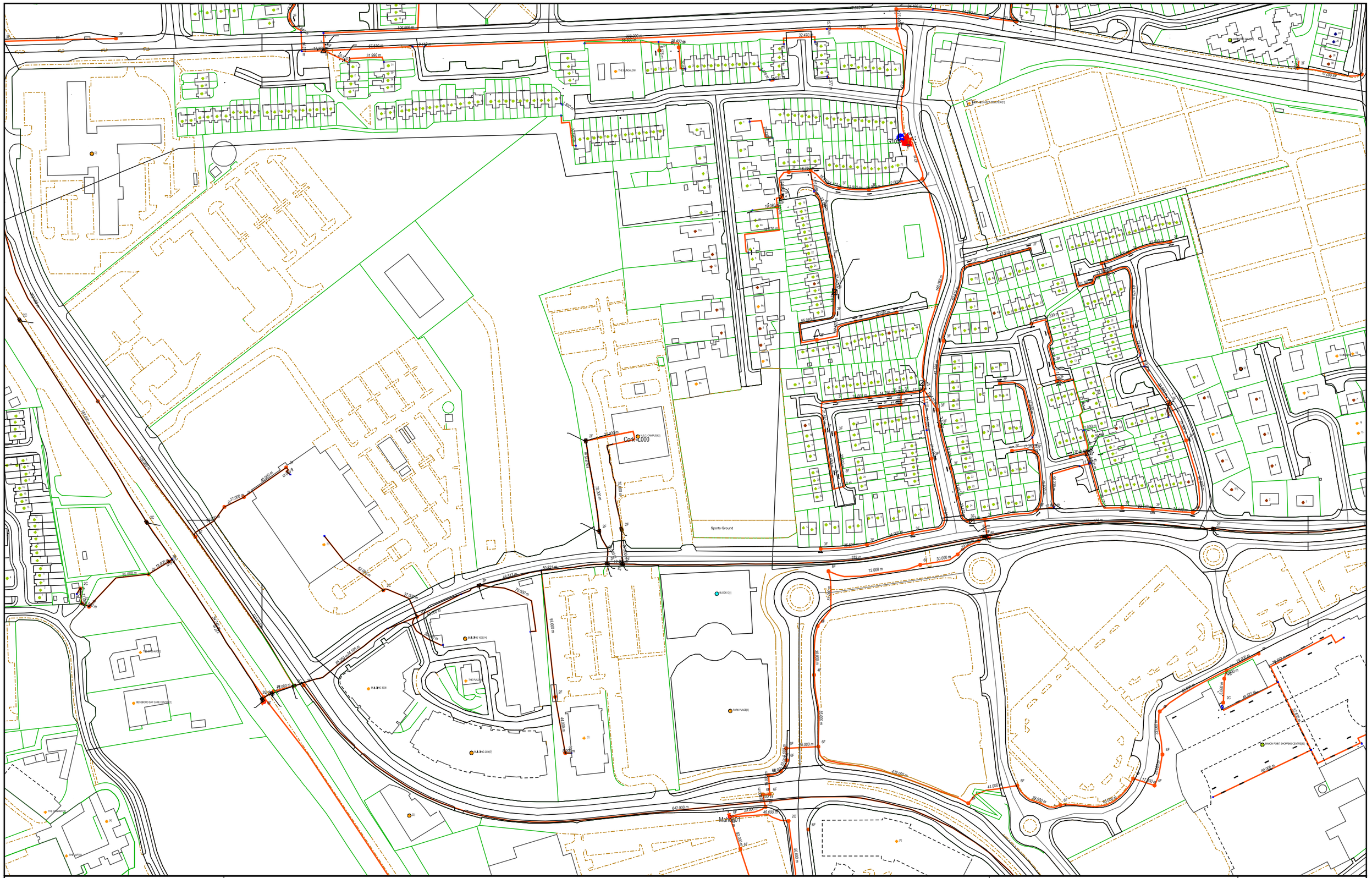
Type	Maximum no. car parking spaces permitted under CCDP for Zone 2	Maximum no. car parking spaces permitted	No. car parking spaces provided
Residential 2-bed	1 per unit	36 units x 1 = 36 total	14 total

The provision of 2 disabled parking spaces exceeds the 5% requirement under the CCDP 2022-2028. Additionally, 2 set-down spaces will be provided in front of the pedestrian/vehicular gates to the development.

Three of the 14 car parking spaces (1 per 5 parking spaces) will be equipped with Electric Vehicle (EV) charging points. The remaining spaces will have the infrastructure for future installation of EV charging points.

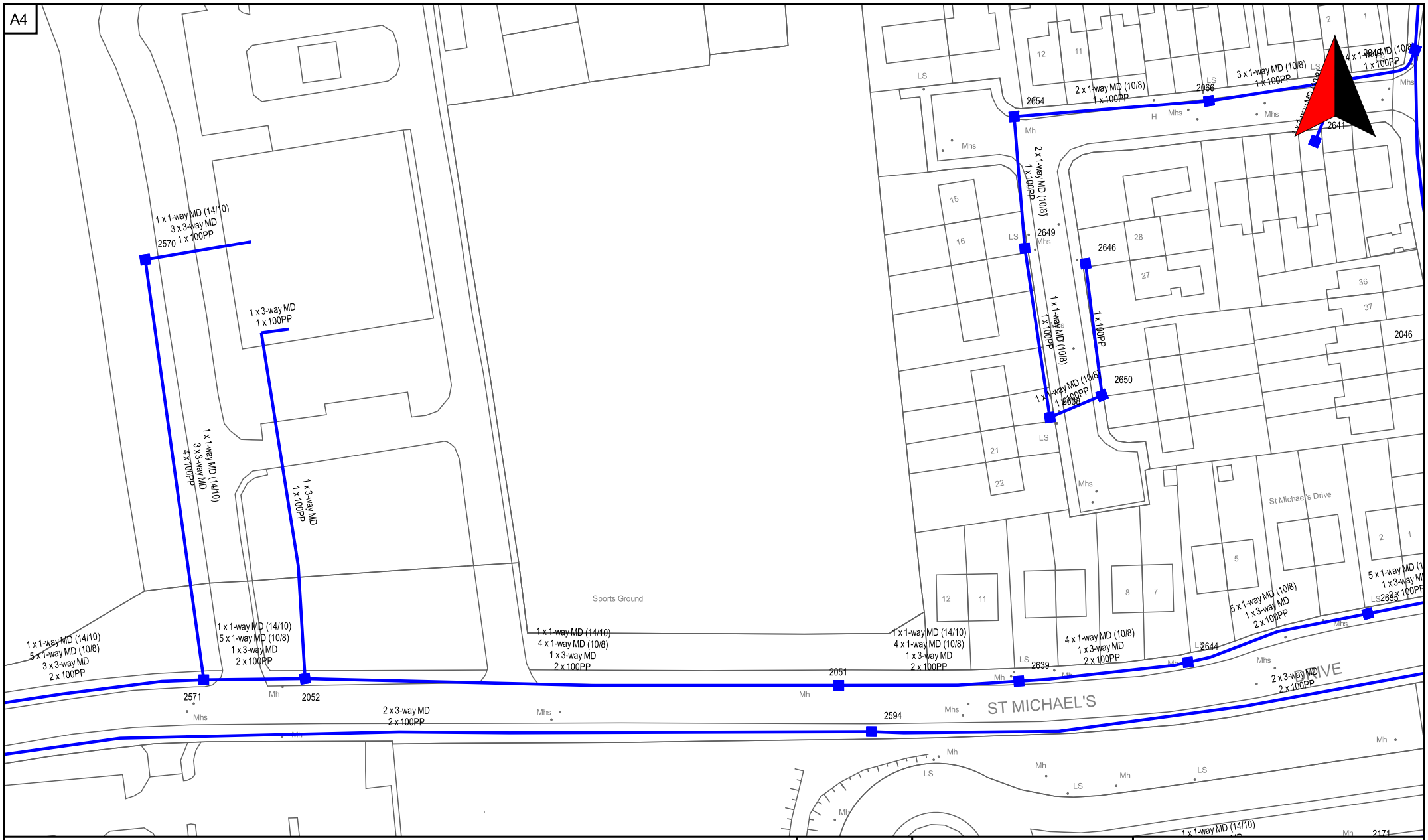
Bicycle parking is planned to be within the private gardens of the residences; therefore, no designated bicycle parking spaces are proposed.

Appendix A Existing Record Drawings



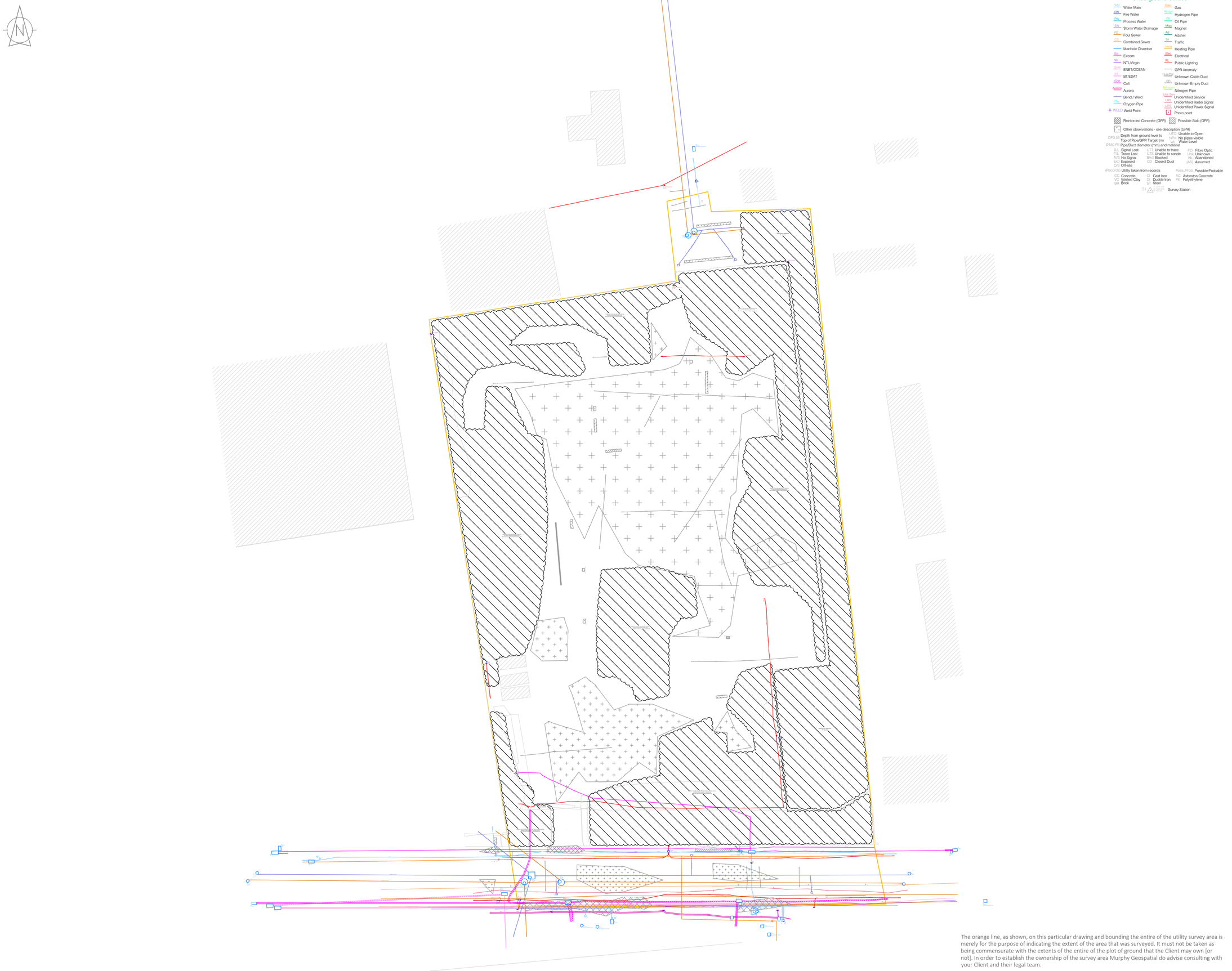
Unit 7, Westgate Business Park, Ballymount, Dublin 24.	PROJECT NAME DESIGNED BY:	Ordnance Survey Ireland Licence No. EN0023805 (c) Ordnance Survey Ireland and Government of Ireland Produced on: 14/09/2023	@ A3

A4



eMaps open eir Civil Engineering Infrastructure Service

Scale: 1:1000	Irish National Grid Co-Ordinates Centre XY: 172367 m, 70614 m
Date 12/09/2023	Smallworld Powered by GE



LEGEND
Underground Utilities

WM	Water Main	Gas	
FW	Fire Water	Hydrogen	Hydrogen Pipe
PW	Process Water	Oil	Oil Pipe
SW	Storm Water Drainage	Mag	Magnet
FS	Foul Sewer	Ad	Adshel
CS	Combined Sewer	Traf	Traffic
	Manhole Chamber	Heat	Heating Pipe
Ei	Eircom	Elec	Electrical
Vo	NTL/Virgin	PL	Public Lighting
Enet	ENET/OCEAN		GPR Anomaly
BT	BT/ESAT	Unk Duct	Unknown Cable Duct
Colt	Colt	Unk	Unknown Empty Duct
Aurora	Aurora	Nitrogen	Nitrogen Pipe
	Bend / Weld	Unk Serv	Unidentified Service
Oxy	Oxygen Pipe	URS	Unidentified Radio Signal
WELD	Weld Point	UPS	Unidentified Power Signal
			Photo point

Reinforced Concrete (GPR) — Possible Slab (GPR)

Other observations - see description (GPR)

(DP0.45) Depth from ground level to Top of Pipe/GPR Target (m)
(D150 PE) Pipe/Duct diameter (mm) and material

S/L	Signal Lost	UTT	Unable to trace
T/L	Trace Lost	UTS	Unable to sonde
N/S	No Signal	Blkd	Blocked
Exp	Exposed	CD	Closed Duct
Off	Off-site		

UTO Unable to Open
NPV No pipes visible
WL Water Level

FO Fibre Optic
Unk Unknown
Ab Abandoned
(Ass) Assumed

(Records) Utility taken from records

CC	Concrete	CI	Cast Iron
VC	Vitrified Clay	DI	Ductile Iron
BR	Brick	ST	Steel

Poss./Prob. Possible/Probable
AC Asbestos Concrete
PE Polyethylene

S1 E:xxxxx.xxx N:xxxxx.xxx — Survey Station

The orange line, as shown, on this particular drawing and bounding the entire of the utility survey area is merely for the purpose of indicating the extent of the area that was surveyed. It must not be taken as being commensurate with the extents of the entire of the plot of ground that the Client may own [or not]. In order to establish the ownership of the survey area Murphy Geospatial do advise consulting with your Client and their legal team.

Murphy Geospatial Ltd. Disclaimer

The survey aims to map all existing utilities and sub surface structures and provide information with respect to pipe size, material type and drainage connectivity. However GPR surveying is limited by the following guidelines and it may not be possible to accurately survey, define and locate all services and sub surface features.

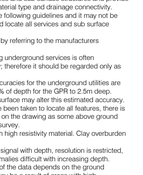
- Locational accuracy is determined by referring to the manufacturers guidelines for the detectors used.
- Existing record information showing underground services is often incomplete and unknown accuracy; therefore it should be regarded only as an indication.
- In ideal conditions these spatial accuracies for the underground utilities are +/- 5% for the RD4000 and +/- 10% of depth for the GPR to 2.5m deep. However, variations within the subsurface may alter this estimated accuracy.
- Although all reasonable steps have been taken to locate all features, there is no guarantee that all will be shown on the drawing as some above ground features may have obstructed the survey.
- GPR surveying operates best within high resistivity material. Clay overburden can impair GPR surveying.
- Due to the attenuation of the radar signal with depth, resolution is restricted, hence making identification of anomalies difficult with increasing depth.
- The depth penetration and quality of the data depends on the ground conditions on the site. Poor data may be a result of areas with high conductivity. Also, high reflective materials close to the surface i.e. rebar may hide deeper anomalies.
- It is not always possible to trace the entire length of each underground service.
- It is always our intention to use the Utility providers' details, if supplied prior to survey commencement as a guide for location purposes. However, should we not be able to locate those guided services we shall not be held responsible for the accuracy, or otherwise, of the location of that service, as issued by the utility provider and therefore shown "Taken from Records" on the drawing and we are not liable for any loss that may arise due to the lack of accuracy in the guided information.
- Unless otherwise stated, all services and sub surface structures shown on Murphy Geospatial Limited plan drawings have been surveyed using approved detectors and the connections between manholes, if not traced, are assumed to run straight.
- Plan accuracies of the order of + or - 150mm may be achieved but this figure will depend on the depth of the service below ground level. Where similar services run on close proximity, separation may be impossible. Successful tracing of non metallic pipes may be limited.
- Please note that not all buried pipes, cables and ducts can be detected and mapped in consideration of their depth, location, material type, geology and proximity to other utilities. Even an appropriate and professionally executed survey may not be able to achieve a 100% detection rate.
- Services which have been untraceable are shown from Records where possible.
- DP represents distance from the surface level to the top of the service/ radar.

No allowance has been made within our quotation, unless otherwise stated, for the location and mapping of undeclared services. Failure to detect or fully map any declared service will be recorded within the notes accompanying our final drawings.
Where technically possible, depth indications will be given. These should be used for guidance only and wherever critical accuracy is required these should be confirmed by the Client by undertaking trial excavations or similar. Bends, lateral service connections, or the close proximity of other services and local magnetic, atmospheric or ground conditions, could in certain situations influence the accuracy of the plan and depth indication facility. Depths will not be provided unless we are reasonably confident of their validity.
Where Murphy Geospatial Limited issues a CAD drawn utility service plan, this should be read in conjunction with all available public utility records etc. As part of our exhaustive Quality Control procedures, Murphy Geospatial Limited Endeavour to add relevant Public Utility record information onto the final issue drawing. An allowance should be made for the width of services, particularly where these are laid in bands or are of significant size etc. For clarification or appropriate easement bands, we would recommend that direct contact is made with the Asset Owner or Statutory Undertaker.
We exclude the following, except where otherwise specified and possible to do so;

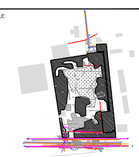
- All private service connections, (including water or gas fittings where no through flow of applied signal is possible.
- Pot ended or disconnected cables or terminated short lengths of pipe.
- Internal building services
- Fibre optic cables (except where laid with a standard communications cable or built in tracer wire or similar conductor system) or can be clearly located using ground penetrating radar.
- Small diameter cables less than 17mm diameter, or pipes less than 38mm diameter.
- Above ground services unless specifically requested.
- Lifting manhole covers which require longer than 10 minute effort using standard heavy duty lifting apparatus.
- Services positioned directly below other pipes or cables etc (i.e. masking signal) - intrusive verification options available on request.
- Deep non metallic pipes, ducts or culverts (unless probing or Pipe Track 3d is specified as part of the fully invasive survey option).
- Passing through detective pipework (displaced joints etc) or acute bends between access points.

Please note that our Quotation does not allow for location of individual service feeds to properties unless reasonable to do so, as access would be required into each property to apply direct connections to inlet points and this would significantly increase the scope of work, survey cost and also cause possible disruption to occupants.
All work carried out by Murphy Geospatial Limited (MGS) conforms to the guidelines set out by The Survey Association (TSA).

North



Map Sheet Layout:



Surveyed by :	MGS	Date:	Jan-2024
Drawn by :	IC	Date:	25.01.2024
Checked by :	DS	Date:	26.01.2024

Datum: Malin Head
Grid System:
Irish National Grid ☐ ITM ☒

Revisions

No.	Date	Description
0	26.01.24	First Drawing

Murphy GEOSPATIAL

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Client : O Mahony Pike

Project : Modular Housing St. Michael's Drive

Date : 26.01.2024 **Scale :** NTS@A1

Description : Utility Survey

Drawing Number : MGS55891_U

Appendix B Site Coordinates & Met Eireann Data

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 172360, Northing: 70674,

	Interval		Years									
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	120,
5 mins	3.2,	4.1,	4.6,	5.2,	5.7,	6.0,	7.0,	8.1,	8.8,	9.7,	10.6,	11.2,	11.6,
10 mins	4.5,	5.7,	6.4,	7.3,	7.9,	8.3,	9.8,	11.3,	12.3,	13.6,	14.7,	15.6,	16.1,
15 mins	5.2,	6.7,	7.5,	8.6,	9.3,	9.8,	11.5,	13.3,	14.4,	16.0,	17.3,	18.3,	19.0,
30 mins	7.0,	9.0,	10.0,	11.4,	12.3,	13.0,	15.2,	17.6,	19.0,	21.1,	22.8,	24.1,	25.0,
1 hours	9.4,	12.0,	13.3,	15.2,	16.4,	17.3,	20.2,	23.2,	25.1,	27.8,	30.0,	31.7,	32.8,
2 hours	12.6,	16.0,	17.7,	20.2,	21.8,	23.0,	26.7,	30.7,	33.2,	36.6,	39.5,	41.7,	43.2,
3 hours	15.0,	19.0,	21.0,	23.9,	25.7,	27.1,	31.5,	36.1,	39.1,	43.0,	46.4,	49.0,	50.7,
4 hours	16.9,	21.4,	23.7,	26.9,	28.9,	30.5,	35.4,	40.6,	43.9,	48.3,	52.1,	54.9,	56.8,
6 hours	20.1,	25.4,	28.0,	31.8,	34.2,	36.0,	41.7,	47.8,	51.6,	56.8,	61.2,	64.5,	66.7,
9 hours	23.8,	30.0,	33.1,	37.5,	40.4,	42.5,	49.2,	56.3,	60.8,	66.8,	71.9,	75.8,	78.3,
12 hours	26.9,	33.9,	37.4,	42.3,	45.5,	47.9,	55.3,	63.3,	68.2,	74.9,	80.7,	85.0,	87.8,
18 hours	32.0,	40.2,	44.2,	50.0,	53.7,	56.5,	65.3,	74.5,	80.3,	88.1,	94.8,	99.8,	103.2,
24 hours	36.1,	45.3,	49.9,	56.3,	60.5,	63.6,	73.4,	83.7,	90.2,	98.9,	106.4,	112.0,	115.6,
2 days	47.1,	57.9,	63.2,	70.5,	75.3,	78.8,	89.7,	101.1,	108.1,	117.6,	125.6,	131.5,	135.5,
3 days	56.3,	68.3,	74.1,	82.2,	87.4,	91.2,	103.0,	115.2,	122.8,	132.9,	141.3,	147.6,	151.8,
4 days	64.4,	77.4,	83.7,	92.5,	98.0,	102.1,	114.7,	127.7,	135.7,	146.3,	155.2,	161.8,	166.1,
6 days	78.9,	93.8,	100.9,	110.7,	116.8,	121.4,	135.3,	149.5,	158.2,	169.7,	179.4,	186.5,	191.1,
8 days	92.1,	108.4,	116.2,	126.9,	133.6,	138.6,	153.6,	168.9,	178.2,	190.4,	200.7,	208.2,	213.1,
10 days	104.3,	122.0,	130.4,	141.8,	149.0,	154.3,	170.3,	186.6,	196.4,	209.3,	220.1,	228.1,	233.2,
12 days	115.9,	134.8,	143.7,	155.9,	163.5,	169.1,	186.0,	203.1,	213.4,	227.0,	238.2,	246.5,	251.9,
16 days	137.8,	158.9,	168.7,	182.2,	190.5,	196.7,	215.2,	233.7,	244.9,	259.5,	271.6,	280.5,	286.3,
20 days	158.4,	181.4,	192.1,	206.7,	215.7,	222.4,	242.2,	262.0,	273.9,	289.5,	302.4,	311.8,	317.9,
25 days	183.0,	208.2,	219.8,	235.6,	245.4,	252.5,	273.9,	295.1,	307.9,	324.5,	338.2,	348.2,	354.6,

NOTES:
These values are derived from a Depth Duration Frequency (DDF) Model update 2023
For details refer to:
'Mateus C., and Coonan, B. 2023. Estimation of point rainfall frequencies in Ireland. Technical Note No. 68. Met Eireann',
Available for download at:
http://hdl.handle.net/2262/102417

M5_60 = 17.3
M5_2D = 78.8
R = 0.220

Appendix C Topographical Survey

LEGEND

Street furniture & Services

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

Natural Features

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

Golf

- Fair Way
- Green
- Tee Box

Other

- Survey Station
- Photo point
- Top of Tree

Built Features

Roads & Road Markings

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

Murphy Surveys Ltd. Disclaimer

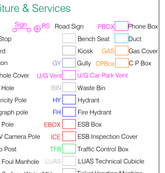
The user or recipient of this survey data understands and acknowledges this data may be inaccurate or contain errors or omissions and the user or recipient assumes full responsibility for any risks or damages resulting from, arising from, or in connection with any use of or reliance upon data displayed herein. Although significant care has been exercised to produce surveys that satisfy survey accuracy standards, these surveys are only as accurate as the source data from which they were compiled. Although all reasonable steps have been taken to locate all features visible at the time of the survey, there is no guarantee that all will be shown on the drawing, as some above ground features may have obstructed the survey. Wherever possible, areas unable to be surveyed will be labelled as "UTS".

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

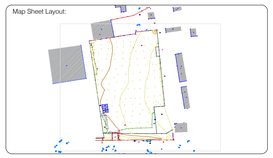
The Client must promptly notify the Company of any errors in mapping of which it becomes aware. If misleading, inaccurate or otherwise inappropriate information is brought to the Company's attention or the Company itself identifies any such imprecision or error in a survey, it shall use its reasonable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

North

Site Location



Map Sheet Layout:



Surveyed by :	IC-ROD	Date: 05.12.2023	Datum : Malin Head
Drawn by :	MS	Date: 12.12.2023	Grid System:
Checked by :	MF	Date: 13.12.2023	Irish National Grid ☐ ITM (IG) ■

Revisions

No	Date	Description
0	13/12/2023	First Drawing
1	19/01/2024	Utility Cover Levels Added

Murphy GEOSPATIAL

Topographic surveys, Measured Building Surveys, Setting-Out, As-Built Surveys, Hydrographic Surveys, Legal Mapping, Pipeline Surveys, Services Location, Ground Penetrating Radar, Laser Scanning, Rectified Photography

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Client :	O'Mahony Pike Architects Cork
Project :	55891- Modular Housing St. Michael's Drive
Date : 19.01.2024	**Scale :** 1:250@A1
Description :	Topographical Survey
Drawing Number :	**MGS55891_T_ITM_2D_Rev1**

Appendix D Causeway Stormwater Drainage Design Calculations

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S4-0	0.169	4.00	9.050	1200	572329.676	570712.023	1.210
S5-0	0.095	4.00	9.800	1200	572291.565	570650.619	1.125
S4-1	0.021	4.00	9.200	1200	572335.405	570657.514	1.648
S4-2			9.300	1200	572336.409	570647.814	1.797
S4-3 (PI)	0.006	4.00	9.400	1200	572344.173	570648.617	2.036
S4-4			9.450	1200	572347.033	570648.913	2.100
Soakaway 2 (South)			9.450	1200	572348.431	570649.078	2.107
S1-0	0.090	4.00	10.150	1200	572279.120	570725.578	1.425
S2-0	0.072	4.00	9.450	1200	572322.604	570760.898	1.125
S2-1			9.400	1200	572324.993	570738.162	1.189
S1-1	0.070	4.00	9.350	1200	572321.448	570732.260	1.598
S1-2	0.034	4.00	9.080	1200	572323.899	570716.792	1.502
S3-0	0.067	4.00	9.800	1200	572280.928	570710.019	1.425
S1-3			9.200	1200	572317.048	570715.711	1.657
S1-4			9.300	1200	572315.928	570722.815	1.793
Soakaway 1 (North)			9.300	1200	572313.318	570722.405	1.806

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
S4.000	S4-0	S4-1	54.809	0.600	7.840	7.552	0.288	190.0	300
S5.000	S5-0	S4-1	44.379	0.600	8.675	7.552	1.123	39.5	225
S4.001	S4-1	S4-2	9.752	0.600	7.552	7.503	0.049	200.0	300
S4.002	S4-2	S4-3 (PI)	7.805	0.600	7.503	7.464	0.039	200.0	300
S4.003	S4-3 (PI)	S4-4	2.875	0.600	7.364	7.350	0.014	200.0	300
S4.004	S4-4	Soakaway 2 (South)	1.408	0.600	7.350	7.343	0.007	200.0	300
S1.000	S1-0	S1-1	42.852	0.600	8.725	7.752	0.973	44.0	225
S2.000	S2-0	S2-1	22.861	0.600	8.325	8.211	0.114	200.0	225
S2.001	S2-1	S1-1	6.885	0.600	8.211	8.177	0.034	200.0	225
S1.001	S1-1	S1-2	15.661	0.600	7.752	7.578	0.174	90.0	300
S1.002	S1-2	S1-3	6.936	0.600	7.578	7.543	0.035	200.0	300
S3.000	S3-0	S1-3	36.566	0.600	8.375	7.543	0.832	43.9	225
S1.003	S1-3	S1-4	7.192	0.600	7.543	7.507	0.036	200.0	300
S1.004	S1-4	Soakaway 1 (North)	2.642	0.600	7.507	7.494	0.013	200.0	300

Name	US Node	DS Node	Vel (m/s)	Flow (l/s)
S4.000	S4-0	S4-1	1.137	22.9
S5.000	S5-0	S4-1	2.087	12.9
S4.001	S4-1	S4-2	1.108	38.6
S4.002	S4-2	S4-3 (PI)	1.108	38.6
S4.003	S4-3 (PI)	S4-4	1.108	39.4
S4.004	S4-4	Soakaway 2 (South)	1.108	39.4
S1.000	S1-0	S1-1	1.976	12.2
S2.000	S2-0	S2-1	0.921	9.8
S2.001	S2-1	S1-1	0.921	9.8
S1.001	S1-1	S1-2	1.658	31.4
S1.002	S1-2	S1-3	1.108	36.0
S3.000	S3-0	S1-3	1.978	9.1
S1.003	S1-3	S1-4	1.108	45.1
S1.004	S1-4	Soakaway 1 (North)	1.108	45.1

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	Scotland and Ireland	Drain Down Time (mins)	240
M5-60 (mm)	17.300	Additional Storage (m³/ha)	20.0
Ratio-R	0.220	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	x
Analysis Speed	Normal		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	20	0	0
30	20	0	0
100	20	0	0

Node Soakaway 1 (North) Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.000	Depth (m)	1.800
Side Inf Coefficient (m/hr)	0.18660	Time to half empty (mins)	767	Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	8.000	Number Required	1
Porosity	0.95	Pit Length (m)	13.500		

Node Soakaway 2 (South) Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	5.650	Depth (m)	2.000
Side Inf Coefficient (m/hr)	0.18660	Time to half empty (mins)	679	Inf Depth (m)	
Safety Factor	1.0	Pit Width (m)	8.000	Number Required	1
Porosity	0.95	Pit Length (m)	10.000		

Results for 5 year +20% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S4-0	7.978	0.138	36.1	0.5432	0.0000	OK
15 minute summer	S5-0	8.750	0.075	20.3	0.2127	0.0000	OK
15 minute summer	S4-1	7.777	0.225	60.6	0.3117	0.0000	OK
15 minute summer	S4-2	7.717	0.214	56.8	0.2424	0.0000	OK
15 minute summer	S4-3 (PI)	7.616	0.252	58.7	0.2997	0.0000	OK
15 minute summer	S4-4	7.576	0.226	58.9	0.2561	0.0000	OK
2160 minute summer	Soakaway 2 (South)	6.888	-0.455	5.5	94.0873	0.0000	OK
15 minute summer	S1-0	8.800	0.075	19.2	0.1804	0.0000	OK
15 minute summer	S2-0	8.431	0.106	15.4	0.2552	0.0000	OK
15 minute summer	S2-1	8.322	0.111	15.4	0.1256	0.0000	OK
15 minute summer	S1-1	7.895	0.143	49.5	0.2869	0.0000	OK
15 minute summer	S1-2	7.844	0.266	56.6	0.4208	0.0000	OK
15 minute summer	S3-0	8.440	0.065	14.3	0.1339	0.0000	OK
15 minute summer	S1-3	7.812	0.269	69.5	0.3043	0.0000	OK
15 minute summer	S1-4	7.753	0.246	68.1	0.2782	0.0000	OK
2160 minute summer	Soakaway 1 (North)	7.100	-0.394	6.3	112.9033	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap
15 minute summer	S4-0	S4.000	S4-1	35.8	0.844	0.445
15 minute summer	S5-0	S5.000	S4-1	20.3	0.841	0.244
15 minute summer	S4-1	S4.001	S4-2	56.8	1.035	0.726
15 minute summer	S4-2	S4.002	S4-3 (PI)	57.6	1.151	0.735
15 minute summer	S4-3 (PI)	S4.003	S4-4	58.9	0.978	0.752
15 minute summer	S4-4	S4.004	Soakaway 2 (South)	59.0	1.134	0.754
2160 minute summer	Soakaway 2 (South)	Infiltration		2.3		
15 minute summer	S1-0	S1.000	S1-1	19.2	1.008	0.244
15 minute summer	S2-0	S2.000	S2-1	15.4	0.816	0.421
15 minute summer	S2-1	S2.001	S1-1	15.3	0.833	0.417
15 minute summer	S1-1	S1.001	S1-2	49.3	0.995	0.420
15 minute summer	S1-2	S1.002	S1-3	55.2	0.832	0.704
15 minute summer	S3-0	S3.000	S1-3	14.3	0.755	0.182
15 minute summer	S1-3	S1.003	S1-4	68.1	1.059	0.869
15 minute summer	S1-4	S1.004	Soakaway 1 (North)	68.2	1.204	0.871
2160 minute summer	Soakaway 1 (North)	Infiltration		2.5		

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S4-0	8.014	0.174	52.9	0.6844	0.0000	OK
15 minute summer	S5-0	8.767	0.092	29.7	0.2608	0.0000	OK
15 minute summer	S4-1	7.884	0.332	88.9	0.4604	0.0000	SURCHARGED
15 minute summer	S4-2	7.792	0.289	84.1	0.3274	0.0000	OK
15 minute summer	S4-3 (PI)	7.696	0.332	85.5	0.3953	0.0000	SURCHARGED
15 minute summer	S4-4	7.640	0.290	86.0	0.3278	0.0000	OK
1440 minute summer	Soakaway 2 (South)	7.306	-0.037	9.8	125.8473	0.0000	OK
15 minute summer	S1-0	8.818	0.093	28.2	0.2217	0.0000	OK
15 minute summer	S2-0	8.460	0.135	22.5	0.3246	0.0000	OK
15 minute summer	S2-1	8.352	0.141	22.5	0.1590	0.0000	OK
15 minute summer	S1-1	8.069	0.317	72.5	0.6355	0.0000	SURCHARGED
15 minute summer	S1-2	7.989	0.411	75.8	0.6507	0.0000	SURCHARGED
15 minute summer	S3-0	8.454	0.079	21.0	0.1635	0.0000	OK
15 minute summer	S1-3	7.925	0.382	94.7	0.4319	0.0000	SURCHARGED
15 minute summer	S1-4	7.823	0.316	95.9	0.3579	0.0000	SURCHARGED
2160 minute summer	Soakaway 1 (North)	7.471	-0.023	8.5	150.8993	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap
15 minute summer	S4-0	S4.000	S4-1	52.6	0.903	0.654
15 minute summer	S5-0	S5.000	S4-1	29.7	0.921	0.358
15 minute summer	S4-1	S4.001	S4-2	84.1	1.194	1.074
15 minute summer	S4-2	S4.002	S4-3 (PI)	83.9	1.298	1.071
15 minute summer	S4-3 (PI)	S4.003	S4-4	86.0	1.221	1.098
15 minute summer	S4-4	S4.004	Soakaway 2 (South)	86.2	1.332	1.101
1440 minute summer	Soakaway 2 (South)	Infiltration		3.1		
15 minute summer	S1-0	S1.000	S1-1	28.2	1.075	0.359
15 minute summer	S2-0	S2.000	S2-1	22.5	0.885	0.615
15 minute summer	S2-1	S2.001	S1-1	22.4	0.921	0.611
15 minute summer	S1-1	S1.001	S1-2	67.0	1.011	0.572
15 minute summer	S1-2	S1.002	S1-3	76.7	1.089	0.979
15 minute summer	S3-0	S3.000	S1-3	21.0	0.848	0.267
15 minute summer	S1-3	S1.003	S1-4	95.9	1.362	1.225
15 minute summer	S1-4	S1.004	Soakaway 1 (North)	96.1	1.409	1.228
2160 minute summer	Soakaway 1 (North)	Infiltration		3.3		

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.97%

Node Event	US Node	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S4-0	8.205	0.365	68.5	1.4318	0.0000	SURCHARGED
15 minute summer	S5-0	8.782	0.107	38.5	0.3018	0.0000	OK
15 minute summer	S4-1	8.023	0.471	104.6	0.6527	0.0000	SURCHARGED
15 minute summer	S4-2	7.885	0.382	101.8	0.4321	0.0000	SURCHARGED
15 minute summer	S4-3 (PI)	7.766	0.402	104.0	0.4780	0.0000	SURCHARGED
15 minute summer	S4-4	7.684	0.334	104.1	0.3774	0.0000	SURCHARGED
1440 minute summer	Soakaway 2 (South)	7.631	0.288	11.9	150.8777	0.0000	OK
15 minute summer	S1-0	8.832	0.107	36.5	0.2563	0.0000	OK
15 minute summer	S2-0	8.488	0.163	29.2	0.3934	0.0000	OK
15 minute summer	S2-1	8.377	0.166	29.2	0.1882	0.0000	OK
15 minute summer	S1-1	8.314	0.562	93.9	1.1281	0.0000	SURCHARGED
15 minute summer	S1-2	8.176	0.598	100.3	0.9465	0.0000	SURCHARGED
15 minute summer	S3-0	8.466	0.091	27.2	0.1879	0.0000	OK
15 minute summer	S1-3	8.067	0.524	125.2	0.5922	0.0000	SURCHARGED
15 minute summer	S1-4	7.893	0.386	124.7	0.4367	0.0000	SURCHARGED
1440 minute summer	Soakaway 1 (North)	7.760	0.266	13.6	180.8706	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap
15 minute summer	S4-0	S4.000	S4-1	60.3	0.939	0.750
15 minute summer	S5-0	S5.000	S4-1	38.5	1.146	0.464
15 minute summer	S4-1	S4.001	S4-2	101.8	1.446	1.300
15 minute summer	S4-2	S4.002	S4-3 (PI)	102.0	1.449	1.303
15 minute summer	S4-3 (PI)	S4.003	S4-4	104.1	1.479	1.329
15 minute summer	S4-4	S4.004	Soakaway 2 (South)	104.1	1.494	1.330
1440 minute summer	Soakaway 2 (South)	Infiltration		3.7		
15 minute summer	S1-0	S1.000	S1-1	36.5	1.140	0.464
15 minute summer	S2-0	S2.000	S2-1	29.2	0.936	0.796
15 minute summer	S2-1	S2.001	S1-1	29.0	0.999	0.792
15 minute summer	S1-1	S1.001	S1-2	87.3	1.240	0.745
15 minute summer	S1-2	S1.002	S1-3	99.8	1.418	1.275
15 minute summer	S3-0	S3.000	S1-3	27.2	0.910	0.346
15 minute summer	S1-3	S1.003	S1-4	124.7	1.772	1.593
15 minute summer	S1-4	S1.004	Soakaway 1 (North)	125.0	1.777	1.596
1440 minute summer	Soakaway 1 (North)	Infiltration		3.9		

Appendix E Petrol Interceptor Sizing Calculations

Petrol Interceptor Sizing

Project title: **Estuary Way, St. Michael's Drive, Mahon, Cork**

Project no.: **234139**

Designed: **DT** Date: **05/06/2024**

(Complete figures in **blue** only)

Ref.

Calculation of Mean Annual Peak Flow

EN 858-2 4.3.5

$$Q_r = CiA$$

Where			**Units**
Q_r	=	Mean Annual Peak Flow	l/sec
A	=	Catchment area	ha
i	=	Rainfall Intensity	l/sec/ha
C	=	Runoff Coefficient	-

C = 1

Area = **0.29** ha

PUNCH Calc (Appendix 1)

i = 115.352 l/sec/ha

Q_r **= 33.45 l/s**

Calculation of Petrol Interceptor Nominal Size

EN 858-2 4.3.1

$$NS = (Q_r + f_x Q_s) f_d$$

Where:

$NS = Nominal\ Size\ of\ Separator$

$Q_r = \max flow\ rate\ of\ rainwater$

$Q_s = \max flow\ rate\ of\ wastewater*$

$f_d = density\ factor\ of\ relevant\ light\ liquid$

$f_x = impediment\ factor\ depending\ on\ nature\ of\ discharge$

***No wastewater discharging in this case, $Q_s = 0$**

EN 858-2 Annex A Table A1

f_d = 1.5

Q_r = 33.45 l/s

Nominal Size: 50.18 litres/second (peak flow rate)

Klargestor Bypass	NSBP006	or equivalent product

Storage Capacity (litres)		Unit Length (mm)	Unit Diameter (mm)	Access Shaft Diameter (mm)
Silt	Oil			
600	90	1700	1350	600

Appendix F Causeway Foul Water Drainage Design Calculations

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
F1-0	8	10.200	Adoptable	572277.336	570726.738	1.638
F2-0	4	9.350	Adoptable	572325.525	570762.531	1.150
F1-1	4	9.250	Adoptable	572328.443	570734.763	1.779
F3-0	6	9.900	Adoptable	572279.636	570708.650	1.350
F1-2	10	9.150	Adoptable	572330.344	570716.681	1.893
F4-0	6	9.800	Adoptable	572289.587	570651.717	1.800
F1-3		9.150	Adoptable	572336.396	570659.101	2.182
F1-4 (Outfall)		9.570	Adoptable	572338.660	570633.640	2.730

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
F1.000	F1-0	F1-1	51.733	0.150	8.562	7.474	1.088	47.5	150
F2.000	F2-0	F1-1	27.921	0.150	8.200	7.471	0.729	38.3	150
F1.001	F1-1	F1-2	18.182	0.150	7.471	7.257	0.214	85.0	225
F3.000	F3-0	F1-2	51.340	0.150	8.550	7.257	1.293	39.7	150
F1.002	F1-2	F1-3	57.897	0.150	7.257	6.968	0.289	200.0	225
F4.000	F4-0	F1-3	47.388	0.150	8.000	6.968	1.032	45.9	150
F1.003	F1-3	F1-4 (Outfall)	25.561	0.150	6.968	6.840	0.128	199.7	225

Name	US Node	DS Node	Vel (m/s)	Flow (l/s)
F1.000	F1-0	F1-1	1.727	0.2
F2.000	F2-0	F1-1	1.929	0.1
F1.001	F1-1	F1-2	1.659	0.5
F3.000	F3-0	F1-2	1.894	0.2
F1.002	F1-2	F1-3	1.067	1.0
F4.000	F4-0	F1-3	1.758	0.2
F1.003	F1-3	F1-4 (Outfall)	1.068	1.2

Appendix G Uisce Éireann Pre-connection Correspondence

CONFIRMATION OF FEASIBILITY

Andrew McCarthy

Elm Court
Boreenmanna Road
Cork
Co. Cork
T12 HHW2

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

16 January 2024

Our Ref: CDS23008839 Pre-Connection Enquiry
Estuary Way, St Michael's Drive, Mahon, Cork, Co. Cork

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 38 unit(s) at Estuary Way, St Michael's Drive, Mahon, Cork, Co. Cork **(the Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Uisce Éireann
- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann:

Please note that current Uisce Éireann records do not show the downstream wastewater network from the existing Ballinure Cottages, located immediately North of the proposed Development (See Section B) and it is possible that this infrastructure extends through a part of the proposed Development. It will be necessary to verify the existence of these network extents and as part of any future connection application process.

Please note that if infrastructure is confirmed to extend through the proposed Development, it will not be permitted to build over any Uisce Éireann infrastructure. The layout of the development must ensure that this pipe is protected and adequate separation distances are provided between Uisce Éireann infrastructure and any structures on site. Alternatively you may enter into a diversion agreement and divert the pipe to accommodate your development.

If you wish to proceed with this option, please make contact with Uisce Éireann Diversions team at Diversions@water.ie. It will be necessary to provide a wayleave over this pipe to the benefit of Uisce Éireann and ensure that it is accessible for maintenance.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

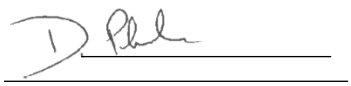
Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Uisce Éireann's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Uisce Éireann's network(s). This is not a connection offer and capacity in Uisce Éireann's network(s) may only be secured by entering into a connection agreement with Uisce Éireann.

For any further information, visit **www.water.ie/connections, email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Dermot Phelan
Connections Delivery Manager

Section A - What is important to know?

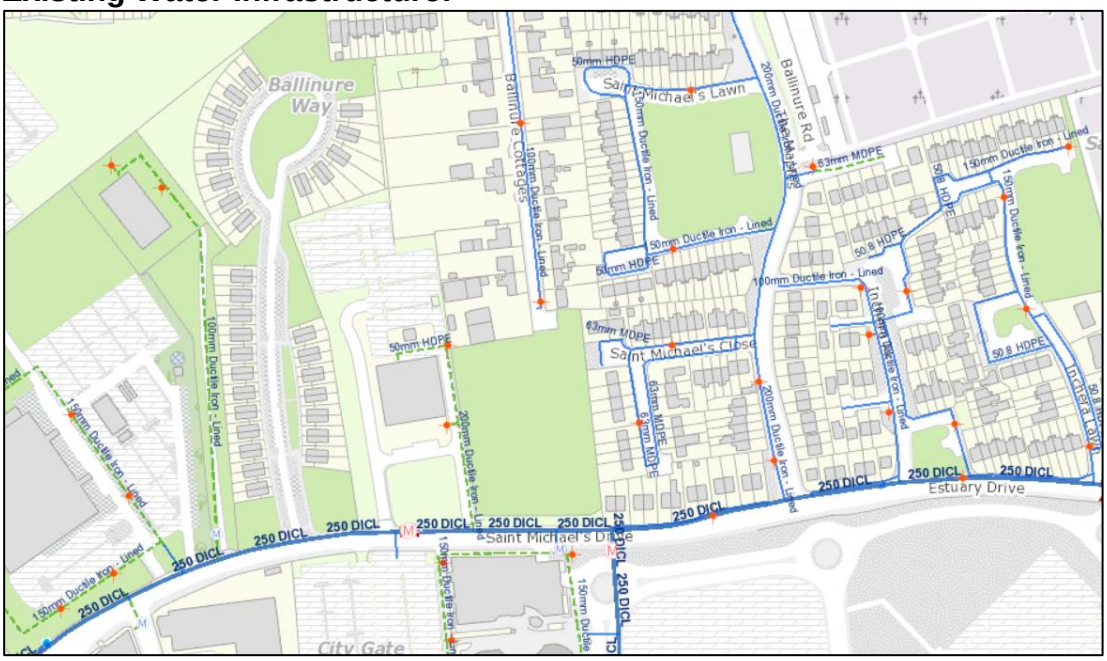
What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce Éireann's network(s), you must submit a connection application and be granted and sign a connection agreement with Uisce Éireann.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Uisce Éireann connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Uisce Éireann's network(s), including works in the public space, must be carried out by Uisce Éireann*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Uisce Éireann's network(s)?	• Requests for maps showing Uisce Éireann's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Uisce Éireann Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Uisce Éireann's Network(s)

The map included below outlines the current Uisce Éireann infrastructure adjacent the Development: To access Uisce Éireann Maps email datarequests@water.ie

Existing Water Infrastructure:



Existing Wastewater Infrastructure:

Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Note: The information provided on the included maps as to the position of Uisce Éireann's underground network(s) is provided as a general guide only.

The information is based on the best available information provided by each Local Authority in Ireland to Uisce Éireann.

Whilst every care has been taken in respect of the information on Uisce Éireann's network(s), Uisce Éireann assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Uisce Éireann's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Uisce Éireann's underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.