Castlelands LRD, Mallow

Appendices

Volume III

October 2024

Castlelands LRD, Mallow

Appendices

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Castlelands LRD, Mallow

CHAPTER 1 Introduction

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Ocotober 2024

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CHARTERED PLANNING CONSULTANTS

Appendix 1.1

Consultation Responses

As part of the consultation process for this EIAR, letters were sent out via email and post in October 2023 to the following statutory bodies:

- Department of Housing, Local Government, and Heritage
- Department of Tourism, Culture, Arts, Gaeltacht, Sport & Media
- Department of Education
- Geological Survey Ireland (Department of the Environment, Climate and Communications)
- The Heritage Council
- Office of Public Works (OPW)
- Transport Infrastructure Ireland (TII)
- The National Transport Authority (NTA)
- The Health and Safety Authority (HSA)
- The Health Service Executive (HSE)
- Inland Fisheries Ireland
- Bat Conservation Ireland
- Uisce Éireann
- An Taisce
- Bord Gais
- ESB
- Environmental Protection Agency
- Fáilte Ireland

An example of the letter sent to the above statutory bodies is provided on the following page.

Responses were received via email from the following:

- Department of Housing, Local Government, and Heritage
- Geological Survey Ireland (Department of the Environment, Climate and Communications)
- Office of Public Works (OPW)
- Transport Infrastructure Ireland (TII)
- Uisce Éireann

A copy of these responses are provided on the following pages.

DUBLIN
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T. +353 (0)21 420 8710

«Company_Name»
«Address_1»
«Address_2»
«Address_3_»
«Address_4»
«Address_5»

«Email_»

11 October 2023

Re: Consultation on the preparation of an Environmental Impact Assessment Report for a proposed residential development at Castlelands, Mallow, Co. Cork

A Chara,

We are acting on behalf of Reside (Castlepark) Ltd. in the preparation of an Environmental Impact Assessment Report (EIAR) for a proposed residential development at Castlelands, Mallow, Co. Cork.

Research and baseline analysis for the EIAR has commenced and an impact assessment will be carried out following completion of the design of the proposed development.

If you have any comments in relation to the potential environmental impacts of the proposed development, I would be grateful if you would forward them to me as soon as is convenient. The details of the site location, project description, and proposed works are outlined further below.

Proposed Development

Reside (Castlepark) Ltd are seeking permission for the construction of c. 463 no. residential units, a creche, and all associated landscaping, amenity areas, and site development works at Castlelands, Mallow, Co. Cork.

The proposed development will be submitted as two applications.

- Application 1 will provide 99 no. residential units and will be submitted as a standard planning application.
- Application 2 will provide c. 364 no. residential units and will be submitted as a Large Scale Residential Development (LRD) planning application.

One creche with c. 122 no. childcare spaces will be provided and this creche will be included within the red line boundary of both applications.

The EIAR will be submitted with the LRD application and will take account of the both applications.

Please find enclosed the following documents which provide further detail of the proposed development.

- Proposed LRD layout prepared by Deady Gahan Architects which includes schedule for both applications and the overall development.

- Proposed layout for application 1.
- Overall Masterplan Site Area drawing.

Please note that the detail provided in the attached drawings are subject to change as the scheme progresses and feedback from the council and other statutory consultees are incorporated.

Site Location and Description

The overall subject site (application 1 and 2) has a site area of c. 12.9ha consists of undeveloped fields which were stripped as part of the construction works of the previously permitted schemes on site. The site is immediately west of the existing Castlepark Estate, to the west of Mallow Town Centre. The recently constructed Scoil Aonghusa Community National School is located to the immediate north of the site. The lands to the east and south consist of greenfield lands.

The subject site is zoned 'Residential'. Objective MW-R-01 applies to the overall subject site area and has the following objective:

> *Medium A Density Residential Development. Proposals will give appropriate consideration to archaeology on the site and seek to maximise physical and ecological connectivity of the site to the Blackwater Amenity Corridor. ^TIA and RSA required*

The lands to the south of the masterplan area are zoned for Green Infrastructure and the Blackwater River Corridor is designated as a Special Area of Conservation (SAC).

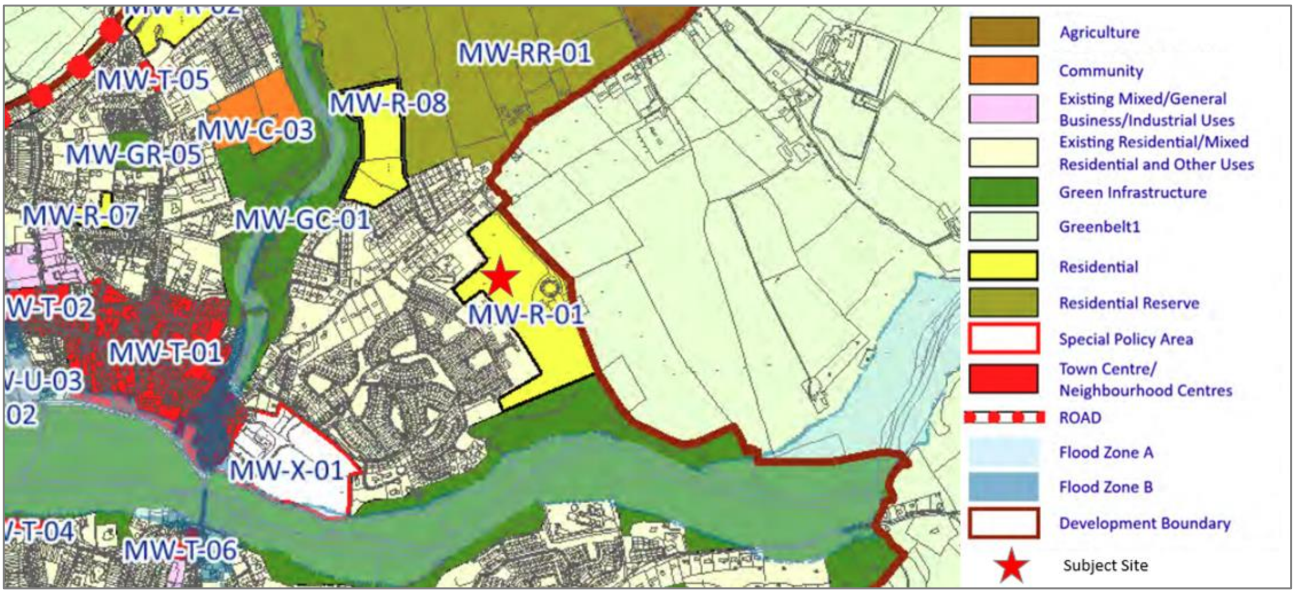

Figure 1 Location of Subject Site on Land Use Zoning Map in Volume 3

EIAR Structure and Content

The EIAR is divided into three volumes as follows:

- Volume 1: Non-Technical Summary
- Volume 2: Main Environmental Impact Assessment Report
- Volume 3: Appendices

The overall structure of Volume 2 of the EIAR is as follows:

Chapter	Chapter Title
1.	Introduction

2.	Site Location and Project Description
3.	Alternatives Considered
4.	Population and Human Health
5.	Land, Soils, and Geology
6.	Hydrology and Hydrogeology
7.	Air Quality
8.	Climate Change
9.	Noise and Vibration
10.	Landscape and Visual Impact
11.	Traffic and Transport
12.	Material Assets: Service Infrastructure and Utilities
13.	Biodiversity
14.	Cultural Heritage and Archaeology
15.	Significant Interaction of Impacts
16.	Summary of Mitigation Measures and Monitoring
17.	Screening for Major Accidents

Each chapter is to include the following elements:

- Introduction and Methodology
- Description of the Existing Environment
- Impact Assessment. Each discipline will consider impacts under the following headings:
  - Do-Nothing Scenario
  - Construction Phase
  - Operational Phase

In assessing impacts regard will be had to direct impacts, indirect impacts, and cumulative impacts. Where relevant, reference may also be made to 'synergistic impacts' or 'secondary impacts'. The assessment of impacts will have regard to the EPA guidelines and advice notes for preparing EIAR.

As the EIA progresses any relevant permitted or proposed projects will be included in the assessment.

The EIAR will also consider:

- Mitigation Measures
- Residual Impacts

Summary

In summary, this EIAR will consider the potential impact of the proposed development, in combination with the relevant planning applications in the vicinity.

The EIAR is being co-ordinated by McCutcheon Halley Charted Planning Consultants. If you have any comments in relation to the potential environmental impacts of the proposed, I would be grateful if you would forward them to me as soon as is convenient.

You can email any comments to me at skavanagh@mhplanning.ie

Yours sincerely,

Saoirse Kavanagh

Saoirse Kavanagh

McCutcheon Halley

Reference: LRD Castlelands, Mallow, Co Cork

12 December 2023

Saoirse Kavanagh
McCutcheon Halley
6 Joyce House
Barrack Square
Ballincollig
Cork
P31 YX97
Email: skavanagh@mhplanning.ie

Re: Consultation on the preparation of an Environmental Impact Assessment Report for a proposed residential development at Castlelands, Mallow, Co. Cork

Hi Saoire,
This Department the following observations on this Scoping request consultation on the above proposed LRD.

These observations are intended to assist you in relation to identifying potential impacts on European sites, other nature conservation sites, and biodiversity and environmental protection in general, in the context of the current proposal. Data collected and surveys carried out in connection with this proposed development may raise other issues that have not been considered here. The observations are not exhaustive and are made without prejudice to any recommendation that may be made by this Department in the future.
<u>Licenses</u>
Where there are impacts on protected species and their habitats, resting or breeding places, licenses may be required under the Wildlife Act 1976-2018 or derogations under the EC (Birds and Natural Habitats) Regulations 2011, as amended.
In particular bats are subject to a regime of strict protection pursuant to the requirements of the Habitats Directive (92/43/EEC) as transposed in Irish law in Regulation 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended). A copy of Circular Letter NPWS 2/07 entitled "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – strict protection of certain species/applications for derogation licences*" can be found on the Departmental web site at www.npws.ie/sites/default/files/general/circular-npws-02-07.pdf. It should be noted that the Regulations of 1997 have since been superseded by the European Communities (Birds and

Natural Habitats) Regulations 2011, as amended. Part 6 of those Regulations is now the relevant section dealing with the protection of flora and fauna. Reference to Regulation 23 in the circular letter should be taken to mean Regulation 51 in the current Regulations.

In addition, the EIAR should take account of species protected under the Wildlife Acts regarding impacts on protected species or their resting or breeding places, in particular birds' nests and will also need to be cognisant of article 5 (d) of the Birds Directive.

In order to apply for any such licenses or derogations that may be required regarding bats and birds the results of a survey should be submitted to the National Parks and Wildlife Service of this Department. Such surveys are to be carried out by appropriately qualified person/s at an appropriate time of the year. Should the survey work have taken place well before construction commences, it is recommended that an additional ecological survey of the development site should take place immediately prior to construction to ensure no significant change in the findings of the baseline ecological survey has occurred. As outlined already, if there has been any significant change mitigation, this may require amendment and where a licence has expired, there will be a need for new licence applications for the protected species.

Regarding this specific site it should be noted that signs of mammal activity (including burrows) are evident at both the eastern boundary wall/hedgerow and towards the south of the site (associated with old now vegetated soil heaps also). It appears the site has been abandoned for a number of years and much vegetation colonisation has occurred (including with willow scrub) and it provides a relatively undisturbed location for species in the area. Therefore it is important that a dedicated mammal survey take place.

In addition at the south eastern corner of the site it appears from aerial photography that a hedgerow/stone wall has been removed in the past. It also appears that part of the SAC (see below) may also have been effected by this work. Consideration should be given when planning and designing the layout and scale of the development to methods of ensuring that the same or greater length of compensatory native hedgerow will be planted. A plan to provide compensatory planting to ensure there is no net loss of biodiversity features at this south eastern corner could then be provided with the development proposal. The previous works at this corner may also have fragmented a potential bat commuting/foraging area (as mature semi-natural woodland occurs immediately adjacent in the SAC) and this should also be considered when planning mitigation and/or enhancement.

A bat survey and report will be very important, the mature semi-natural woodland within the SAC (visible as woodland on 1st edition 6 inch maps) has been supplemented by the planting of Oak and Scots Pine in the adjacent field and therefore the entire southern boundary is immediately adjacent to semi-natural woodland. As well as the high bat usage potential the habitat here to the south is also of generally high biodiversity value. Disturbance from lighting, noise, human access etc. should be fully assessed and addressed in the EIA. Consideration

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could be given to a potential buffer zone, screening, habitat establishment etc. and mitigation should address this potential issue.

TII Guidelines should be referenced. Regarding Lighting the procedures outlined in 'Guidance Note 08/18 Bats and Artificial Lighting in the UK' and Eurobats 'Guidelines for Consideration of Bats in Lighting Projects' provide useful guidance with respect to lighting design in ecologically sensitive locations, such as along treelines and hedgerows. Dark Sky Ireland also provide useful guidance "Best practice in public lighting" , notably that "warm" colour temperatures should be used at 2700K or less. . Lighting of the hedgerows or woodland should be avoided or minimised (this is particularly important regarding continuing usage by bat species). Minimising lighting through directional lighting, potential cowls etc. should be considered. The project should also ensure that the use of energy efficient (LED) lighting, does not have adverse effects on biodiversity by limiting lighting only to where it is required and using 'warm white' lighting with a Correlated Colour Temperature (CCT) of below 2700 kelvins. It must have smart control systems to allow cut-off periods during hours of darkness and diming at dawn and dusk.

The eastern hedgerow/stone wall boundary also has biodiversity value and the EIA should consider how it could be retained intact/protected during construction works and subsequently through a buffer, temporary fencing etc.

The landscape plan should have regard to the All-Ireland Pollinator Plan for 2021-2025. Regarding the choice of any proposed wildflower mix reference should be made to the data in the recent paper Barry, C.; Hodge, S. 'You Reap What You Sow: A Botanical and Economic Assessment of Wildflower Seed Mixes Available in Ireland'. Conservation 2023, 3, 73–87 (https://doi.org/10.3390/conservation3010007).

Guidance on the Appropriate Assessment (AA)

The consultation letter provided mentions EIA scoping only but it is presumed Appropriate Assessment screening and Full AA/Natura Impact Assessment is also being carried out. The development site is both hydrologically connected to the Blackwater River (Cork/Waterford) SAC 002170 and immediately adjacent to the SAC at the south eastern end. Appropriate Assessment, must therefore ensure that the proposal would not have adverse impacts on the SAC through water quality effects (such as through sedimentation, run off or other pollution during the construction phase or through sewage, surface water discharge etc. during the operational phase of the proposed development) and that it is compatible with the Conservation Objectives (CO's) for the SAC Qualifying Interest (QI) habitats and species. This is particularly important as the site slopes all the way down to the SAC River (though with an existing vegetated buffer between the site and the river itself).

In order to carry out the Appropriate Assessment screening, and/or prepare a Natura Impact Statement (NIS), information about the relevant European sites including their conservation objectives will need to be collected.

Screening for appropriate assessment should focus on the likely significant effects of the proposed development and related activities on European sites noting that impacts to sites via air and water may occur over large distances using the source-pathway-receptor model. Details of designated sites and species and conservation objectives can be found on http://www.npws.ie/ .

The Departmental guidance document on Appropriate Assessment is available on the NPWS website at https://www.npws.ie/development-consultations and in EU Commission guidance entitled:

- "*Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*"[1];
- 2018 Commission notice "*Managing Natura 2000 sites The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*"[2] (updated June 2020)

An NIS should present a robust and reasoned scientific assessment and analysis of the implications of the proposals for the relevant conservation objectives of relevant European sites. Best scientific knowledge in the field should be applied to the understanding of the likely effects, and to the assessment and analysis of the implications of the proposals for the conservation objectives and integrity of the sites. When carried out by the competent authority, the appropriate assessment cannot have lacunae and must contain complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the project on European sites.

Construction Management Plans and Mitigation

Complete project details including Construction Management Plans (CMPs) need to be provided in order to allow an adequate EIAR and appropriate assessment to be undertaken. CMPS should contain sufficient detail to avoid any post construction doubt with regard to the implementation of mitigation measures, timings and roles and responsibilities for same. Any mitigation needs to be included in detail and if being relied upon to reach conclusions must be proved to be achievable and likely to be effective in any given scenario it is needed. Proof of effectiveness will be required with examples of where similar techniques have been employed previously.

[1] http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

[2] https://ec.europa.eu/environment/nature/natura2000/management/docs/art6/EN_art_6_guide_jun_2019.pdf

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Applicants need to be able to demonstrate that CMPs and other such plans are adequate, all mitigation is included and effective and supported by scientific information and analysis and that they are feasible within the physical constraints of the site.
Construction work should not be allowed to impact on water quality and measures should be detailed in the EIAR to prevent sediment and/or fuel runoff from getting into watercourses.

Mitigation in General

Any Mitigation measures proposed for protected species need to be assessed against the adverse effects the project or plan is likely to cause (alone or in combination with other projects or plans). To assess mitigation measures, the following tasks must be completed:

- list each of the measures to be introduced (e.g. habitat compensation, timing of construction works);
- explain how the measures will avoid the adverse impacts on the species
- explain how the measures will reduce the adverse impacts on the species

Then, for each of the listed mitigation measures:

- provide evidence of how they will be secured and implemented and by whom;
- provide evidence of the degree of confidence in their likely success;
- provide a timescale, relative to the project or plan, when they will be implemented;

Where residual impacts remain, further mitigation measures may be required.
Evidence should be provided of how the mitigation measures will be monitored, and, should mitigation failure be identified, how that failure will be rectified. The applicant should not use any proposed post construction monitoring as mitigation to supplement inadequate information in the assessment. The overall approach to mitigation and survey above also applies to habitats."

You are requested to send any further communications to this Department's Development Applications Unit (DAU) at referrals@npws.gov.ie, where used, or to the following address:

The Manager
Development Applications Unit (DAU)
Government Offices
Newtown Road
Wexford
Y35 AP90

Is mise, le meas

David O’Connor
Development Applications Unit
Administration

…..

Saoirse Kavanagh

From:	GSI Planning <GSIPlanning@GSI.ie>
Sent:	Tuesday 17 October 2023 13:10
To:	Saoirse Kavanagh
Cc:	GSI Planning; Planning Advisory
Subject:	RE: EIS 23/301 EIAR Consultation - Castlelands, Mallow Residential Development
Attachments:	23_301 Castlelands Res Dev Mallow Co Cork.pdf; GSI datasets relevant to EIA & SEA_20210421.pdf

NOTE: *This email originated from outside the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Dear Saoirse,
With reference to your email received on the 11 October 2023, concerning the Consultation on the preparation of an EIAR for a proposed residential development at Castlelands, Mallow, Co. Cork, please find attached response and dataset sheet from Geological Survey Ireland.

Yours sincerely,
Trish Smullen

Trish Smullen Geoheritage & Planning.
Geological Survey Ireland, Booterstown Hall, Booterstown Ave., Co. Dublin A94 N2R6.
Email: trish.smullen@gsi.ie **www.gsi.ie**

A division of the Department of the Environment, Climate and Communications.

From: Saoirse Kavanagh <skavanagh@mhplanning.ie>
Sent: Wednesday 11 October 2023 12:25
To: GSI Planning <GSIPlanning@GSI.ie>
Subject: EIAR Consultation - Castlelands, Mallow Residential Development

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A Chara,

We are acting on behalf of Reside (Castlepark) Ltd in the preparation of an Environmental Impact Assessment Report (EIAR) for a proposed residential development at Castlelands, Mallow, Co. Cork. The proposed development will comprise a total of c. 463 no. units and will be submitted as two applications – a standard planning application for c. 99 no. units and an LRD application for c. 364 no. units. The EIAR will take account of both applications and will be submitted with the LRD application.

Research and baseline analysis for the EIAR has commenced and an impact assessment will be carried out following completion of the design of the proposed development.

Please see attached a letter with details of the site location, proposed development, and the proposed EIAR.

Please also see attached the following documents which provide further detail of the proposed development.

- Proposed LRD layout including schedule for Phase 1 (standard application) and Phase 2 (LRD).
- Proposed Layout for Phase 1
- Overall Masterplan Site Area drawing.

If you have any comments in relation to the potential environmental impacts of the proposed development, I would be grateful if you would forward them to me as soon as is convenient.

Kind regards,
Saoirse

Saoirse Kavanagh
Executive Planning Consultant
McCutcheon Halley
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An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications

Geological Survey
Suirbhéireacht Gheolaíochta
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Saoirse Kavanagh
McCutcheon Halley
6 Joyce House
Barrack Square
Ballincollig
Cork P31 YX97

17 October 2023

Re: Consultation on the preparation of an Environmental Impact Assessment Report for a proposed residential development at Castlelands, Mallow, Co. Cork

Your Ref: n/a
Our Ref: 23/301

Dear Saoirse,

Geological Survey Ireland is the national earth science agency and is a division of the Department of the Environment, Climate and Communications. We provide independent geological information and gather various data for that purpose. Please see our website for data availability. We recommend using these various data sets, when conducting the EIAR, SEA, planning and scoping processes. Use of our data or maps should be attributed correctly to 'Geological Survey Ireland'.

The publicly available data referenced/presented here, should in no way be construed as Geological Survey Ireland support for or objection to the proposed development or plan. The data is made freely available to all and can be used as independent scientific data in assessments, plans or policies. It should be noted that in many cases this data is a baseline or starting point for further site specific assessments.

With reference to your email received on the 11 October 2023, concerning the Consultation on the preparation of an EIAR for a proposed residential development at Castlelands, Mallow, Co. Cork, Geological Survey Ireland would encourage use of and reference to our datasets. Please find attached a list of our publicly available datasets that may be useful to the environmental assessment and planning process. We recommend that you review this list and refer to any datasets you consider relevant to your assessment. The remainder of this letter and following sections provide more detail on some of these datasets.

Geoheritage

A national inventory of geoheritage sites known as County Geological Sites (CGSs) is managed by the Geoheritage Programme of Geological Survey Ireland. CGSs, as adopted under the National Heritage Plan, include sites that are of national importance which have been selected as the very best examples for NHA (Natural Heritage Areas) designation. NHA designation will be completed in partnership with the National Parks and Wildlife Service (NPWS). CGSs are now routinely included in County Development Plans and in the GIS of planning departments, to ensure the recognition and appropriate protection of geological heritage within the planning system. CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer.

The audit for Co. Cork commenced in 2021; it is a three year process that will be completed in 2024. However, unaudited CGSs can be viewed online under the Geological Heritage tab on the online Map Viewer. **Our records show that there are no unaudited CGSs in the vicinity of the proposed residential development.**

Groundwater

Geological Survey Ireland's Groundwater and Geothermal Unit, provides advice, data and maps relating to groundwater distribution, quality and use, which is especially relevant for safe and secure drinking water supplies and healthy ecosystems. Proposed developments need to consider any potential impact on specific groundwater abstractions and on groundwater resources in general. We recommend using the groundwater maps on our Map viewer which should include: wells; drinking water source protection areas; the national map suite - aquifer, groundwater vulnerability, groundwater recharge and subsoil permeability maps. For areas underlain by limestone, please refer to the karst specific data layers (karst features, tracer test database; turlough water levels (gwlevel.ie). Background information is also provided in the Groundwater Body Descriptions. Please read all disclaimers carefully when using Geological Survey Ireland data.

The Groundwater Data Viewer indicates an aquifer classed as a 'Regionally Important Aquifer - Karstified (diffuse)' underlies the proposed development. The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas.

GWClimate is a groundwater monitoring and modelling project that aims to investigate the impact of climate change on groundwater in Ireland. This is a follow on from a previous project (GWFlood) and the data may be useful in relation to Flood Risk Assessment (FRA) and management plans. Maps and data are available on the Map viewer.

Geological Survey Ireland has completed Groundwater Protection Schemes (GWPSs) in partnership with Local Authorities, and there is now national coverage of GWPS mapping. A Groundwater Protection Scheme provides guidelines for the planning and licensing authorities in carrying out their functions, and a framework to assist in decision-making on the location, nature and control of developments and activities in order to protect groundwater. **The Groundwater Protection Response overview and link to the main reports is here: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/projects/protecting-drinking-water/what-is-drinking-water-protection/county-groundwater-protection-schemes/Pages/default.aspx**

Geological Mapping
Geological Survey Ireland maintains online datasets of bedrock and subsoils geological mapping that are reliable and accessible. We would encourage you to use these data which can be found here, in your future assessments.

Please note we have recently launched QGIS compatible bedrock (100K) and Quaternary geology map data, with instructional manuals and videos. This makes our data more accessible to general public and external stakeholders. QGIS compatible data can be found in our downloadable bedrock 100k .zip file on the Data & Maps section of our website.

Geohazards
Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides, flooding and coastal erosion are the most prevalent of these hazards. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so.

Geological Survey Ireland has information available on landslides in Ireland via the National Landslide Database and Landslide Susceptibility Map both of which are available for viewing on our dedicated Map Viewer. Associated guidance documentation relating to the National Landslide Susceptibility Map is also available.

Geological Survey Ireland also engaged in a national project on Groundwater Flooding. The data from this project may be useful in relation to Flood Risk Assessment (FRA) and management plans, and is described in more detail under 'Groundwater' above.

Natural Resources (Minerals/Aggregates)
Geological Survey Ireland provides data, maps, interpretations and advice on matters related to minerals, their use and their development in our Minerals section of the website. The Active Quarries, Mineral Localities and the Aggregate Potential maps are available on our Map Viewer.

We would recommend use of the Aggregate Potential Mapping viewer to identify areas of High to Very High source aggregate potential within the area. In keeping with a sustainable approach we would recommend use of our data and mapping viewers to identify and ensure that natural resources used in the proposed development are sustainably sourced from properly recognised and licensed facilities, and that consideration of future resource sterilization is considered.

Guidelines
The following guidelines may also be of assistance:

- Institute of Geologists of Ireland, 2013. Guidelines for the Preparation of the Soils, Geology and Hydrogeology Chapters of Geology in Environmental Impact Statements.

- EPA, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)

Other Comments
Should development go ahead, all other factors considered, Geological Survey Ireland would much appreciate a copy of reports detailing any site investigations carried out. The data would be added to Geological Survey Ireland's national database of site investigation boreholes, implemented to provide a better service to the civil engineering sector. Data can be sent to the Geological Mapping Unit, at mailto:GeologicalMappingInfo@gsi.ie, 01-678 2795.

I hope that these comments are of assistance, and if we can be of any further help, please do not hesitate to the Geological Survey Ireland Planning Team at GSIPlanning@gsi.ie.

Yours sincerely,

Geoheritage and Planning Programme

Enc: Table - Geological Survey Ireland's Publicly Available Datasets Relevant to Planning, EIA and SEA processes.

An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications

Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Geological Survey Ireland's Publicly Available Datasets Relevant to Planning, EIA and SEA processes

following European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018

(S.I. No. 296 of 2018)

Geological Survey Ireland Programme	Dataset	Relevant EIA Topic	Coverage	Description / Notes / Limitations	Link to Geological Survey Ireland map viewer
Geohazards	Landslide: National landslide database and landslide susceptibility map	Land & Soil/Climate/Landscape	National	Associated guidance documentation relating to the National Landslide Susceptibility Map is also available.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b68cf1e4a9044a5981f950e9b9c5625c
Geohazards	Groundwater Flooding (Historic)	Water	Regional	Provide information of historic flooding, both surface water and groundwater. [A lack of flooding presented in any specific location of the map only indicates that a flood has not been detected. It does not indicate that a flood cannot occur in that location at present or in the future]	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc
Geohazards	Groundwater Flooding (Predictive)	Water	Regional	Provides information on the probability of future karst groundwater flooding (where available). [The maps do not, and are not intended to, constitute advice. Professional or specialist advice should be sought before taking, or refraining from, any action on the basis of the flood maps]	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=848f83c85799436b808652f9c735b1cc
Geohazards	Radon Map	Land & Soils/Air	National		http://www.epa.ie/radiation/radonmap/
Geoheritage	County Geological Sites as adopted by National Heritage Plan and listed in County Development Pla	Land & Soils/Landscape	Regional	All geological heritage sites identified by Geological Survey Ireland are categorised as CGS pending any further NHA designation by NPWS.	https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228
Geological Mapping	Bedrock geology:	Land & Soils	National	1:100,000 scale and associated memoirs.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0
Geological Mapping	Bedrock geology:	Land & Soils	Regional	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0
Geological Mapping	Quaternary geology: Sediments	Land & Soils	National	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0
Geological Mapping	Quaternary geology: Geomorphology	Land & Soils	National	1:50,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=de7012a99d2748ea9106e7ee1b6ab8d5&scale=0
Geological Mapping	Physiographic units:	Land & Soils	National	Broad-scale physical landscape units mapped at 1:100,000 scale in order to be represented as a cartographic digital map at 1:250,000 scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=afa76a420fc54877843aca1bc075c62b
Geological Mapping	GeoUrban: Spatial geological data for the greater Dublin and Cork areas	Land & Soils	Regional	includes 3D models	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=9768f4818b79416093b6b2212a850ce6&scale=0
Geological Mapping	Geotechnical database	Land & Soils	National	Digitised geotechnical and Site Investigation Reports and boreholes which can be accessed through online downloads	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=a2718be1873d47a585a3f0415b4a724c
Goldmine	Historical data sets including geological memoirs and 6" to 1 mile geological mapping records	land & Soils/Water	National	available online	https://secure.dccae.gov.ie/goldmine/index.html
Groundwater & Geothermal	Groundwater resources (aquifers)	Water	National	Data limited to 1:100,000 scale; sites should be investigated at local scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Groundwater recharge.	Water	National	Data limited to 1:40,000 scale; sites should be investigated at local scale; long term annual average recharge	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Groundwater vulnerability.	Water	National	Data limited to 1:40,000 scale; sites should be investigated at local scale	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Group scheme and public supply source protection areas.	Water	National	Not all PWS / GWS have SPZ / ZOC. Check with IW / coco / NFGWS for private supplies.	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Groundwater Protection Schemes	Water	National	Data is limited to scale of 1:40,000. Data does not include all of the source protections areas	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Catchment and WFD management units.	Water	National		https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	karst specific data layers	water	National	For areas underlain by limestone, includes karst features, tracer test database; turlough water levels (gwlevel.ie).	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Wells and Springs	Water	National	Not comprehensive, there may be unrecorded wells and springs	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=7e8a202301594687ab14629a10b748ef
Groundwater & Geothermal	Groundwater body Descriptions	Water	National	Not exhaustive; only those in designated SACs; could be other GWDTEs; for more information contact NPWS / EPA / site investigations	https://www.gsi.ie/en-ie/programmes-and-projects/groundwater-and-geothermal-unit/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx
Groundwater & Geothermal	Geothermal Suitability maps	land & Soils/Water	National	Also, Roadmap for a Policy and Regulatory Framework for Geothermal Energy, November 2020	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=9ee46bee08de41278b90a991d60c0b9e
Marine & Coastal Unit	INFOMAR - Ireland's national marine mapping programme; providing key baseline data for Ireland's	Water	National		https://secure.dccae.gov.ie/GSI/INFOMAR_VIEWER/
Marine & Coastal Unit	CHERISH - Coastal change project (Climate, Heritage and Environments of Reefs, Islands, and Headla	Water	Regional		http://www.cherishproject.eu/en/
Marine & Coastal Unit	Coastal Vulnerability Index (CVI).	water /Land & Soils	Regional	Currently the project is being carried out on the east coast and will be rolled out nationally	https://www.gsi.ie/en-ie/programmes-and-projects/marine-and-coastal-unit/projects/Pages/Coastal-Vulnerability-Index.aspx
Minerals	Aggregate potential	Land & Soils/Material Assets	National	Consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process	https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956
Minerals	Active quarries	Land & Soils	National		https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=ee8c4c285a49413aa6f1344416dc9956
Minerals	Historic mines	Land & Soils/Cultural Heritage	National	Inventory and Risk Classification 2009. Environmental Protection Agency, Economic Minerals Division and Geological Survey Ireland (DECC).	https://gis.epa.ie/EPAMaps/default?easting=?&northing=?&lid=EPA:LEMA_Facilties_Extractive_Facilities https://www.epa.ie/enforcement/mines/
Tellus	Geochemical data: multi-element data for shallow soil, stream sediment and stream water	Land & Soils	Regional	A national mapping programme	https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754
Tellus	Airborne geophysical data including radiometrics, electromagnetics and magnetics	Land & Soils	Regional	A national mapping programme	https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754
Tellus	urban geochemistry mapping (Dublin SURGE project),	Land & Soils	Regional		https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=6304e122b733498b99642707ff72f754

Notes:

1. The maps and data listed above are available on the Geological Survey Ireland map viewer https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx

2. Please read all disclaimers carefully when using Geological Survey Ireland data

3. Geological Survey Ireland and Irish Concrete Federation published guidelines for the treatment of geological heritage in the extractive industry in 2008.

Saoirse Kavanagh

From: Drainage Admin <drainage.admin@opw.ie>
Sent: Monday 12 February 2024 13:55
To: Saoirse Kavanagh
Subject: Re: EIAR Consultation - Castlelands, Mallow Residential Development

NOTE: *This email originated from outside the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.*

Dear Saoirse,

I refer to your email below and apologies for the delay in reply.

The Office Of Public Works (OPW) South West Drainage Maintenance office have no comment to make regarding this development.

Kind regards
Karen

From: Saoirse Kavanagh <skavanagh@mhplanning.ie>
Sent: Wednesday 11 October 2023 12:27
To: Info Opw <info@opw.ie>
Subject: EIAR Consultation - Castlelands, Mallow Residential Development

A Chara,

We are acting on behalf of Reside (Castlepark) Ltd in the preparation of an Environmental Impact Assessment Report (EIAR) for a proposed residential development at Castlelands, Mallow, Co. Cork. The proposed development will comprise a total of c. 463 no. units and will be submitted as two applications – a standard planning application for c. 99 no. units and an LRD application for c. 364 no. units. The EIAR will take account of both applications and will be submitted with the LRD application.

Research and baseline analysis for the EIAR has commenced and an impact assessment will be carried out following completion of the design of the proposed development.

Please see attached a letter with details of the site location, proposed development, and the proposed EIAR.

Please also see attached the following documents which provide further detail of the proposed development. Please note these details are subject to change as the design progresses.

- Proposed LRD layout including schedule for Phase 1 (standard application) and Phase 2 (LRD).
- Proposed Layout for Phase 1
- Overall Masterplan Site Area drawing.

If you have any comments in relation to the potential environmental impacts of the proposed development, I would be grateful if you would forward them to me as soon as is convenient.

Kind regards,
Saoirse

Saoirse Kavanagh
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McCutcheon Halley
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Saoirse Kavanagh

From:	INFO <Information@tii.ie>
Sent:	Monday 6 November 2023 13:59
To:	Saoirse Kavanagh
Subject:	TII Ref: TII23-124761 - EIAR Consultation - Castlelands, Mallow Residential Development, Cork

Dear Ms. Kavanagh,

Thank you for your correspondence of 11 October 2023 regarding the above. Transport Infrastructure Ireland's (TII's) position in relation to your enquiry is as follows.

National Strategic Outcome 2 of the National Planning Framework includes the objective to maintain the strategic capacity and safety of the national road network. It is also an investment priority of the National Development Plan, to ensure that the extensive transport networks which have been greatly enhanced over the last two decades, are maintained to a high level to ensure quality levels of service, accessibility, and connectivity to transport users.

The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals, following the examination of any valid planning application referred.
With respect to EIAR/Environmental Constraints Scoping issues, the recommendations indicated below provide only general guidance for the preparation of an EIAR, which may affect the national road network.
The developer should have regard, inter alia, to the following:

- Consultations should be had with the relevant Local Authority/National Roads Design Office, with regard to the locations of existing and future national road schemes in the area.
- As established in the Spatial Planning and National Roads Guidelines, it is in the public interest that the national road network continues to serve its intended strategic purpose. The developer should ensure regard to TII's 'Traffic and Transport Assessment Guidelines' (2014).
- Any proposals related to future public transport provision are a matter for the NTA.
- The Environmental Impact Assessment shall include provision for travel planning / mobility management planning in the interests of protecting national roads capacity and of sustainable travel policy. Transport analysis should also consider:
    - A mobility management plan should accompany the transport assessment.
    - Modal share targets should be outlined and how any public transport modal share is accommodated.
    - Measures proposed to reduce car dependency should be outlined.
    - Detailed phasing proposals of development with associated transport infrastructure provision is required.
    - Consider and address cumulative impacts of other development and impacts on limited national road capacity.
    - The traffic and transport assessment should consider all road users.
    - Mitigation measures should be aligned with phasing of road infrastructure improvements and required public transport interventions; all clearly outlined.
- Assessments, design and construction and maintenance standards and guidance are available at TII Publications. In particular, the developer is advised to address the requirements for Road Safety Audit (RSA).
- The developer should assess visual impacts from existing national roads and future roads schemes.

- The developer, in conducting Environmental Impact Assessment, should have regard to TII Environment Guidelines that deal with assessment and mitigation measures for varied environmental factors and occurrences, in particular:
    - TII's Environmental Assessment and Construction Guidelines, including the, 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes', (National Roads Authority (NRA), 2006),
    - The EIAR should consider the 'Environmental Noise Regulations 2006 (SI 140 of 2006)' and how the development will affect future action plans by the relevant competent authority, as well as the 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes', (1st Rev., NRA, 2004).
- The developer is advised that any additional works/structures/ mitigations required because of the Assessment should be funded by the developer. TII will not entertain future claims in respect of impacts (e.g. noise, dust, visual and air), due to the presence of the existing national road or any road scheme.

Notwithstanding, any of the above, the developer should be aware that this list is non-exhaustive, thus site and development specific issues should be addressed in accordance with best practice.

I hope that this information is of assistance to you.

Yours sincerely,

____

Andrew Moore
Senior Regulatory & Administration Executive

From: Saoirse Kavanagh <skavanagh@mhplanning.ie>
Sent: Wednesday, October 11, 2023 12:27 PM
To: Landuse Planning <LandUsePlanning@tii.ie>
Subject: EIAR Consultation - Castlelands, Mallow Residential Development

A Chara,

We are acting on behalf of Reside (Castlepark) Ltd in the preparation of an Environmental Impact Assessment Report (EIAR) for a proposed residential development at Castlelands, Mallow, Co. Cork. The proposed development will comprise a total of c. 463 no. units and will be submitted as two applications – a standard planning application for c. 99 no. units and an LRD application for c. 364 no. units. The EIAR will take account of both applications and will be submitted with the LRD application.

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Please also see attached the following documents which provide further detail of the proposed development. Please note these details are subject to change as the design progresses.

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- Proposed Layout for Phase 1
- Overall Masterplan Site Area drawing.

If you have any comments in relation to the potential environmental impacts of the proposed development, I would be grateful if you would forward them to me as soon as is convenient.

Kind regards,
Saoirse

Saoirse Kavanagh
Executive Planning Consultant
McCutcheon Halley
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In accordance with TII's Right to Disconnect policy, if you are receiving this email outside of normal working hours, I do not expect a response or action outside of your own working hours unless it is clearly noted as requiring urgent attention.

De réir pholasaí BIÉ An Ceart gan a bheith Ceangailte, má tá an ríomhphost seo á fháil agat lasmuigh de na gnáthuaireanta oibre, nílim ag súil le freagra ná le gníomh uait lasmuigh de do ghnáthuaireanta oibre féin mura bhfuil sé ráite go soiléir go bhfuil gá gníomhú go práinneach.

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then please notify postmaster@tii.ie and delete the original including attachments.

Córas r-phoist BIE: Tá an ríomhphost seo agus aon chomhaid a tharchuirtear leis faoi rún agus beartaithe lena n-úsáid ag an duine aonair nó ag an eintiteas a bhfuil siad dírithe chuige/chuici amháin. Más rud é go bhfuair tú an ríomhphost seo trí bhotún, cuir sin in iúil do postmaster@tii.ie, le do thoil, agus scrios an ríomhphost bunaidh agus aon cheangaltáin.

Uisce Éireann
Irish Water

FAO: Saoirse Kavanagh

McCutcheon Halley Planning Consultants
6 Joyce House,
Barrack Square,
Ballincollig,
Cork, P31
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T: +353 1 89 25000
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www.water.ie

17th October, 2023

By Email: skavanagh@mhplanning.ie

Re: EIA Scoping Request – for a proposed residential development consisting of c.463 no. residential units at Castlelands, Mallow, Co. Cork

Dear Saoirse Kavanagh,

Uisce Éireann has received notification of your Environmental Impact Assessment (EIA) scoping request relating to the forthcoming planning application for a proposed residential development consisting of c.463 no. residential units at Castlelands, Mallow, Co. Cork

Please see attached, Uisce Éireann's scoping opinion in relation to Water Services. On receipt of the planning referral, Uisce Éireann will review the finalised Environmental Impact Assessment Report (EIAR) as part of the planning process.

Queries relating to the terms and observations above should be directed to planning@water.ie

Yours sincerely,

PP Ali Robinson

Signed on behalf of Yvonne Harris

Connections and Developer Services

Uisce Éireann's Response to EIA Scoping Requests

At present, Uisce Éireann does not have the capacity to advise on the scoping of individual projects. However, in general the following aspects of Water Services should be considered in the scope of an EIA where relevant;

a) Where the development proposal has the potential to impact an Uisce Éireann Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Uisce Éireann's Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified as part of the report.

b) Where the development proposes the backfilling of materials, the applicant is required to include a waste sampling strategy to ensure the material is inert.

c) Mitigations should be proposed for any potential negative impacts on any water source(s) which may be in proximity and included in the environmental management plan and incident response.

d) Any and all potential impacts on the nearby reservoir as public water supply water source(s) are assessed, including any impact on hydrogeology and any groundwater/ surface water interactions.

e) Impacts of the development on the capacity of water services (*i.e. do existing water services have the capacity to cater for the new development*). This is confirmed by Uisce Éireann in the form of a Confirmation of Feasibility (COF). If a development requires a connection to either a public water supply or sewage collection system, the developer is advised to submit a Pre-Connection Enquiry (PCE) enquiry to Uisce Éireann to determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available from https://www.water.ie/connections/connection-steps/.

f) The applicant shall identify any upgrading of water services infrastructure that would be required to accommodate the proposed development.

g) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an Uisce Éireann collection network.

h) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks and potential measures to minimise and or / stop surface waters from combined sewers.

i) Any physical impact on Uisce Éireann assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets.

j) When considering a development proposal, the applicant is advised to determine the location of public water services assets, possible connection points from the applicant's site / lands to the public network and any drinking water abstraction catchments to ensure these are included and fully assessed in any pre-planning proposals. Details, where known, can be obtained by emailing an Ordnance Survey map identifying the proposed location of the applicant's intended development to datarequests@water.ie

k) Other indicators or methodologies for identifying infrastructure located within the applicant's lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed site.

l) Any potential impacts on the assimilative capacity of receiving waters in relation to Uisce Éireann discharge outfalls including changes in dispersion / circulation characterises. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified within the report.

m) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (*and resultant potential impact on the capacity of the source*) or the potential of the development to influence / present a risk to the quality of the water abstracted by Uisce Éireann for public supply should be identified within the report.

n) Where a development proposes to connect to an Uisce Éireann network and that network either abstracts water from or discharges wastewater to a "protected"/ sensitive area, consideration as to whether the integrity of the site / conservation objectives of the site would be compromised should be identified within the report.

o) Mitigation measures in relation to any of the above ensuring a zero risk to any Irish Water drinking water sources (Surface and Ground water).

This is not an exhaustive list.

Please note;

• Where connection(s) to the public network is required as part of the development proposal, applicants are advised to complete the Pre-Connection Enquiry process and have received a Confirmation of Feasibility letter from Uisce Éireann ahead of any planning application.

• Uisce Éireann will not accept new surface water discharges to combined sewer networks.

Castlelands LRD, Mallow

CHAPTER 5 Land, Soil, & Geology

Appendix 5.1 Priority Geotechnical Ltd., 2024 Trial Pit Logs and Infiltration Tests

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 5.1 Priority Geotechnical Ltd., 2024 Trial Pit Logs and Infiltration Tests

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **SA01**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:**		**Date** 06/02/2024
		Level:		
Location: Co. Cork		**Dimensions (m):**	2.70 × 0.80	**Scale** 1:25
Client:		**Depth:** 2.30m BGL		**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.50			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to course angular rounded.
	2.00	B		2.30			Brown slightly Clayey slightly Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded.
							End of Pit at 2.300m

Depth scale: 1, 2, 3, 4, 5

Stability: Good
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

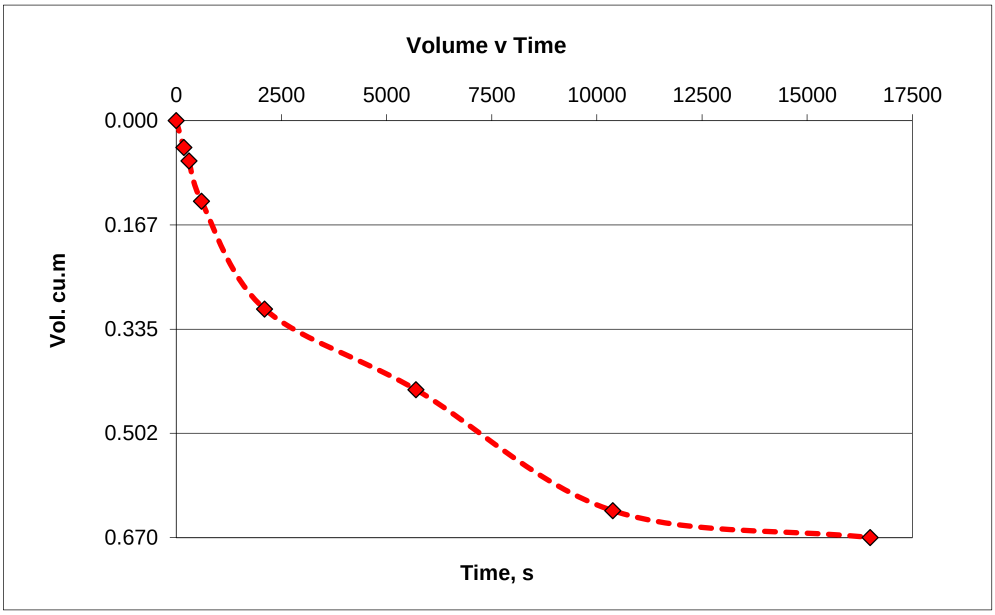
Project Nr. P24011
Project Name Castlelands Mallow
Location SA01
Cycle 1
Date: 06/02/2024

l, m	**2.70**	b, m	**0.80**	d, m	**2.30**
l_base, m	**2.70**			d_eff, m	**1.30**
l_eff, m	**2.70**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:35	0	1.00	0	1.30	0.00	0.000
	3	1.02	180	1.28	0.02	0.043
	5	1.03	300	1.27	0.03	0.065
	10	1.06	600	1.24	0.06	0.130
	35	1.14	2100	1.16	0.14	0.302
	95	1.20	5700	1.10	0.20	0.432
	173	1.29	10380	1.01	0.29	0.626
	275	1.31	16500	0.99	0.31	0.670

Area	2.160 m^2	$V_{p75\text{-}25\ theory}$	volume	1.4040 m^3
50% Area_eff, a_{p50}	6.710 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.3348 m^3
50% Area_act, a_{p50}	5.625 m^2	$t_{p\ 75\text{-}\ 25\ actual}$	time	6471 s

Infiltration Coefficient *f* 9.20E-06 ms^-1



NOTES:
See SA01 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA01**	**Project**	Castlelands, Mallow, Co. Cork.
		Project No	P24011
		Engineer	DOSA

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **SA02**

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:**	**Date** 06/02/2024
		Level:	
Location: Co. Cork		**Dimensions (m):** 3.20 × 0.80	**Scale** 1:25
Client:		**Depth:** 2.00m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30			Hard Yellowish Brown Sandy slightly Gravelly CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 63-200mm.*
	2.00	B		2.00			Yellowish Brown Clayey Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded. *Cobble content between 63-200mm.*
							End of Pit at 2.000m

Depth scale: 1, 2, 3, 4, 5

Stability: Good.
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.00m bgl, scheduled depth reached.

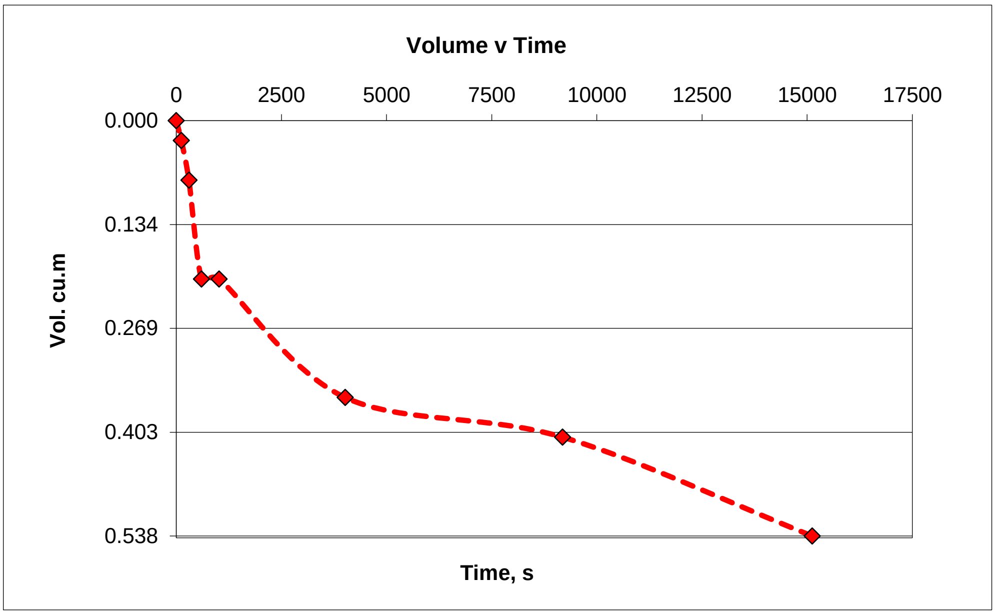
Project Nr. P24011
Project Name Castlelands Mallow
Location SA02
Cycle 1
Date: 06/02/2024

l, m	**3.20**	b, m	**0.80**	d, m	**2.00**
l_base, m	**3.20**			d_eff, m	**1.30**
l_eff, m	**3.20**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:58	0	0.70	0	1.30	0.00	0.000
	2	0.71	120	1.29	0.01	0.026
	5	0.73	300	1.27	0.03	0.077
	10	0.78	600	1.22	0.08	0.205
	17	0.78	1020	1.22	0.08	0.205
	67	0.84	4020	1.16	0.14	0.358
	153	0.86	9180	1.14	0.16	0.410
	252	0.91	15120	1.09	0.21	0.538

Area	2.560 m^2	$V_{p75-25\ theory}$	volume	1.6640 m^3
50% Area_eff, a_{p50}	7.760 m^2	$V_{p\ 75-25\ actual}$	volume	0.2688 m^3
50% Area_act, a_{p50}	6.920 m^2	$t_{p\ 75-25\ actual}$	time	8048 s

Infiltration Coefficient *f* 4.83E-06 ms^-1



NOTES:
See SA02 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

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www.prioritygeotechnical.ie

Trial Pit No **SA03**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:** **Level:**	**Date** 06/02/2024
Location: Co. Cork		**Dimensions (m):** 3.00 × 0.80	**Scale** 1:25
Client:		**Depth:** 2.30m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to medium angular sub-rounded.
				1.70			Yellowish Brown Gravelly Sandy CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles angular sub-angular with mudstone lithology. *Cobble content between 63-280mm.* *Red oxidised layer at 0.5-0.8m bgl.* *Colour change to brown at 0.8-1.7m bgl.*
	2.00	B		2.30			Brown very Sandy Clayey GRAVEL with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 68-160mm.*
							End of Pit at 2.300m

Stability: Very Poor to Good.
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

Photographic Record

Number: **SA03**	**Project**	Castlelands, Mallow, Co. Cork.	
	Project No	P24011	
	Engineer	DOSA	

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

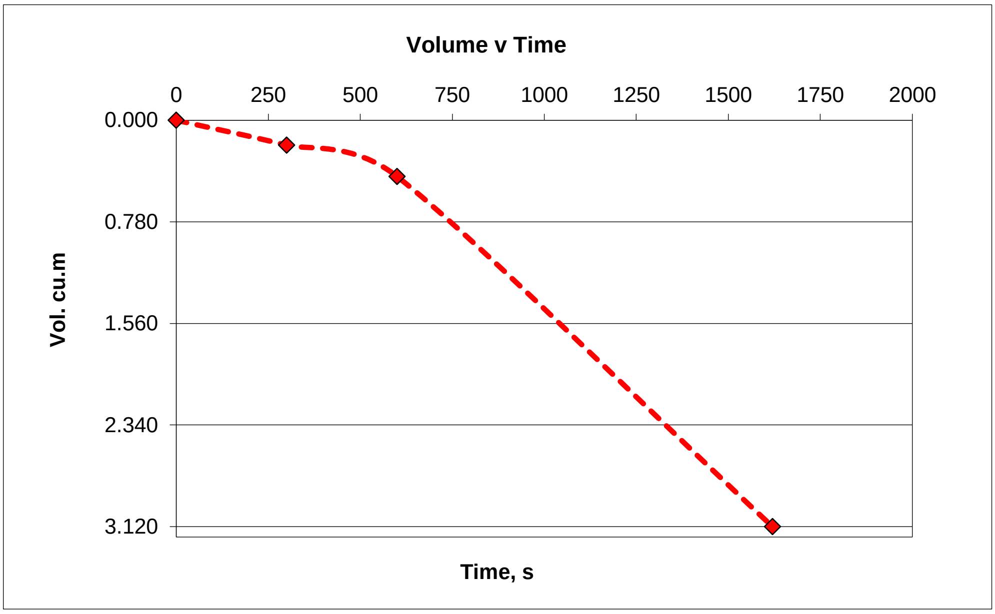
Project Nr. P24011
Project Name Castlelands Mallow
Location SA03
Cycle 1
Date: 06/02/2024

l, m	**3.00**	b, m	**0.80**	d, m	**2.30**
l_base, m	**3.00**			d_eff, m	**1.30**
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
13:28	0	1.00	0	1.30	0.00	0.000
	5	1.08	300	1.22	0.08	0.192
	10	1.18	600	1.12	0.18	0.432
13:55	27	2.30	1620	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75\text{-}25\ theory}$	volume	1.56 m^3	
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.56 m^3	
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ 75\text{-}\ 25\ actual}$	time	465 s	

Infiltration Coefficient *f* 4.57E-04 ms^-1



NOTES:
See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over effective depths.

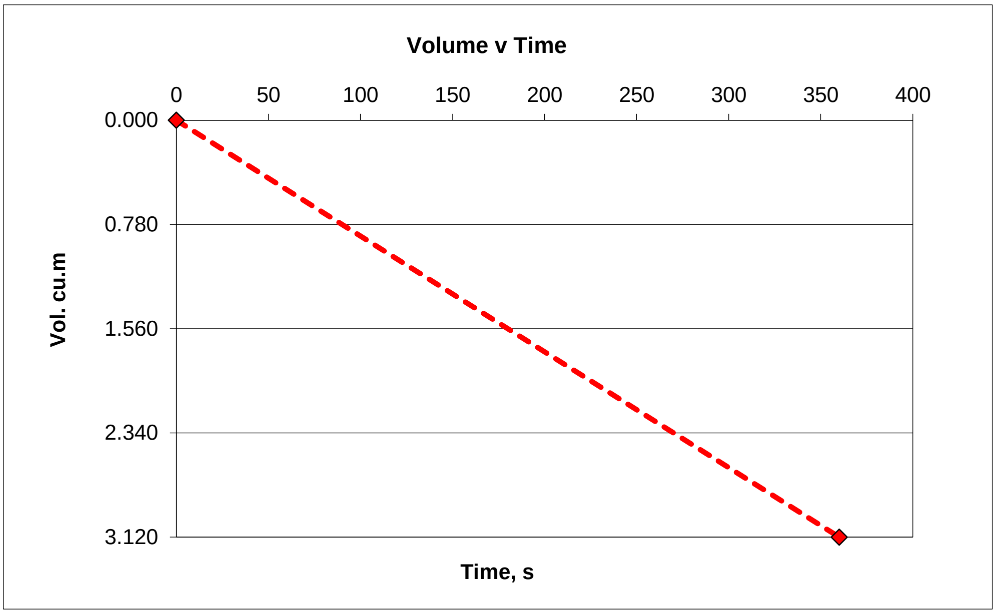
Project Nr. P24011
Project Name Castlelands Mallow
Location SA03
Cycle 2
Date: 06/02/2024

l, m	**3.00**	b, m	**0.80**	d, m	**2.30**
l_base, m	**3.00**			d_eff, m	**1.30**
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
15:35	0	1.00	0	1.30	0.00	0.000
15:41	6	2.30	360	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75\text{-}25\ theory}$	volume	1.5600	m^3
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.5600	m^3
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	175	s

Infiltration Coefficient *f* 1.75E+02 ms^-1



NOTES:
See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall
Further tests termianted due to pit collapse

0.325	0.325
0.975	0.975
0.78	

Castlelands LRD, Mallow

CHAPTER 6 Hydrology & Hydrogeology

Appendix 6.1 Priority Geotechnical Ltd., 2024 Trial Pit Logs and Infiltration Tests

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 6.1 Priority Geotechnical Ltd., 2024 Trial Pit Logs and Infiltration Tests

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

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Trial Pit No **SA01**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:**		**Date** 06/02/2024
		Level:		
Location: Co. Cork		**Dimensions (m):** 2.70 × 0.80		**Scale** 1:25
Client:		**Depth:** 2.30m BGL		**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.50			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to course angular rounded.
	2.00	B		2.30			Brown slightly Clayey slightly Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded.
							End of Pit at 2.300m

Depth scale: 1, 2, 3, 4, 5

Stability: Good
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

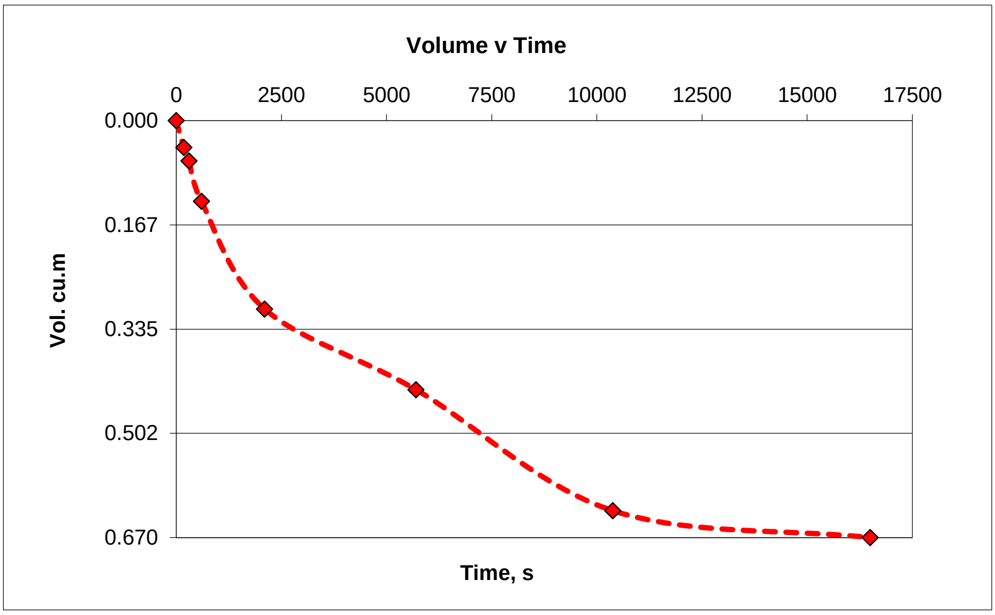
Project Nr. P24011
Project Name Castlelands Mallow
Location SA01
Cycle 1
Date: 06/02/2024

l, m	**2.70**	b, m	**0.80**	d, m	**2.30**
l_base, m	**2.70**			d_eff, m	**1.30**
l_eff, m	**2.70**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:35	0	1.00	0	1.30	0.00	0.000
	3	1.02	180	1.28	0.02	0.043
	5	1.03	300	1.27	0.03	0.065
	10	1.06	600	1.24	0.06	0.130
	35	1.14	2100	1.16	0.14	0.302
	95	1.20	5700	1.10	0.20	0.432
	173	1.29	10380	1.01	0.29	0.626
	275	1.31	16500	0.99	0.31	0.670

Area	2.160 m^2	$V_{p75\text{-}25\ theory}$	volume	1.4040 m^3
50% Area_eff, a_{p50}	6.710 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.3348 m^3
50% Area_act, a_{p50}	5.625 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	6471 s

Infiltration Coefficient *f* 9.20E-06 ms^-1



NOTES:
See SA01 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

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Trial Pit No **SA02**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:** **Level:**	**Date** 06/02/2024
Location: Co. Cork		**Dimensions (m):** 3.20 × 0.80	**Scale** 1:25
Client:		**Depth:** 2.00m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.30			Hard Yellowish Brown Sandy slightly Gravelly CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 63-200mm.*
							Yellowish Brown Clayey Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded. *Cobble content between 63-200mm.*
	2.00	B		2.00			End of Pit at 2.000m

Depth scale: 1, 2, 3, 4, 5

Stability: Good.
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.00m bgl, scheduled depth reached.

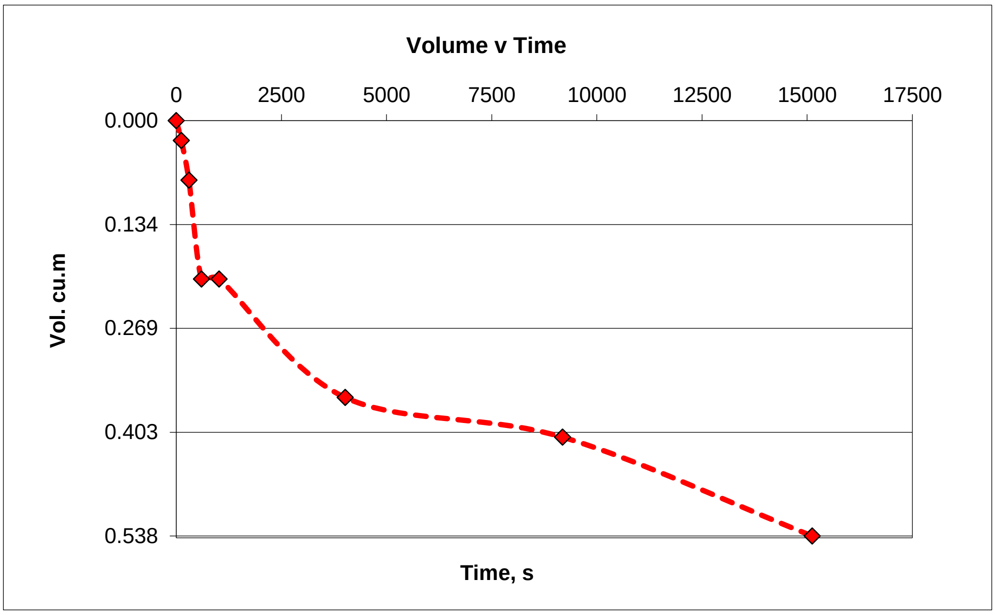
Project Nr.	P24011
Project Name	Castlelands Mallow
Location	SA02
Cycle	1
Date:	06/02/2024

l, m	**3.20**	b, m	**0.80**	d, m	**2.00**
l_base, m	**3.20**			d_eff, m	**1.30**
l_eff, m	**3.20**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:58	0	0.70	0	1.30	0.00	0.000
	2	0.71	120	1.29	0.01	0.026
	5	0.73	300	1.27	0.03	0.077
	10	0.78	600	1.22	0.08	0.205
	17	0.78	1020	1.22	0.08	0.205
	67	0.84	4020	1.16	0.14	0.358
	153	0.86	9180	1.14	0.16	0.410
	252	0.91	15120	1.09	0.21	0.538

Area	2.560 m^2	$V_{p75\text{-}25\ theory}$	volume	1.6640 m^3
50% Area_eff, a_{p50}	7.760 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.2688 m^3
50% Area_act, a_{p50}	6.920 m^2	t_p 75- 25 actual	time	8048 s

Infiltration Coefficient *f* 4.83E-06 ms^-1



NOTES:
See SA02 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Priority Geotechnical Ltd. Tel: 021 4631600 Fax: 021 4638690 www.prioritygeotechnical.ie	Trial Pit No **SA03** Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:** **Level:**	**Date** 06/02/2024
Location: Co. Cork		**Dimensions (m):** 3.00 × 0.80	**Scale** 1:25
Client:		**Depth:** 2.30m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to medium angular sub-rounded.
				1.70			Yellowish Brown Gravelly Sandy CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles angular sub-angular with mudstone lithology. *Cobble content between 63-280mm.* *Red oxidised layer at 0.5-0.8m bgl.* *Colour change to brown at 0.8-1.7m bgl.*
	2.00	B		2.30			Brown very Sandy Clayey GRAVEL with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 68-160mm.*
							End of Pit at 2.300m

1 2 3 4 5

Stability: Very Poor to Good.
Plant: 14t Excavator.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

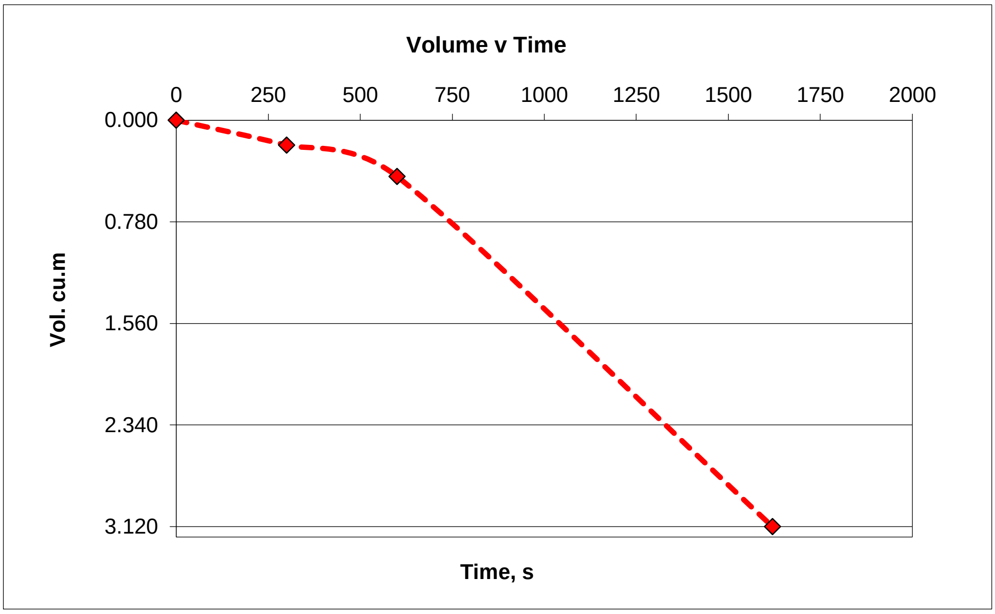
Project Nr.	P24011
Project Name	Castlelands Mallow
Location	SA03
Cycle	1
Date:	06/02/2024

l, m	**3.00**	b, m	**0.80**	d, m	**2.30**
l_base, m	**3.00**			d_eff, m	**1.30**
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
13:28	0	1.00	0	1.30	0.00	0.000
	5	1.08	300	1.22	0.08	0.192
	10	1.18	600	1.12	0.18	0.432
13:55	27	2.30	1620	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75-25\ theory}$	volume	1.56 m^3
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75-25\ actual}$	volume	1.56 m^3
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ 75-25\ actual}$	time	465 s

Infiltration Coefficient *f* 4.57E-04 ms^-1



NOTES:
See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over effective depths.

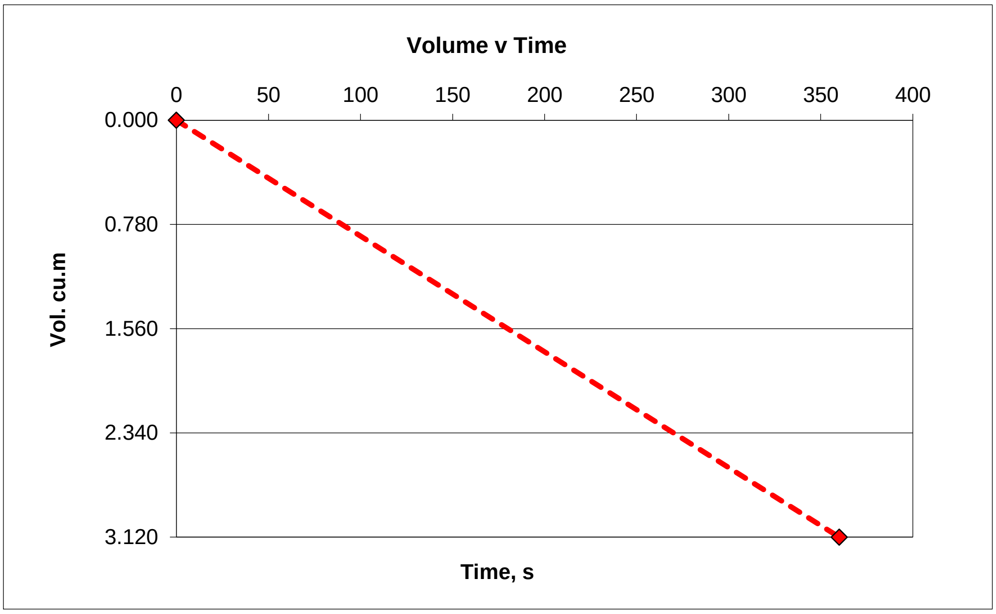
Project Nr.	P24011
Project Name	Castlelands Mallow
Location	SA03
Cycle	2
Date:	06/02/2024

l, m	**3.00**	b, m	**0.80**	d, m	**2.30**
l_base, m	**3.00**			d_eff, m	**1.30**
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
15:35	0	1.00	0	1.30	0.00	0.000
15:41	6	2.30	360	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75\text{-}25\ theory}$	volume	1.5600	m^3
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.5600	m^3
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	175	s

Infiltration Coefficient *f* 1.75E+02 ms^-1



NOTES:

See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall
Further tests termianted due to pit collapse

0.325	0.325
0.975	0.975
0.78	

Castlelands LRD, Mallow

CHAPTER 10 Landscape & Visual Impact

Appendix 10.1 Photomontages

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 10.1 Photomontages

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

CASTLE PARK, CASTLELANDS, MALLOW

LRD Verified View Photomontages

October 2024

Document at A3 prepared by G-Net 3D

NSC Campus, Mahon, Cork

www. gnet3d.com

Photomontage Methodology

The methodology used to develop the photomontages is based on the "Visual Representation of Development Proposals" Guidance note by the Landscape Institute, 2019.

Photography

The photography was carried out on the November 7th and 13th, 2023, using Sony α7RIII full frame camera. Two lenses 24mm and 50mm prime lens were used for the photography.
A 24mm - wide angle lens was selected for the photography to provide more information on the context around the proposed development. The horizontal field of view of these photographs is 74°. The above-mentioned guidance suggests that 40° angle is the closest to human eye vision and is recommended for the verified photomontages. In the cases where the wide lens is used, there should be an indication of 40° field of view, which is shown on the bottom of all the views.
A recommended viewing distance of the photomontages taken using 50mm lens is around 500mm and 24mm lens - 300mm from eyes when printed on A3 paper.

Geomax Zenith 60 GPS Antennae was used to accurately record the viewpoint and reference markers' coordinates and height levels. Viewpoint locations are indicated in the viewpoint map to the right, viewpoint coordinates and information on photography is under each photo.

Modelling

Preparation of an accurate 3D model of the proposed residential development, including existing landscape and infrastructure.

Setup

The following information is used to accurately position the model of the proposed development into the photographs:
-Site survey,
-Photographs,
-Verified viewpoint coordinates and height levels are accurately marked on the location OSi map.
To match the 3D camera view with the photograph we take the following steps:
The camera height is taken from information gathered on the levels from where the photos are taken (table below). The height levels of the proposed development are outlined on the site. Focal length is based on the photograph EXIF info.
This data is imported into our 3D software and the 3D camera is matched with the selected photographs. To match the 3D camera accurately we use all the above data and the reference 3D models. The reference 3D models are existing structures i.e. buildings, roads, lamps, etc which are visible on the photographs. These items are modelled based on the survey information. After all the above conditions are fulfilled and we are satisfied that the camera matches correctly, we proceed to the next step.

Rendering

We apply the materials and textures prior to rendering the photomontage images. Light settings are adjusted to match the brightness of the photographs and sun is positioned according to the date and time the photo was taken.

Post processing

This process means incorporating a 3D image of the proposed development into the photograph to achieve the final result.

View 1. As Exists

Project Name: Castle Park LRD	Photo Date: 13.11.2023 Photo Time: 13:35 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556248.966;598434.229;52.078

Prepared By G-Net 3D

View 1. Outline of Proposed

Project Name: Castle Park LRD	Photo Date: 13.11.2023 Photo Time: 13:35 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556248.966;598434.229;52.078	Prepared By G-Net 3D

View 2. As Exists

Project Name: Castle Park LRD	Photo Date: 13.11.2023 Photo Time: 13:45 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556646.552;598784.020;86.193	Prepared By G-Net 3D

View 2. Proposed

Project Name: Castle Park LRD	Photo Date: 13.11.2023 Photo Time: 13:45 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556646.552;598784.020;86.193	Prepared By G-Net 3D

View 3. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 11:22 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 557121.164;599259.607;76.423	Prepared By G-Net 3D

View 3. Proposed

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 11:22 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 557121.164;599259.607;76.423	Prepared By G-Net 3D G-NET 3D

View 4. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 11:39 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 558050.160;599099.229;72.755

Prepared By G-Net 3D

View 4. Outline of Proposed

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 11:39 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 558050.160;599099.229;72.755

Prepared By G-Net 3D

View 5. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 12:29 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 558808.642;598296.988;55.488	Prepared By G-Net 3D G-NET 3D

View 5. Outline of Proposed

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 12:29 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 558808.642;598296.988;55.488	Prepared By G-Net 3D G-NET3D

View 6. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 13:28 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 557326.290;597915.355;62.326	Prepared By G-Net 3D

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 13:28 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 557326.290;597915.355;62.326	Prepared By G-Net 3D G-NET 3D

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 14:48 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556809.559;598060.900;43.973	Prepared By G-Net 3D

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 14:48 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556809.559;598060.900;43.973

View 8. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 14:11 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556297.998;598231.679;55.092	Prepared By G-Net 3D

View 8. Outline of Proposed

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 14:11 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556297.998;598231.679;55.092	Prepared By G-Net 3D G-NET 3D

View 9. As Exists

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 13:44 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556094.630;598021.454;47.348	Prepared By G-Net 3D

View 9. Outline of Proposed

Project Name: Castle Park LRD	Photo Date: 07.11.2023 Photo Time: 13:44 Camera: Sony a7RIII	Viewpoint Coordinates (ITM): 556094.630;598021.454;47.348	Prepared By G-Net 3D

Castlelands LRD, Mallow

CHAPTER 12 Material Assets: Service Infrastructure & Utilities

Appendix 12.1 Proposed DOSA Surface Water Drainage Drawings
Appendix 12.2 Proposed DOSA Wastewater Drainage Drawings
Appendix 12.3 Proposed DOSA Water Supply Drawings
Appendix 12.4 DOSA Infrastructure Report
Appendix 12.5 DOSA Surface Water Management Plan
Appendix 12.6 Kelliher Electrical Public Lighting Drawings & Report

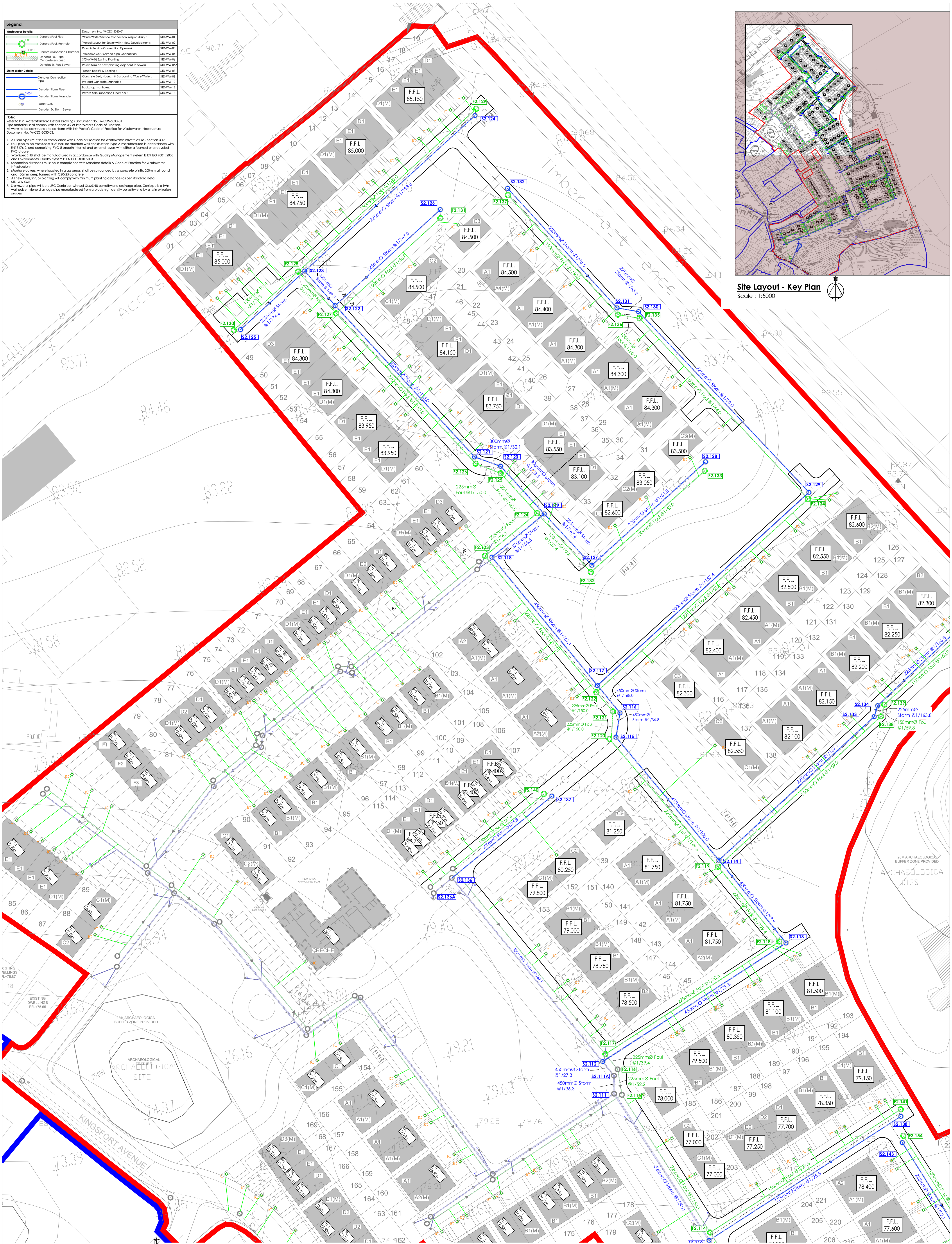
Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 12.1 Proposed DOSA Surface Water Drainage Drawings

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS



Site Layout - Key Plan
Scale : 1:5000

Legend:

Wastewater Details:	Document No. IW-CDS-5030-01	
Denotes Foul Pipe	Waste Water Service Connection Responsibility :	STD-WW-01
F.001 Denotes Foul Manhole	Typical Layout for Sewer within New Developments	STD-WW-02
IC051 Denotes Inspection Chamber	Drain & Service Connection Pipework :	STD-WW-03
Denotes Foul Pipe Concrete encased	Typical Sewer / Service pipe Connection :	STD-WW-04
Denotes Ex. Foul Sewer	STD-WW-06 Existing Planting	STD-WW-06
	Restrictions on new planting adjacent to sewers	STD-WW-06A
Storm Water Details:	Trench Backfill & Bearing :	STD-WW-07
Denotes Connection Pipe	Concrete Bed, Haunch & Surround to Waste Water :	STD-WW-08
Denotes Storm Pipe	Pre-cast Concrete Manhole :	STD-WW-10
S.001 Denotes Storm Manhole	Backdrop manholes:	STD-WW-12
Road Gully	Private Side Inspection Chamber :	STD-WW-13
Denotes Ex. Storm Sewer		

Note:
Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5030-01
Pipe materials shall comply with Section 3.9 of Irish Water's Code of Practice.
All works to be constructed to conform with Irish Water's Code of Practice for Wastewater Infrastructure Document No. IW-CDS-5030-03.

1. All Foul pipes must be in compliance with Code of Practice for Wastewater Infrastructure - Section 3.13
2. Foul pipe to be 'WavSpec SN8' shall be structure wall construction Type A manufactured in accordance with EN13476-2, and comprising PVC-U smooth internal and external layers with either a foamed or a recycled PVC-U core
3. 'WavSpec SN8' shall be manufactured in accordance with Quality Management system IS EN ISO 9001: 2008 and Environmental Quality System IS EN ISO 14001:2004
4. Separation distances must be in compliance with Standard details & Code of Practice for Wastewater Infrastructure
5. Manhole covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete
6. All new trees/shrubs planting will comply with minimum planting distances as per standard detail STD-WW-06A
7. Stormwater pipe will be a JFC Corripipe twin wall SN6/SN8 polyethylene drainage pipe. Corripipe is a twin wall polyethylene drainage pipe manufactured from a black high density polyethylene by a twin extrusion process.

Proposed Drainage Layout 1 of 3
Scale : 1:500

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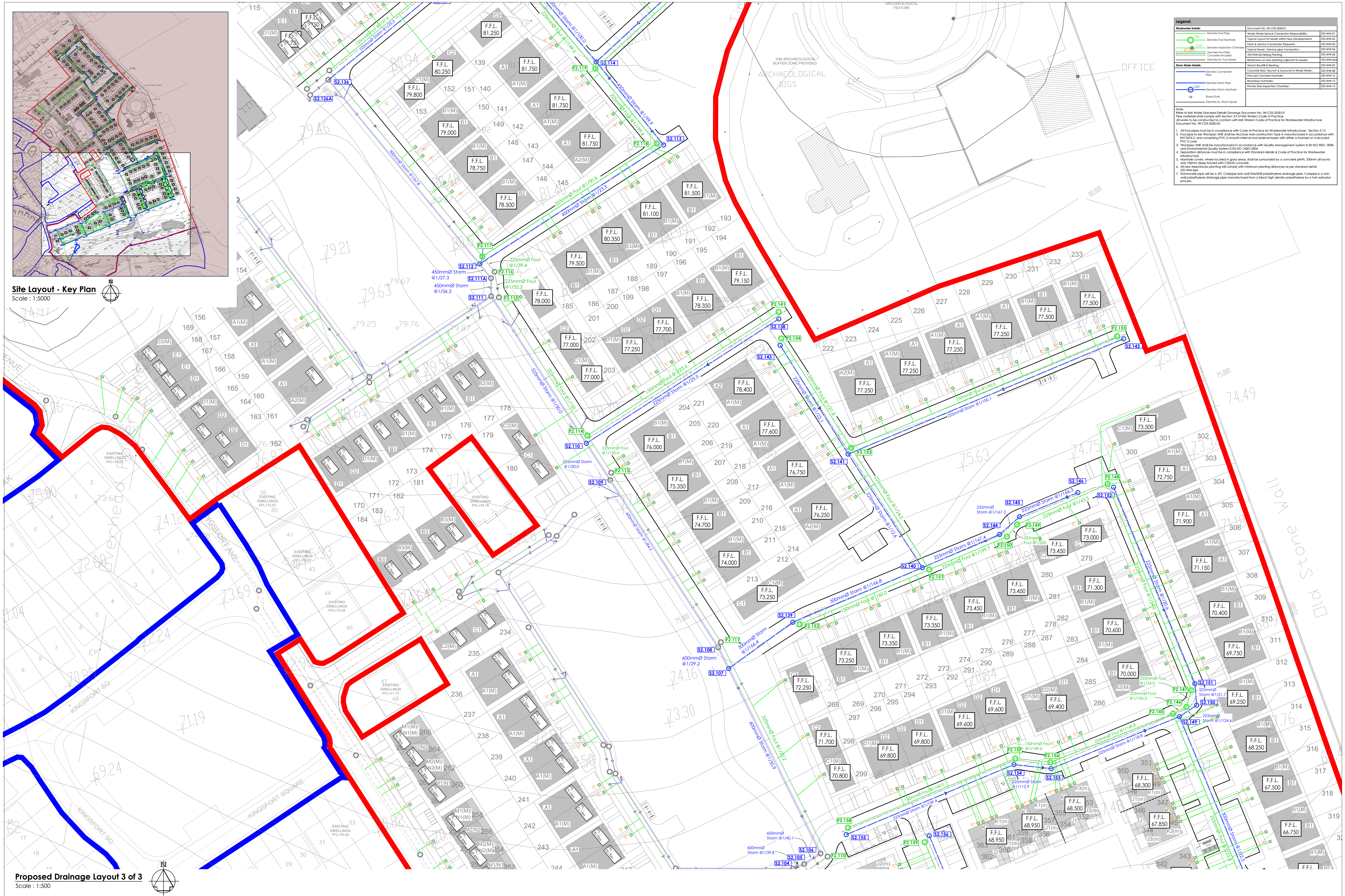
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.'24	Issued for LRD Application

CLIENT: Reside (Castlepark) Ltd.
PROJECT: Castlepark, Mallow, Co. Cork
DRAWING TITLE: LRD Proposed Drainage Layout 1 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2020	E



Site Layout - Key Plan

Scale : 1:5000

Legend:

Wastewater Details:	Document No. IW-CDS-5030-01	
Denotes Foul Pipe	Waste Water Service Connection Responsibility :	STD-WW-01
Denotes Foul Manhole	Typical Layout for Sewer within New Developments	STD-WW-02
Denotes Inspection Chamber	Drain & Service Connection Pipework :	STD-WW-03
Denotes Foul Pipe Concrete encased	Typical Sewer / Service pipe Connection :	STD-WW-04
Denotes Ex. Foul Sewer	STD-WW-06 Existing Planting	STD-WW-06
Storm Water Details:	Restrictions on new planting adjacent to sewers	STD-WW-06A
Denotes Connection Pipe	Trench Backfill & Bearing :	STD-WW-07
Denotes Storm Pipe	Concrete Bed, Haunch & Surround to Waste Water :	STD-WW-08
Denotes Storm Manhole	Pre-cast Concrete Manhole :	STD-WW-10
Road Gully	Backdrop manholes:	STD-WW-12
Denotes Ex. Storm Sewer	Private Side Inspection Chamber :	STD-WW-13

Note:
Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5030-01
Pipe materials shall comply with Section 3.9 of Irish Water's Code of Practice.
All works to be constructed to conform with Irish Water's Code of Practice for Wastewater Infrastructure Document No. IW-CDS-5030-03.

1. All Foul pipes must be in compliance with Code of Practice for Wastewater Infrastructure - Section 3.13
2. Foul pipe to be 'WavSpec SN8' shall be structure wall construction Type A manufactured in accordance with EN13476-2, and comprising PVC-U smooth internal and external layers with either a foamed or a recycled PVC-U core
3. 'WavSpec SN8' shall be manufactured in accordance with Quality Management system IS EN ISO 9001: 2008 and Environmental Quality System IS EN ISO 14001:2004
4. Separation distances must be in compliance with Standard details & Code of Practice for Wastewater Infrastructure
5. Manhole covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete
6. All new trees/shrubs planting will comply with minimum planting distances as per standard detail STD-WW-06A
7. Stormwater pipe will be a JFC Corripipe twin wall SN6/SN8 polyethylene drainage pipe. Corripipe is a twin wall polyethylene drainage pipe manufactured from a black high density polyethylene by a twin extrusion process.

Proposed Drainage Layout 3 of 3

Scale : 1:500

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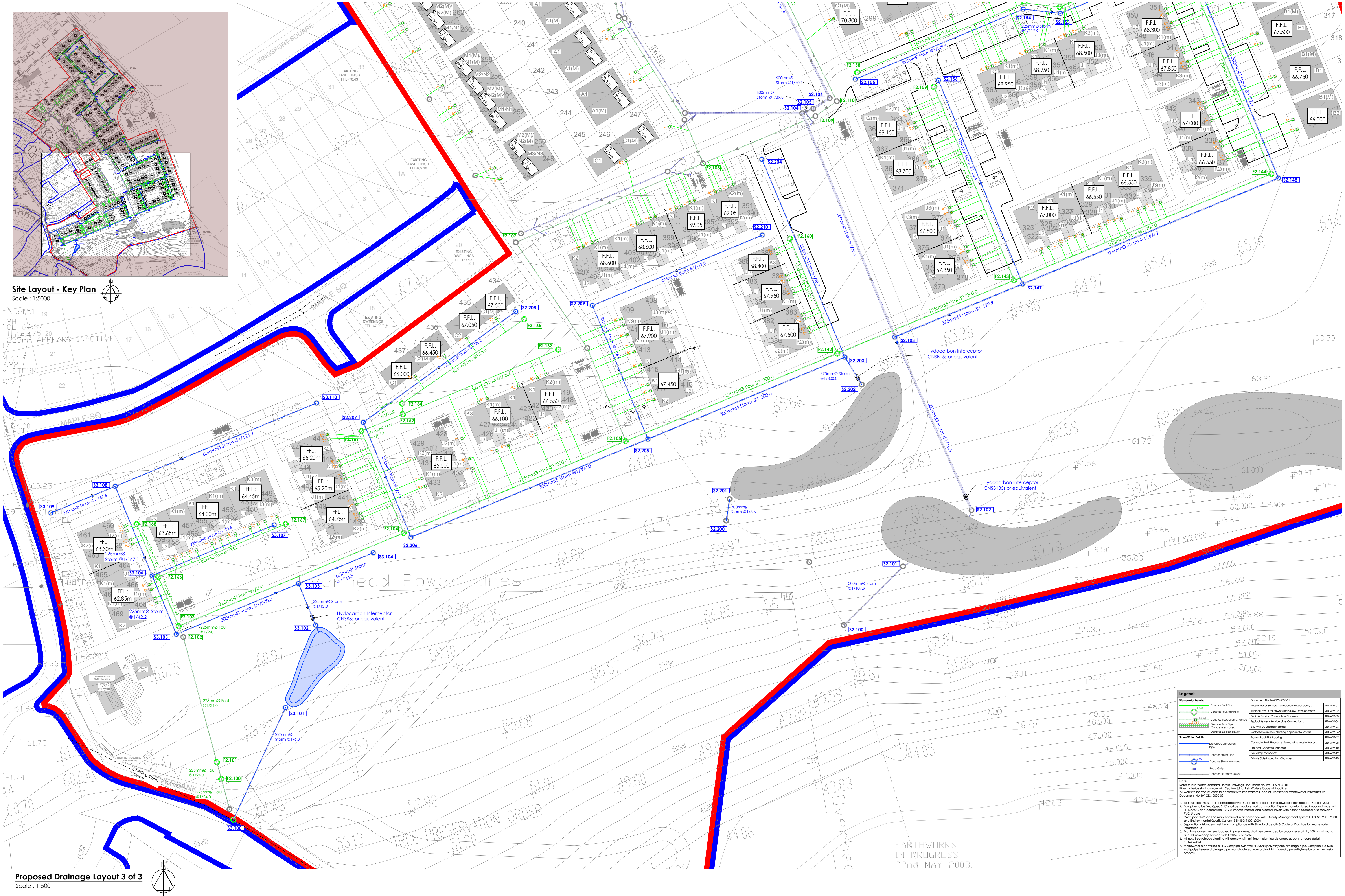
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
F	K.M.	S.O'G	S.O'G	01.10.24	Revised & Issued for LRD Application

CLIENT	Reside (Castlepark) Ltd.
PROJECT	Castlepark, Mallow, Co. Cork
DRAWING TITLE	LRD Proposed Drainage Layout 2 of 3
SHEET	A1
SCALE	1:500
PROJECT NO.	6621
DRAWING NO.	2021
STATUS/ISSUE	F



Proposed Drainage Layout 3 of 3
Scale : 1:500

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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT: Reside (Castlepark) Ltd.

DRAWING TITLE: LRD Proposed Drainage Layout 3 of 3

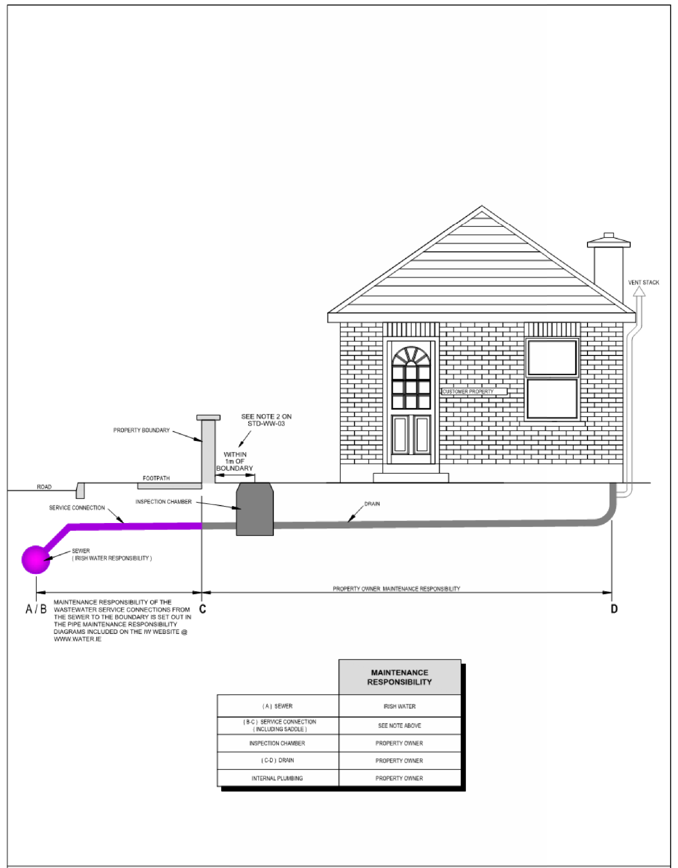
PROJECT: Castlepark, Mallow, Co. Cork

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2022	E

Appendix 12.2 Proposed DOSA Wastewater Drainage Drawings

Ocotober 2024

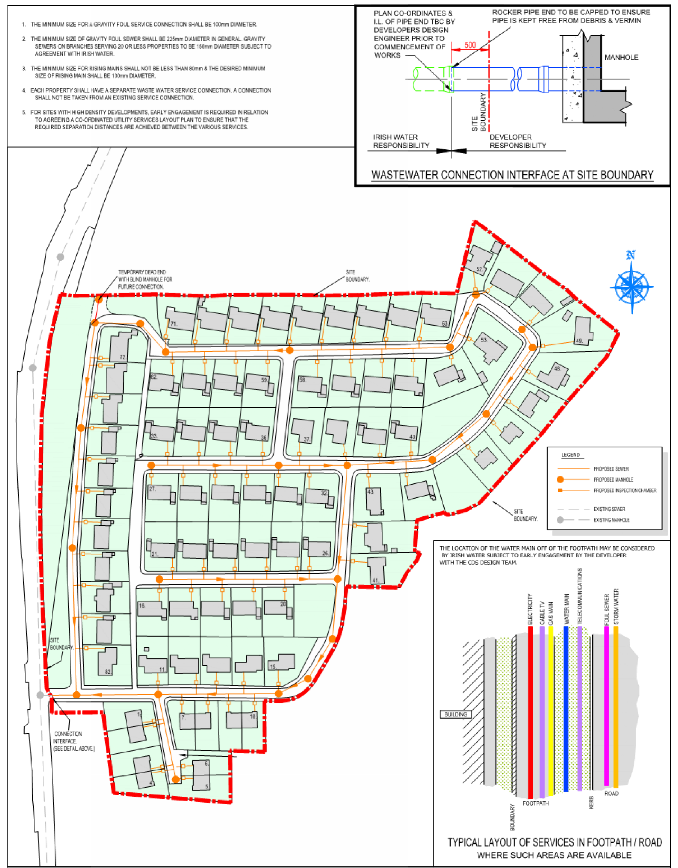
McCutcheon Halley
CHARTERED PLANNING CONSULTANTS



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

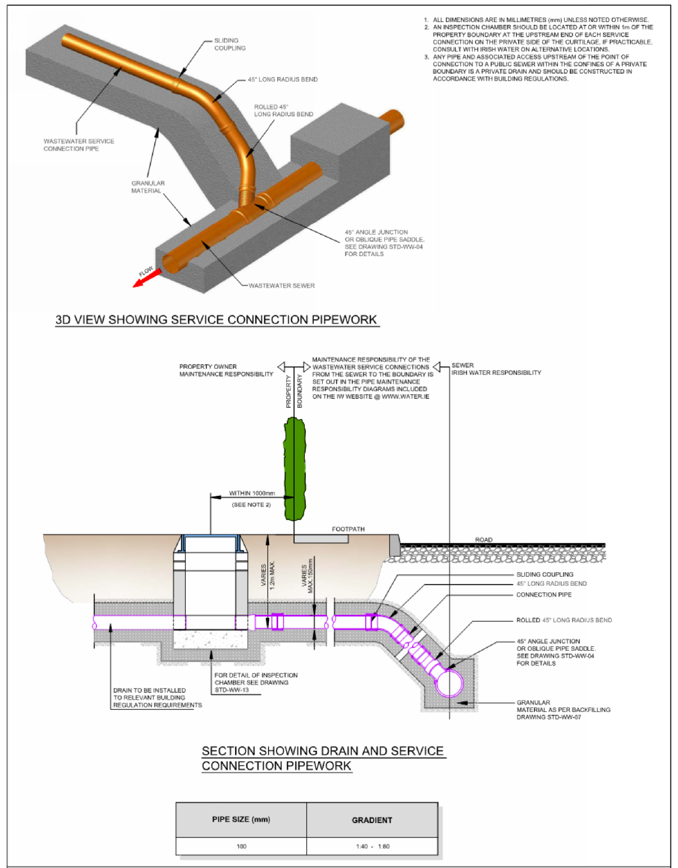
TITLE: WASTEWATER SERVICE CONNECTION MAINTENANCE RESPONSIBILITY — DRAWING No.: STD-WW-01 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

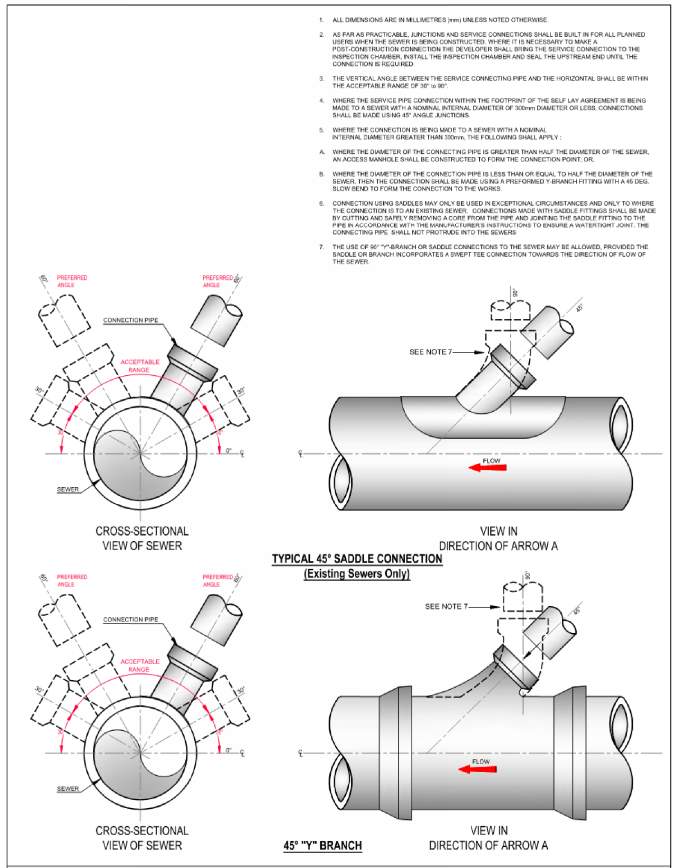
TITLE: TYPICAL LAYOUT FOR SEWER WITHIN NEW DEVELOPMENTS — DRAWING No.: STD-WW-02 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

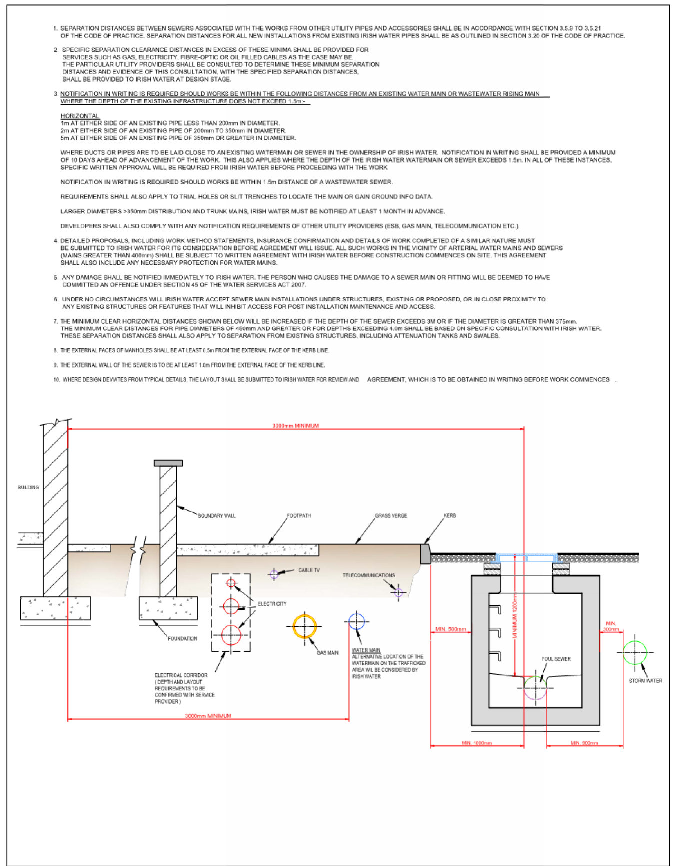
TITLE: DRAIN AND SERVICE CONNECTION PIPEWORK — DRAWING No.: STD-WW-03 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

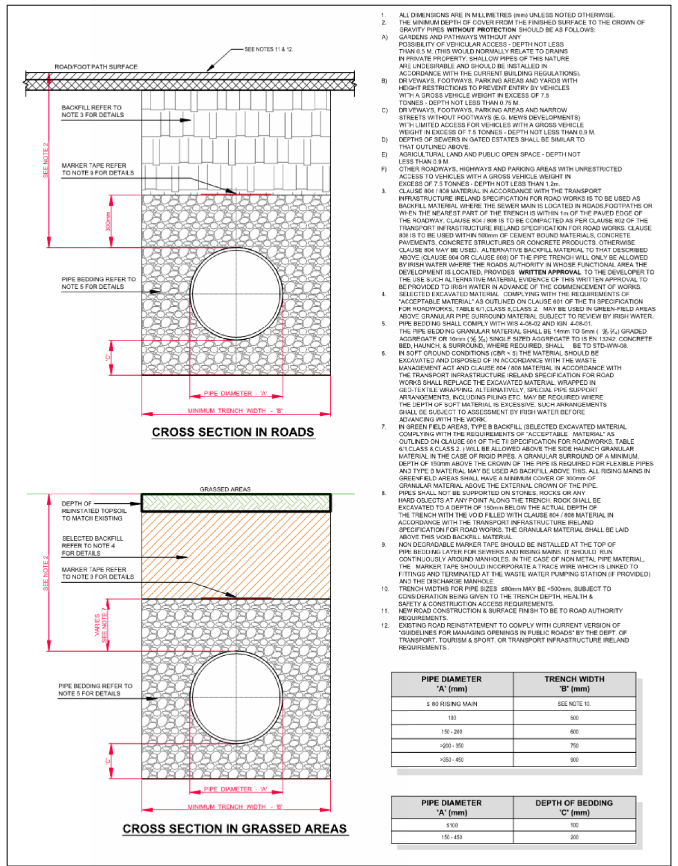
TITLE: TYPICAL SEWER / SERVICE PIPE CONNECTION — DRAWING No.: STD-WW-04 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

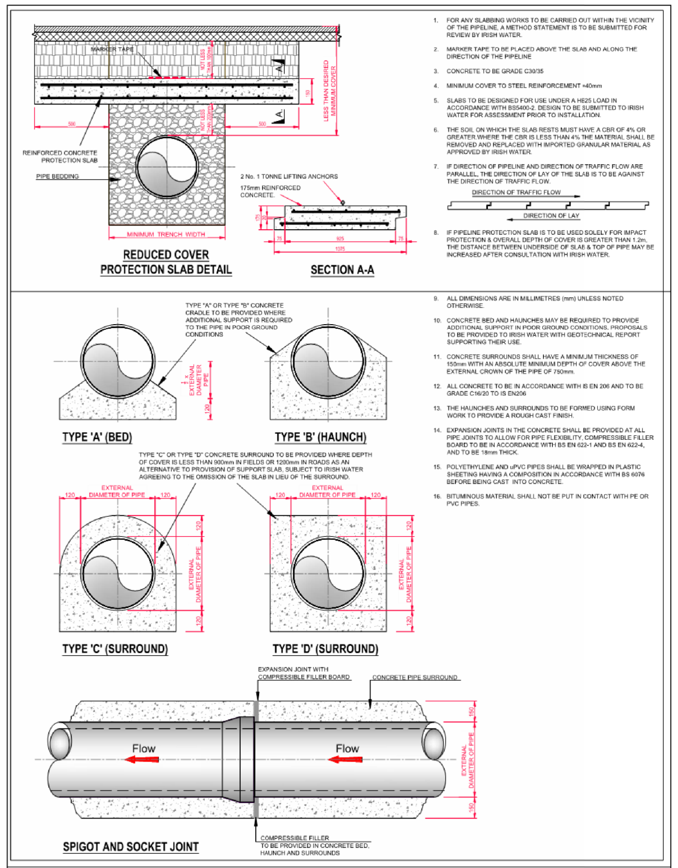
TITLE: TYPICAL SERVICE LAYOUT INDICATING SEPARATION DISTANCES — DRAWING No.: STD-WW-05 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

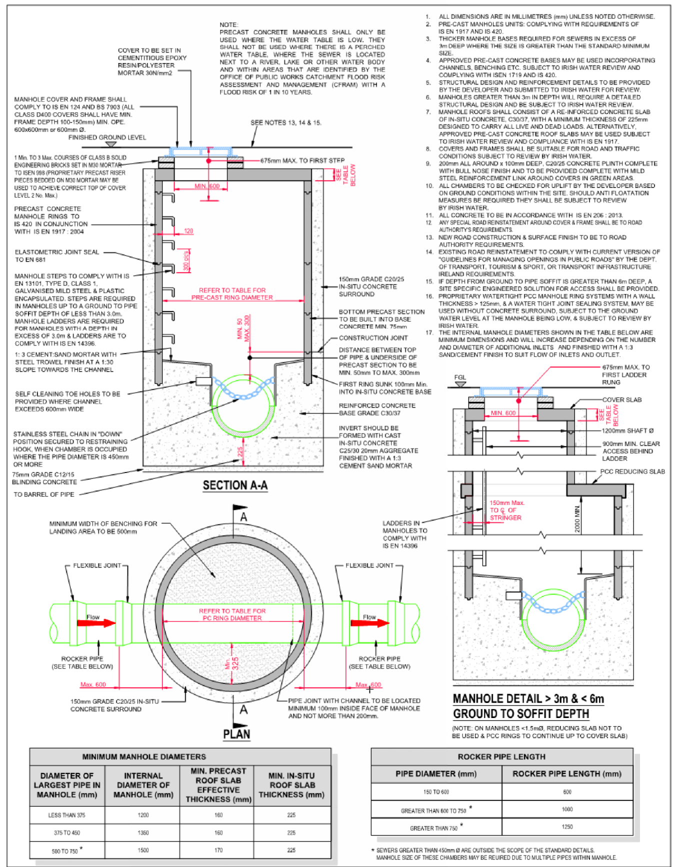
TITLE: TRENCH BACKFILL AND BEDDING — DRAWING No.: STD-WW-07 — REV: 2



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

TITLE: CONCRETE PROTECTION SLAB, BED, HAUNCH, AND SURROUND, TO WASTEWATER PIPES — DRAWING No.: STD-WW-08 — REV: 1



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER — STANDARD DETAILS - WASTEWATER — SCALE: NOT TO SCALE — DATE: SEPT. 2015

TITLE: PRE-CAST CONCRETE MANHOLE WITH CAST IN-SITU BASE — DRAWING No.: STD-WW-10 — REV: 3

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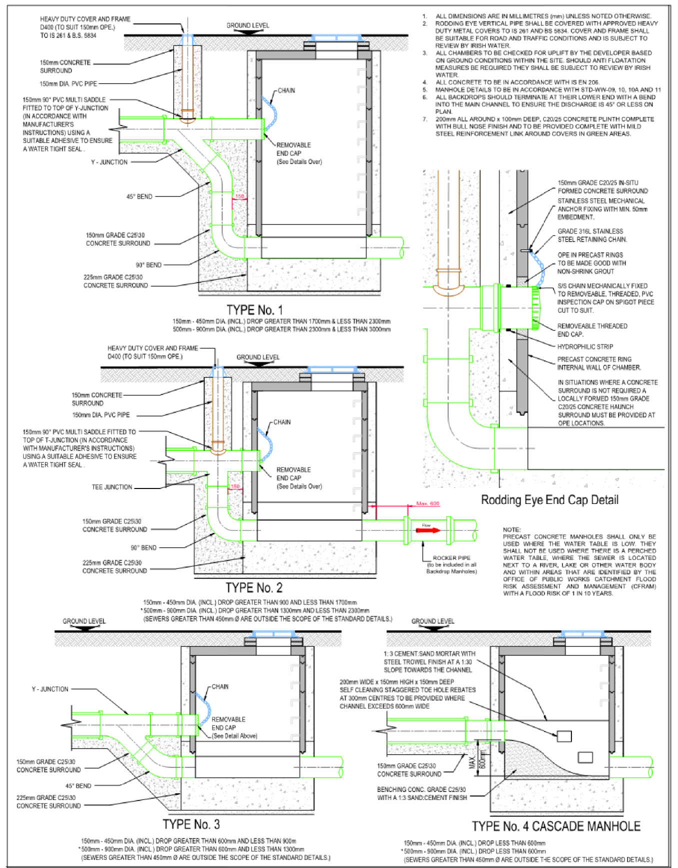
REV.	DRAWN	DATE	DETAILS
B	K.M.	27.09.'24	Issued for LRD Application
A	G.S.	13.12.23	Issued for Section 32B Application.

CLIENT: Reside (Castlepark) Ltd.

PROJECT: Castlepark, Mallow, Co. Cork

DRAWING TITLE: Proposed Wastewater Details (Sheet 1 of 2).

SHEET	SCALE	DRAWN	CHECKED	APPROVED	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1 : 1	G.S.	S.O'G	L.O'T.	6621	2025	B



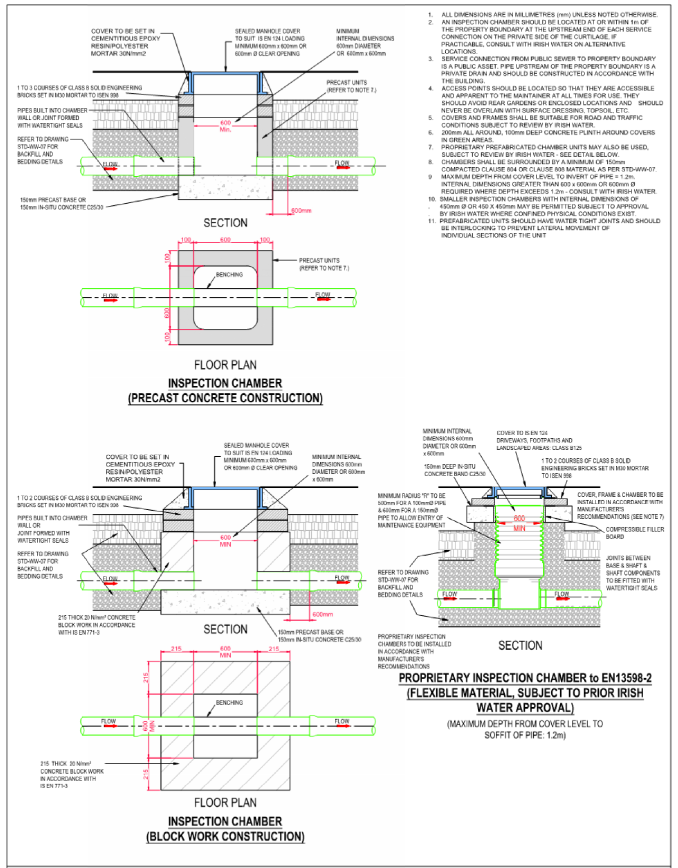
REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

BACKDROP AND CASCADE MANHOLES

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW-12 | REV: 3



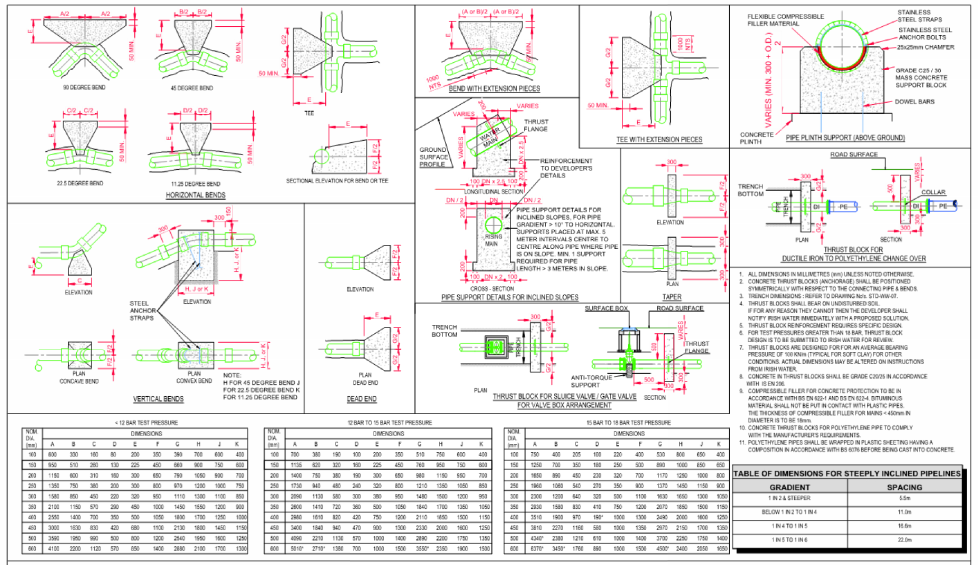
REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

PRIVATE SIDE INSPECTION CHAMBER

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW-13 | REV: 3



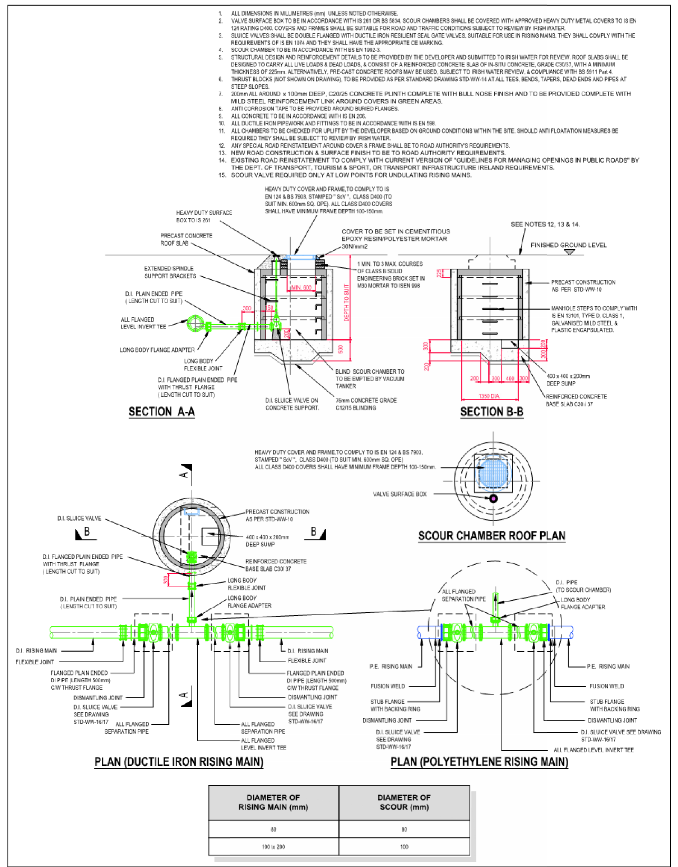
REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

THRUST BLOCKS FOR RISING MAINS

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW- 14 | REV: 2



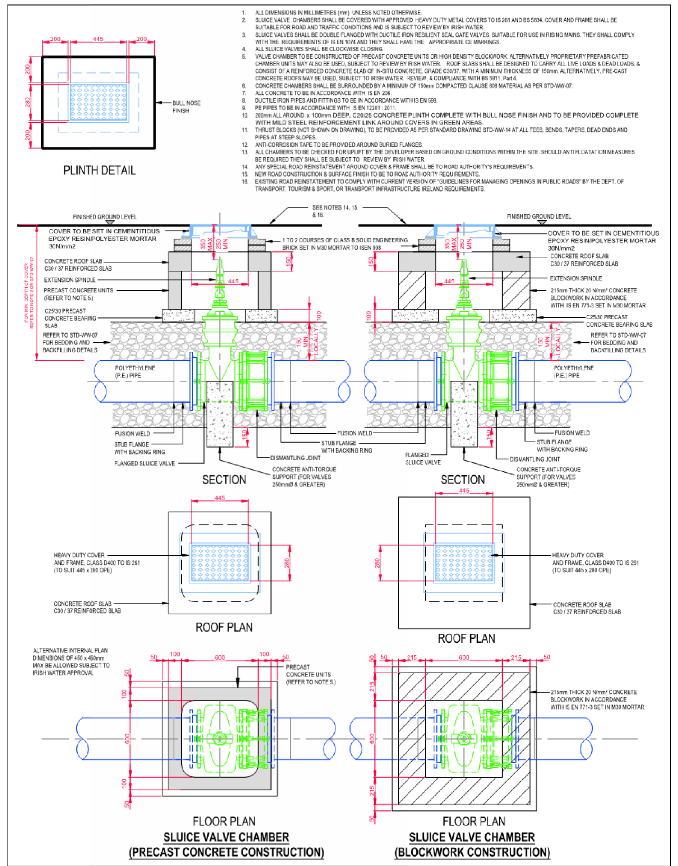
REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

SCOUR VALVE CHAMBER
FOUL RISING MAIN (≤ 200mm DIA.)

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW-15 | REV: 3



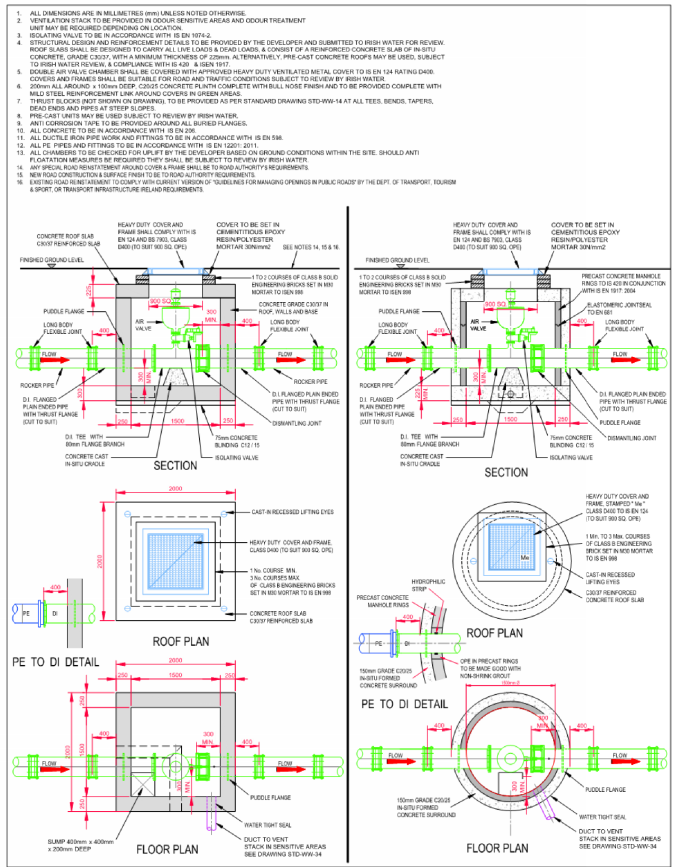
REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

SLUICE VALVE DETAILS FOR RISING MAINS
POLYETHYLENE (P.E.) PIPE (≤ 200mm DIA.)
(Sheet 2 of 2)

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW-17 | REV: 3



REFER TO INDEX SHEET FOR NOTES REGARDING DESIGN RESPONSIBILITY & RISK ASSESSMENT

UISCE ÉIREANN : IRISH WATER

STANDARD DETAILS - WASTEWATER

AIR VALVE CHAMBER
(FOUL RISING MAIN ≤ 200mm DIA.)

SCALE: NOT TO SCALE | DATE: SEPT. 2015 | DRAWING No.: STD-WW-18 | REV: 3

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REV.	DRAWN	DATE	DETAILS
B	K.M.	27.09.'24	Issued for LRD Application
A	G.S.	13.12.23	Issued for Section 32B Application.

CLIENT: Reside (Castlepark) Ltd.

PROJECT: Castlepark, Mallow, Co. Cork

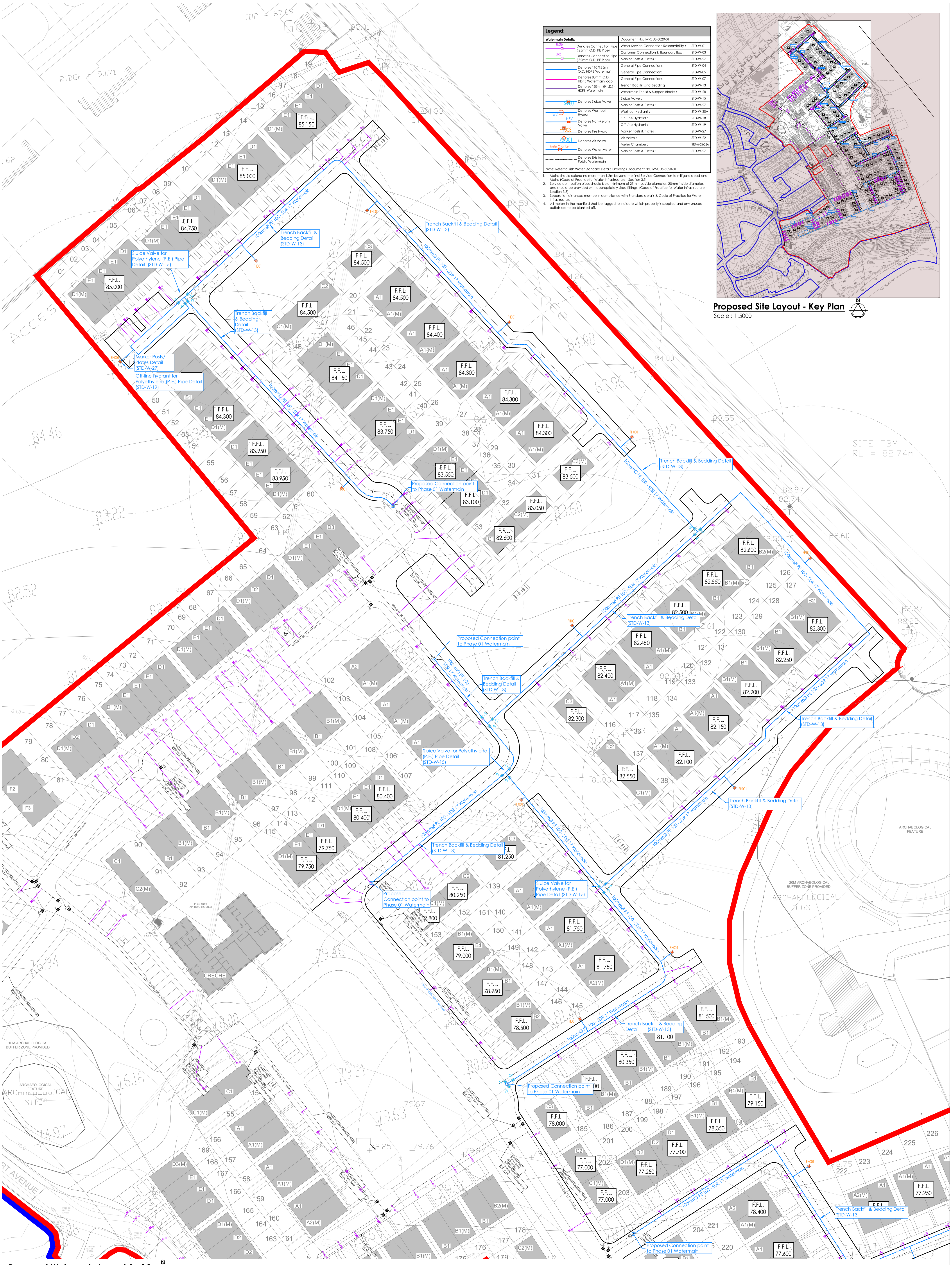
DRAWING TITLE: Proposed Wastewater Details (Sheet 2 of 2).

SHEET	SCALE	DRAWN	CHECKED	APPROVED	PROJECT NO. - DRAWING NO. - STATUS/ISSUE
A1	1 : 1	G.S.	S.O'G	L.O'T.	6621 - 2026 - B

Appendix 12.3 Proposed DOSA Water Supply Drawings

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS



Proposed Site Layout - Key Plan
Scale : 1:5000

Legend:		
Watermain Details:	Document No. IW-CDS-5020-01	
BB050 Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
BB051 Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
	General Pipe Connections :	STD-W-05
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-07
Denotes 150mm Ø (I.D.) - HDPE Watermain	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
SV001 Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
WO Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
NRV Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
	Off Line Hydrant :	STD-W-19
FH003 Denotes Fire Hydrant	Marker Posts & Plates :	STD-W-27
AV001 Denotes Air Valve	Air Valve :	STD-W-22
Meter Chamber Denotes Water Meter	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		
Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01		

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout 1 of 3
Scale : 1:5000

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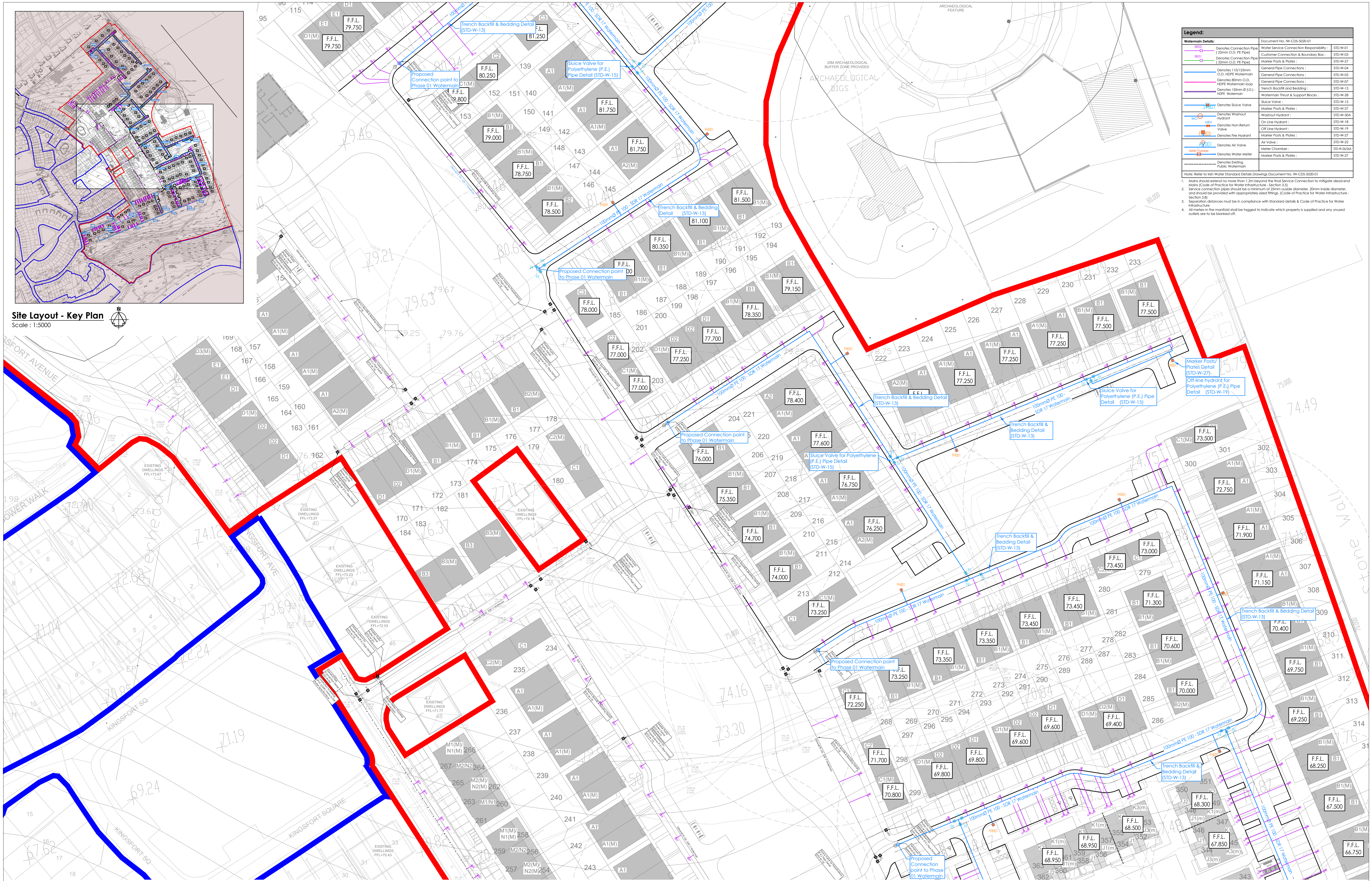
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
D	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT: Reside (Castlepark) Ltd.
PROJECT: Castlepark, Mallow, Co. Cork
DRAWING TITLE: Proposed Drainage Layout 1 of 3
SHEET: A1
SCALE: 1:500
PROJECT NO.: 6621 DRAWING NO.: 2030 STATUS/ISSUE: D



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
BB050 Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
BB051 Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-05
Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
SV001 Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
WO Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
NRV Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
FH003 Denotes Fire Hydrant	Off Line Hydrant :	STD-W-19
	Marker Posts & Plates :	STD-W-27
AV001 Denotes Air Valve	Air Valve :	STD-W-22
Meter Chamber Denotes Water Meter	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout 3 of 3
Scale : 1:500

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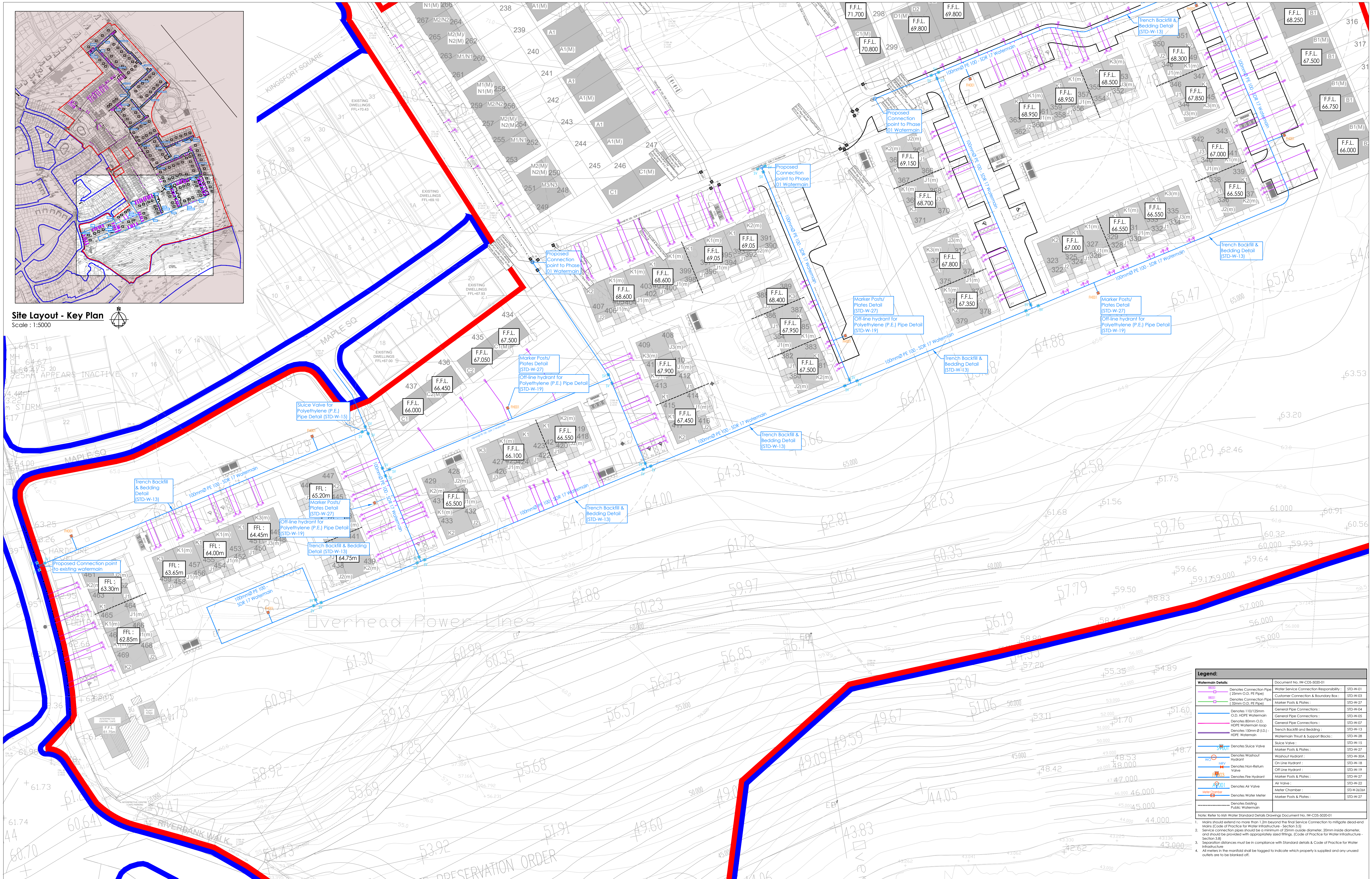
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.24	Revised & Issued for LRD Application

CLIENT	DRAWING TITLE
Reside (Castlepark) Ltd.	Proposed Watermain Layout 2 of 3

PROJECT	SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
Castlepark, Mallow, Co. Cork	A1	1:500	6621	2031	E



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-05
Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
	Off Line Hydrant :	STD-W-19
Denotes Fire Hydrant	Marker Posts & Plates :	STD-W-27
Denotes Air Valve	Air Valve :	STD-W-22
Denotes Water Meter	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout 3 of 3
Scale : 1:500

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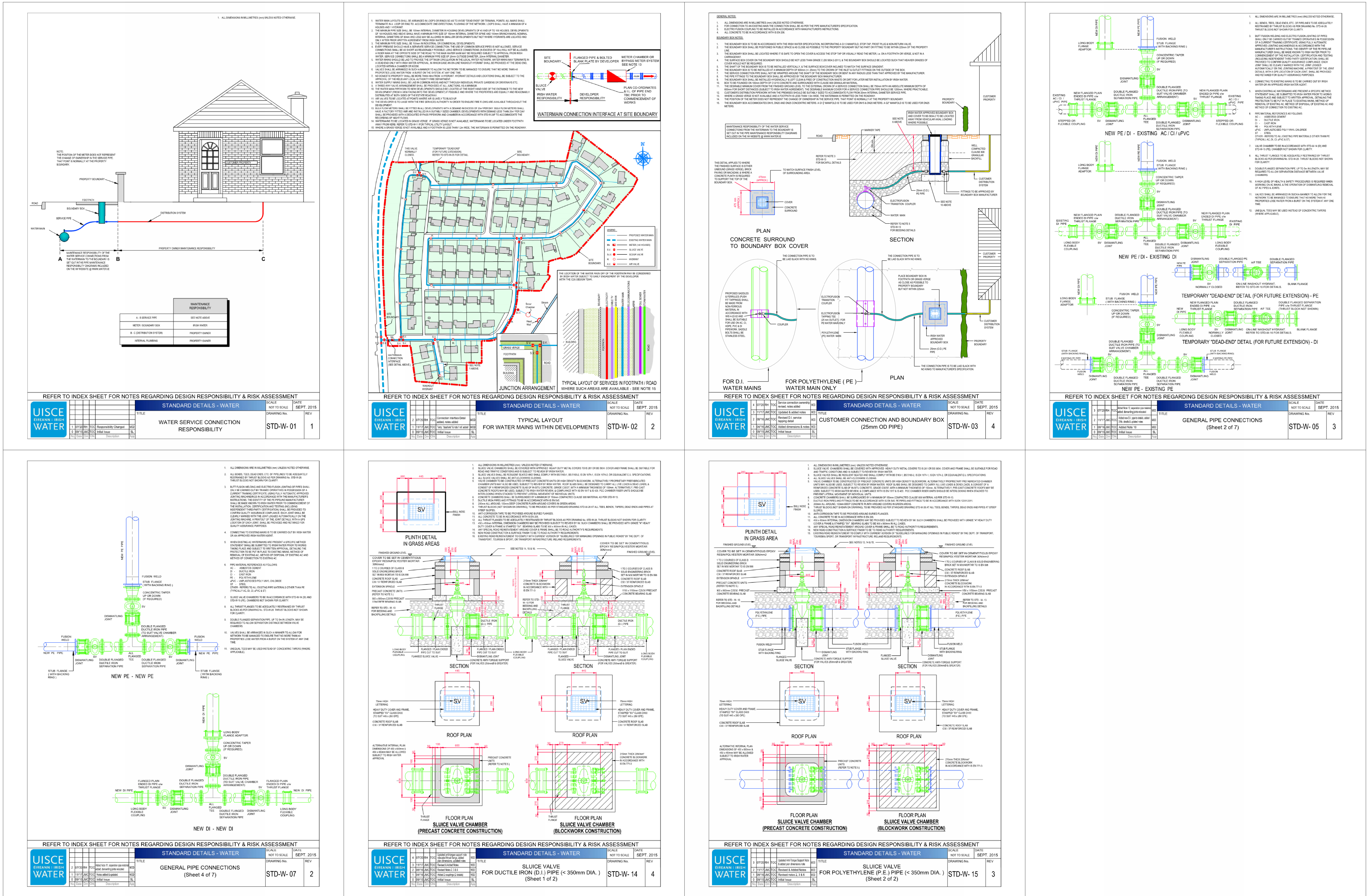
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
D	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT	DRAWING TITLE
Reside (Castlepark) Ltd.	Proposed Watermain Layout 3 of 3

PROJECT	SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
Castlepark, Mallow, Co. Cork	A1	1:500	6621	2032	D



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REV.	DRAWN	DATE	DETAILS
B	K.M.	27.09.'24	Issued for LRD Application
A	G.S.	13.12.23	Issued for Section 32B Application

CLIENT: Reside (Castlepark) Ltd

PROJECT: Castlepark, Mallow, Co. Cork

DRAWING TITLE: Proposed Watermain Details (Sheet 1 of 2).

SHEET	SCALE	DRAWN	CHECKED	APPROVED	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
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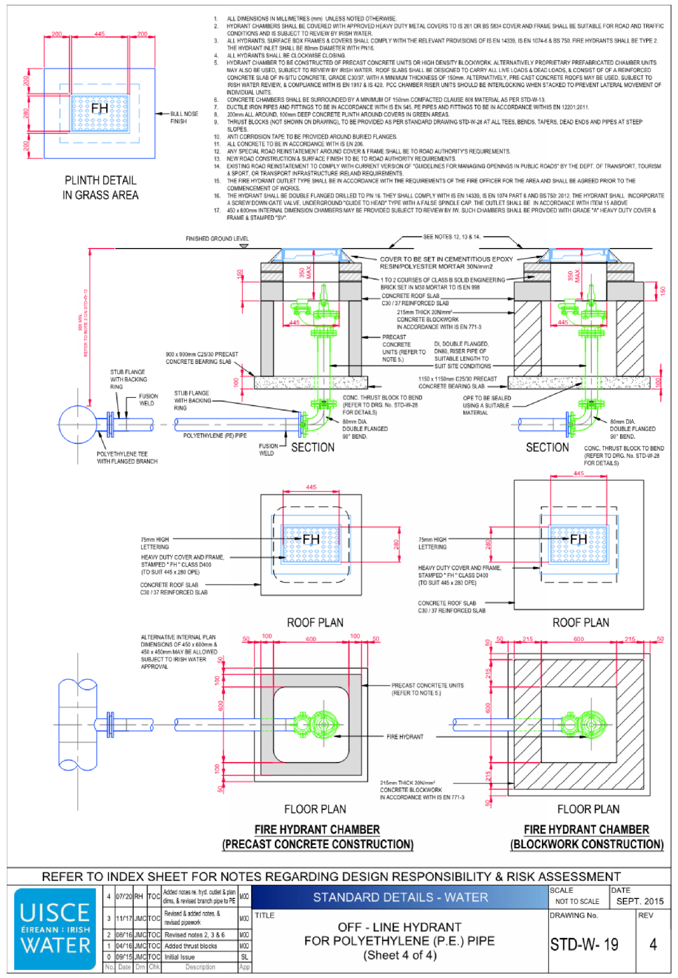

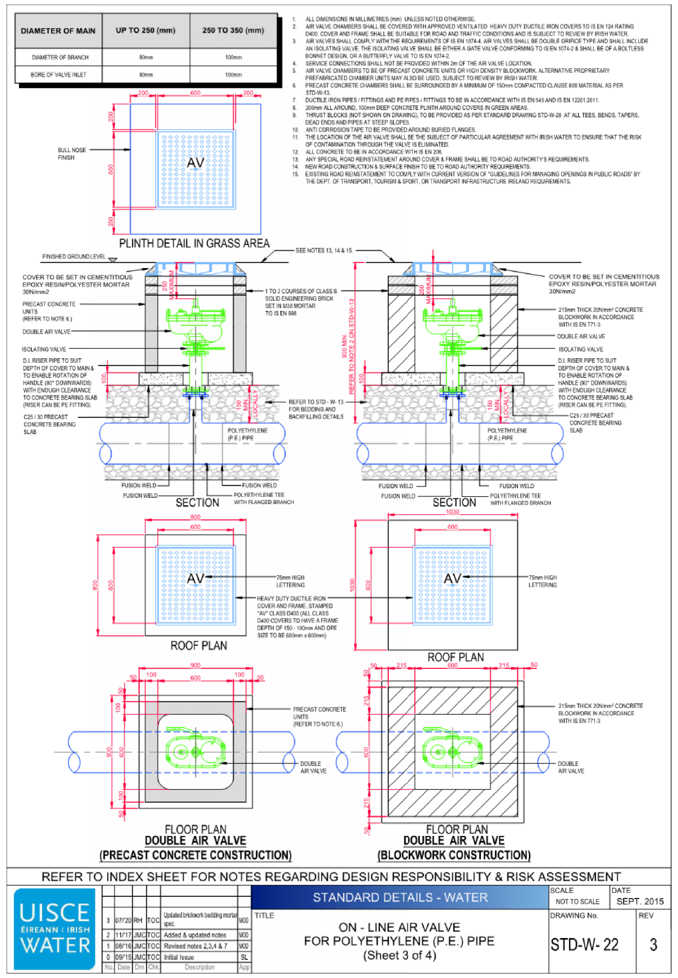

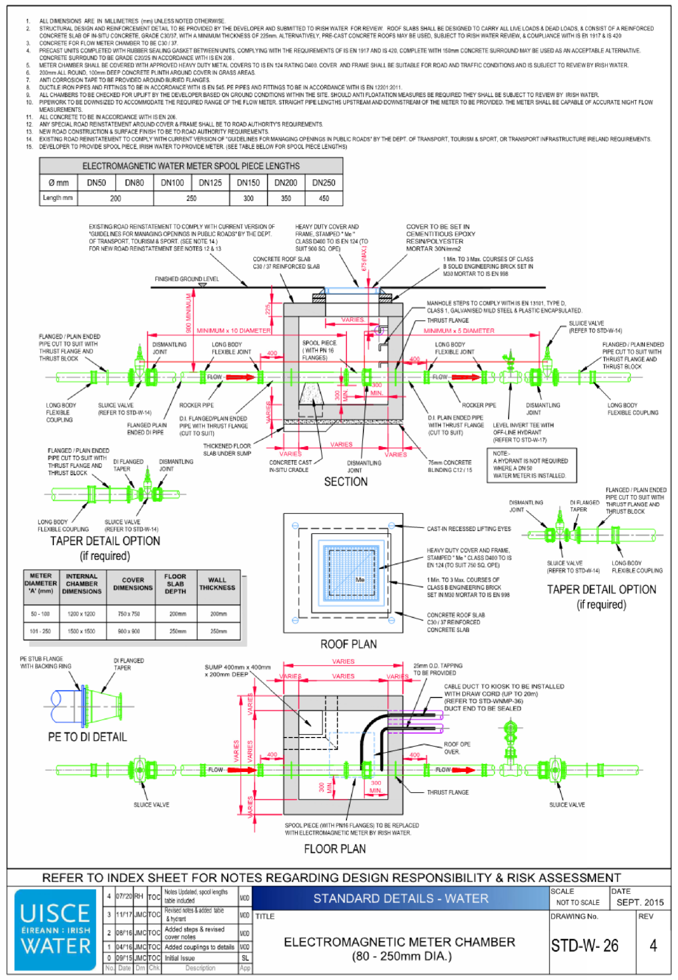

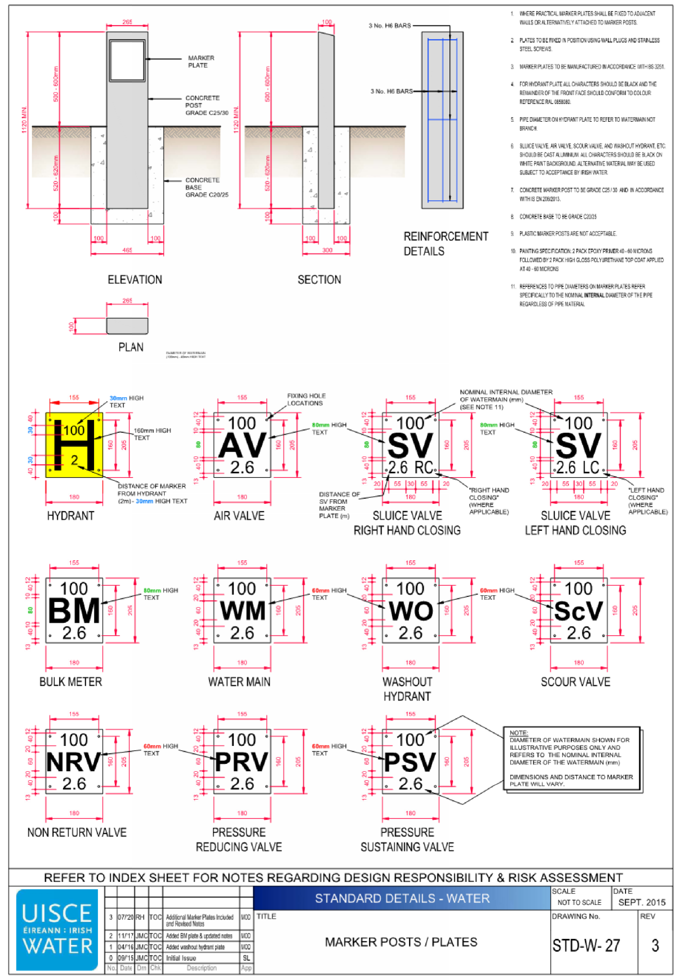

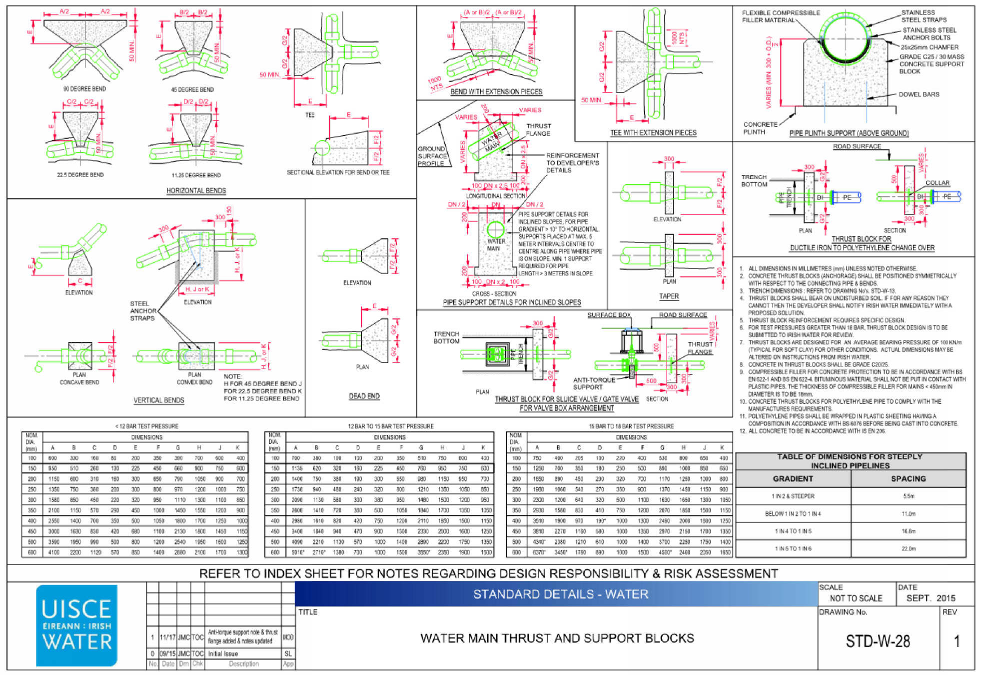

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REV.	DRAWN	DATE	DETAILS
B	K.M.	27.09.'24	Issued for LRD Application
A	G.S.	13.12.23	Issued for Section 32B Application

CLIENT
Reside (Castlepark) Ltd

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed Watermain Details (Sheet 2 of 2).

SHEET	SCALE	DRAWN	CHECKED	APPROVED	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1 : 1	G.S.	S.O'G	L.O'T	6621	2036	B

Appendix 12.4 DOSA Infrastructure Report

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT AT CASTLEPARK, MALLOW, CO. CORK

INFRASTRUCTURE REPORT

DATE 17/10/2024

REVISION 3

JOB NO. 6621

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DOCUMENT CONTROL

PROJECT NAME: Residential Development at Castlepark, Mallow, Co. Cork

PROJECT NUMBER: 6621

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Contents

1 *Introduction*

DOSA Consulting Engineers were engaged as Engineers for the proposed development at Castlepark, Mallow, Co. Cork.

1.1 Objectives

A number of site investigations have been carried out and their findings have been incorporated to deal with solutions to:

- Storm Water Drainage Network
- Foul Drainage Network
- Water Supply

1.2 Site Location

The subject site which is currently undeveloped is located on the southeast of Mallow town. The site is a greenfield site characterised by its undulating topography and its steep slope rising from the southern & end. The Blackwater River runs along the site's southern edge, with the L-1220-0/St, Joseph's Road & Scoil Aonghusa CNS to the north, farmland and stand-alone detached farmhouse to the east and the existing Castle Park Village estate to the west. A snapshot of the proposed site is outlined in Figure 1.1 below.

Figure 1.1 – Context Map

1.3 References

The advice provided in the report is based on:

a) Site observations undertaken during site visits and inspections undertaken by DOSA for review of existing Structural, Civil services conditions.
b) Liaison and discussions with Irish Water & Cork County Council.
c) Desktop Review of available Planning Data.

1.4 Site Topography

The topography of the site slopes southwards towards the River Blackwater. It comprises one large single plot across which the levels vary from +87.5m O.D. along the boundary with the L-1220-0/St Joseph's Road to +43m O.D. at its most elevated southern extremity.

Figure 1.2 – Site Topography

1.5 Site History

The Castle Park site was broken into the phases detailed in Table 1.4 below.

Phase	Planning Reference	Development Details	Status
1	05/55093	157 dwellings and creche	Fully developed.
2	06/55035 Amended by: 07/55057 07/55085 08/55085	Permission for 141 residential units. Amendments reduced residential units to 130.	Commenced and 2 units constructed. Permission expired.
4	07/55076	38 dwellings	Not commenced. Permission expired.
Total	325 permitted dwellings; 155 developed (153 + 2)		
1 A & B	07/55077 & 07/55078	Mainly commercial with 18 residential units	Not commenced
3	-	No permitted development.	5 acres sold to DOE and 3.15 acres with Bankruptcy (as of Feb. 2018)

Table 1.4– Castle Park Lands, Phasing & Status

1.6 Proposed Development

The development will consist of the construction of 469 no. residential units (comprising a mix of 1, 2, 3, and 4 bed semi-detached, townhouse, and duplex/apartment units), creche, and all associated ancillary site development works including vehicular access, parking, footpaths, drainage, amenity areas, and a wastewater treatment plant at Castlepark, Castlelands (townland), St Jospeh's Road, Mallow, Co. Cork.

Figure 1.6 – Proposed Development

2 Storm Water Design

2.1 Surface Water System

The subject lands are drained naturally and have the benefit of direct access to the public stormwater network in the existing estate. The lands directly abut a stormwater network already laid within the existing estate along Kingsfort Avenue, Maple Square and Maple Avenue which outfalls directly into the River Blackwater as outlined in Figure 2.1 below.

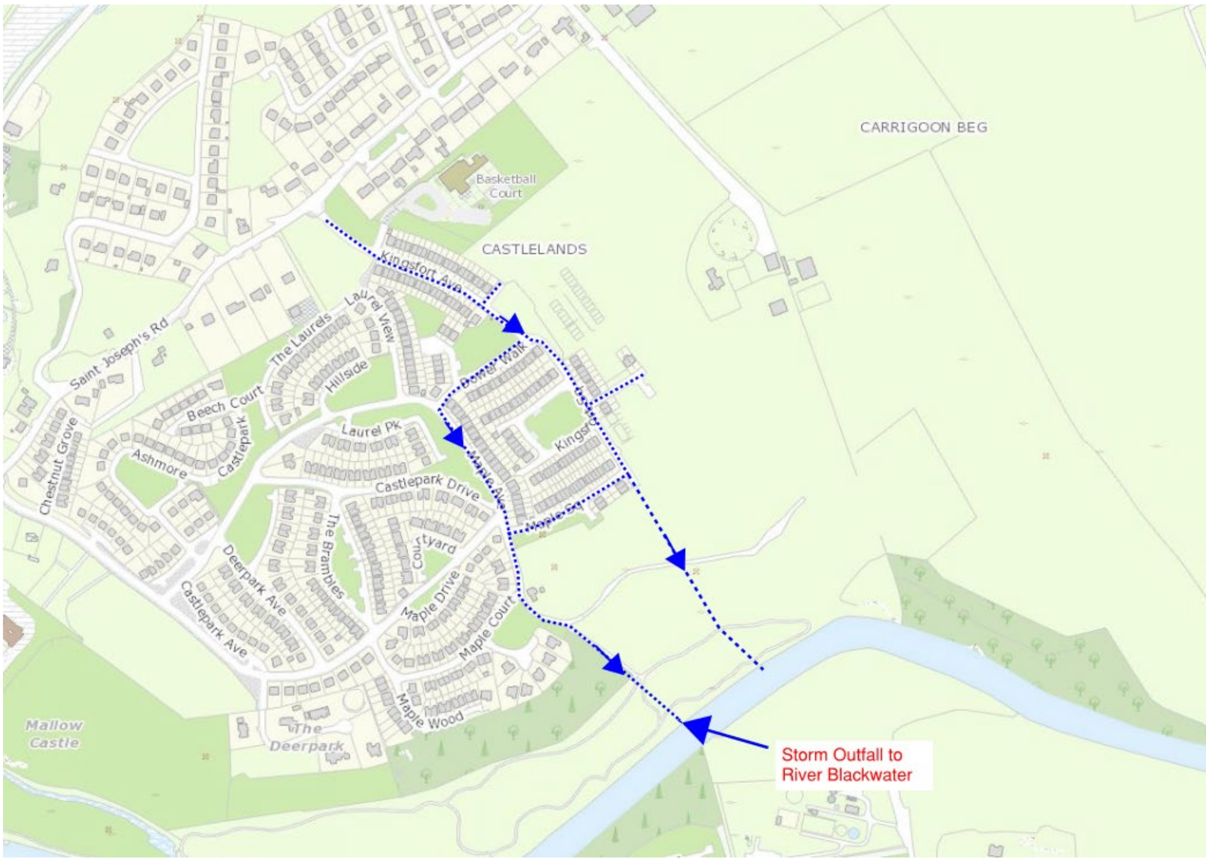

Figure 2.1 – Stormwater Outfall

Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control devices (Hydrobrakes or equivalent) and associated detention basins. Surface water discharge will also pass via a full retention fuel / oil separators (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the detention basins, flow control devices and separator arrangement as noted above. Surface water runoff from the site's road network will be directed to the proposed pipe network/ constructed swales in green areas via conventional road gullies with additional surface water runoff from driveways and roofs also routed to the proposed surface water pipe network.

2.2 Surface Water Drainage Network

The existing public stormwater network is located in the existing adjacent estate road in the Castle Park estate. Refer to DOSA Drawing No.'s 6621-2020, 6621-2021 & 6621-2022 for details of the proposed surface water outfall. Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control devices (Hydrobrakes or equivalent) and associated detention basins. Surface water discharge will also pass via a full retention fuel / oil separators (sized in accordance with permitted discharge from the site).

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the detention basins, flow control devices and separator arrangement as noted above. Surface water runoff from the site's road network will be directed to the proposed pipe network/ constructed swales in green areas via conventional road gullies with additional surface water runoff from driveways and roofs also routed to the proposed surface water pipe network.

2.3 Compliance with GDSDS Surface Water Drainage Policy

The site's surface water management infrastructure has been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The GDSDS (Vol. 2, Chapter 6.3.4) requires that the following design criteria are applied to all sites:

Criterion 1: River Water Quality Protection

Satisfied by providing stormwater detention basins and treatment of surface water run-off by SUDS features such full retention fuel/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information (e.g. Lee CFRAM Study as outlined in Appendix C) relating to the site's proximity to tidal and fluvial flood plains (up to 1 in 100-year flood event).

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains.

Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was carried out using the facility on the website of Irishsuds.ie (Guidance and Tools). The preliminary analysis indicated that the following techniques were possibly suitable Attenuation Tanks, Basins, Permeable Paving, Soakaways, Swales and Rainwater Harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.4 SuDS Appraisal

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SUDS techniques that would be applicable.

The following methodologies are being implemented as part of a SuDS treatment train approach:

2.4.1 Permeable Pavement

Permeable pavement reduces the overall impermeable area of the hard-standing area, which will reduce the impact of the discharge and improve the quality of the effluent from the proposed development.

2.4.2 Rainwater Harvesting

In relation to rainwater harvesting an option is to provide a water butt with each individual dwelling. This will be located to the rear of each unit. This water butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants.

2.4.3 Filter Drain

Trenches filled with permeable material and a perforated collection pipe at the invert with an optional permeable 'sandy' topsoil at surface. These can treat, convey and attenuate runoff at source, and can infiltrate to the ground where the subgrade is suitable. These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less run-off from these areas in small rainfall events thus mimicking the natural response for this catchment. These will be located along the proposed pedestrian/cycle pathways and will allow groundwater to recharge to its natural state.

2.4.4 Tree Pits

Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly. Tree pits are proposed to be in green space areas to treat and control runoff, while at the same time providing amenity value to adjacent pedestrian, and residential zones. It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows while high flows will discharge into the surface water network during extreme rainfall events. Rain water gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.

2.4.5 Detention Basin

The proposed attenuation system will provide treatment to the storm water before it passes to the local drainage network. The basin has been designed to be 'off-line' which provides treatment even in low flow conditions This minimises maintenance requirements and maintenance costs.

The system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site.

2.4.6 Flow Control Device

It is proposed to provide a hydrobrake, or similar approved, at the outfall of the surface water catchment to restrict the outflow of water from the subject site. The hydro-brakes will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes.

2.4.7 Petrol Interceptor

It is proposed to provide a petrol interceptor upstream of the detention basins to ensure that any remaining hydro-carbons or pollutants within the runoff from trafficked areas are treated prior to outfall to the existing watercourse. It is proposed to provide a Conder Bypass Separator Types or similar approved.

In conclusion the water quality from this catchment should be of a high quality due to the above-mentioned measures, which are applied in a treatment train to treat the water before discharge at a restricted rate to the local network.

The above measures ensure a suitable management train is provided.

2.4.8 Swales

Broad, shallow drainage channels covered in grass which can treat, convey and attenuate runoff, at source, and can infiltrate to the ground where the subgrade is suitable. Swales can also promote biodiversity. This will be located adjacent to roads and hard-standing areas on the southern portion of the site receiving water from the adjoining roads and footpaths. The swales will allow for an element of infiltration but ultimately have a connection to the attenuation system.

2.4.9 Management Train

The management train commences with source control through the provision of permeable paving where possible and rain water butts in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pts will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors and swales in open areas which provide a degree of treatment before discharging to the attenuation system.

The detention basins and detention basins offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

2.5 Maintenance Regime for SuDS Devices

The SuDS features proposed above for the site will require the following maintenance:

2.5.1 Wet Swales:

Requires regular inspection of inlets and outlets, vegetation, mulching and the removal of nuisance plants and rubbish as necessary. Trees and vegetation should be trimmed every 2 years. Swale surface should be spiked, scarified and removed of 'thatch' every 3 years with regular inspection of surface infiltration to avoid areas of ponding. Repair erosion at inlets and outlets and re-turf surfacing as required. Wet swales will be maintained from adjacent access roads.

2.5.2 Detention Basins

The detention basins will require regular maintenance to ensure continuing operation to design performance standards. This will be relatively straightforward for landscape contractors and does not generally require any additional works above what is necessary for a standard public open space.

2.5.3 Tree Pits

Maintenance of trees will be greatest in the first few years, which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibly irrigation during long dry periods.

2.5.4 Filter Drains

Inspection of the system should be carried out monthly on the inlet / outlet pipework and any control systems for blockages. Inspection of pre-treatment systems including should be carried out every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build-ups. Removal of silt build-up may be required more frequent. Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network. Perforated pipework should be cleared of blockage if required.

2.5.5 Hydrobrake Manhole:

Normally little maintenance is required as there are no moving parts within a hydrobrake, however, after installation, hydrobrakes should be inspected to ensure the hydrobrake orifice is not blocked on a monthly basis for three months and thereafter at six monthly intervals and hosed down if required. Remove rubbish or debris from hydrobrake if present. Hydro-Brake Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.

2.5.6 Petrol Interceptor:

Systems 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. Systems 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, oils and grease should be removed where required.

The permeable paving has a design life equivalent to standard block paving. The surface blocks require routine maintenance. There are four levels of cleaning that can be carried out on a paved area:

1. General dirt should be removed by regular dry brushing.
2. Where the paving has become dull, showing a loss of colour, a wet wash with a stiff bristle brush and garden hose can be adequate.
3. For more stubborn areas a power washer can be used, taking care not to remove the jointing materials (sand or mortar). The washer should be on a medium pressure setting or lower, and should not be aimed directly at the paving surface, but at an angle of 30° approximately.

Cleaning detergents can be used; however, some detergents are acidic and overuse can damage some paving products. It is advisable to follow the manufacturer's instructions and rinse the areas fully. The resulting runoff should be carefully channelled to either drainage points or containers from where it can be safely disposed. Replace any washed-out jointing sand with new dried sand once the paving has dried.

The detention basins will require regular maintenance to ensure continuing operation to design performance standards.

2.6 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Microdrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

2.7 Design Criteria:

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

• Return period for pipe work design	2 years
• Return period for attenuation design	100 years
• Soil Type	2
• Allowable Outflow	44.50 l/sec
• Time of entry	5 minutes
• M5 – 60	18.80 mm
• Ratio "r"	0.250
• Pipe Friction (Ks)	0.6 mm
• Minimum Velocity (based on pipe flowing full)	1.0 m/s
• Rainfall Runoff from Roads and Footpaths	100%

- Rainfall Runoff from Roofs 80%
- Rainfall Runoff from Driveways 80%
- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

(in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 6.2 Climate Change Factors to be Applied to Drainage Design

The global variables required for the model were the M5-60 and Rainfall Ratio. These two factors may be read from maps contained in the Wallingford procedure. They enable the program to calculate the intensity, duration and frequency characteristics of storms.

M5-60 is the rainfall depth based on a 60-minute storm of 5 years return period. Ratio R is the ratio of the 60-minute storm to the 2-day storm for the 5-year return period events. These values are as follows:

- M5-60 = 18.80mm
- Ratio R = 0.250

Microdrainage generates design storms using the principles set out in the Flood Studies Report (NERC 1975).

A summer rainfall profile was used for the design of the pipework and a winter rainfall profile was used for the design of the storm water attenuation to give the critical design. A summer profile gives higher rainfall intensities and results in higher runoff rates and is used to determine the required capacity of the pipework. A winter rainfall profile gives a flatter more sustained profile and results in higher runoff volumes and is used to determine the attenuation/storage requirements.

The surface water drainage network was assessed for compliance with maximum and minimum velocities, pipe length etc. The network was designed to ensure velocities in the network and pipe gradients did not exceed the maximum velocity of 4.0m/s. The minimum velocity allowed was 1.00m/s.

The design of the drainage network was assessed using events with a range of different durations to determine the critical event for each return period analysed as follows:

- 1 in 2-year return period events were used to ensure that the system did not surcharge.

- 1 in 100-year return period events were used to ensure that flooding did not occur.

2.7.1 Pre-Development Conditions

For this development, the permissible outflow is calculated using the estimation method contained in the Institute of Hydrology Report No. 124: Flood estimation for small catchments.

$$QBAR = 0.00108 \times (AREA)^{0.89} \times (SAAR)^{1.17} \times (SOIL)^{2.17}$$

QBAR = The Mean Annual Peak Flow (Permissible outflow in m3.sec

AREA = Area of the Catchment (site) in km^2

SAAR = Standard Annual Average Rainfall

SOIL = Soil index

As the development is smaller than 50 ha, the analysis for determining the permissible outflow uses 50 ha in the formula and linearly interpolates the flow rate value based on the ratio of the development to 50 ha. This is a statistical based method within the Microdrainage Software utilizing the Regional Flood Frequency by Catchment Characteristics to give the Index Flood (QBAR)

The Mean Annual Peak Flow (permissible outflow) was calculated for the particular design development areas.

The allowable runoff estimation method utilises IH 124, and the Soil Index value taken from the Micrcodrainage Design Package mapping system gives a Soil Index of 0.3.

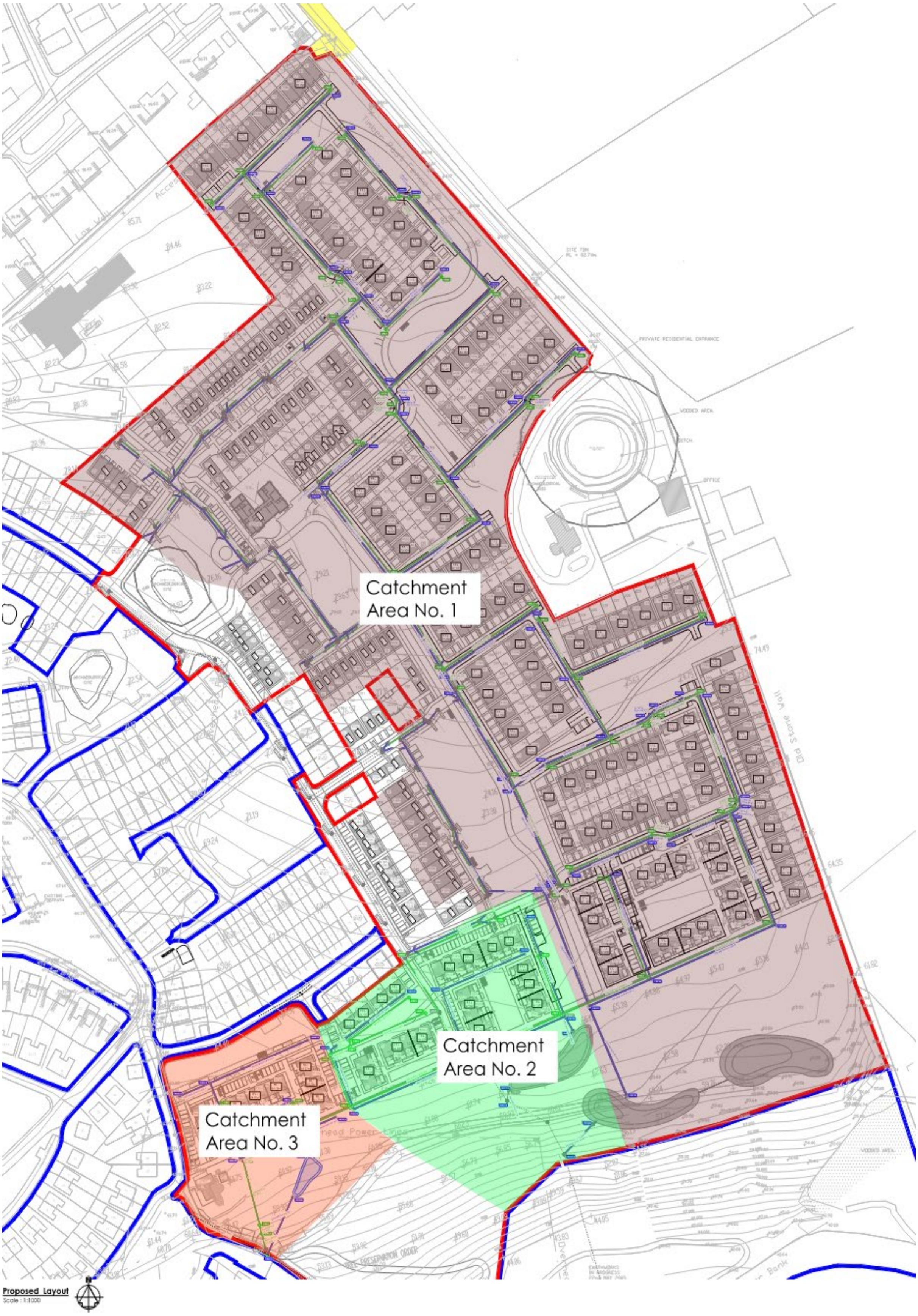

Figure 2.7 – Catchment Areas of Development

Contributing Area	Permissible Outflow (l/sec)
Catchment Area No. 1	35.30 l/sec
Catchment Area No. 2	5.70 l/sec
Catchment Area No. 3	3.50 l/sec

2.7.2 Post-Development Conditions

The stormwater management plan adopted for the particular development involves using detention basins located in the green areas of the site.

All surface water runoff arising from the paved development will be drained away from the site. The detention basins will be designed for a 100-year storm event. The maximum discharge from the tanks will be limited to calculated permissible runoff (QBAR) for the catchment area.

Based on the proposed development design there will be a change in the land surface. Therefore, due to this proposed change a corresponding increase in the peak rate of surface runoff from the site will arise during times rainfall. The flood peak runoff rates from the post-development grassy permeable area (Q_p grass) and the post-development impervious area (Q_p imp.) using the Rational Method (100% impermeability of hard surfaces) are calculated using Windes 10.4. The Sources Control Module of the Microdrainage Software was used to design the attenuation tank and detention basin capacities. This module also provides the critical storm duration for the attenuation tank detention basins during the design process.

It should be noted that climate change will be accounted for in the design. As per volume 5 of the GDSDS a factor of 20% has been incorporated into the design.

2.8 Detention Basins

2.8.1 Volume of Detention Basins

The capacity of the detention basins are designed to cater for the capacity required for a 1 in 100-year ARI event. These capacities are summarised as follows:

Tank/Basin No.	Capacity (m^3)	Restricted Outlet (l/sec)
1	2100.0	35.0 l/sec
2	240.0	5.70 l/sec
3	140.0	3.50 l/sec

2.9 Hydrocarbon Treatment

A petrol interceptor is a trap used to filter out hydrocarbon pollutants from rainwater runoff. It is used in construction to prevent fuel contamination of streams carrying away the runoff.

Petrol interceptors work on the premise that some hydrocarbons such as petroleum and diesel float on the top of water. The contaminated water enters the interceptor typically after flowing off roads or hardstanding areas before being deposited into the first tank inside the interceptor.

The first tank builds up a layer of the hydrocarbon as well as other scum. Typically, petrol interceptors have 3 separate tanks each connected with a dip pipe, as more liquid enters the interceptor the water enters into the second tank leaving the majority of the hydrocarbon behind as it cannot enter the dip pipe, whose opening into the second tank is below the surface.

However, some of the contaminants may by chance enter the second tank. This second tank will not build up as much of the hydrocarbon on its surface. As before, the water is pushed into the third tank and more water enters the second.

The third tank should be practically clear of any hydrocarbon floating on its surface. As a precaution, the outlet pipe is also a dip pipe. When the water leaves the third tank via the outlet pipe it should be contaminant free.

In this project there are a number of catchment areas and detention basins that eventually discharge to the adjoining public network.

Table 2.9 – Petrol Interceptor Details

Catchment Reference	Petrol Interceptor Make & Model	Oil Storage Capacity (l)
Catchment Area No. 1	1 No. Conder CSNB135s	1875.0 litres
Catchment Area No. 2	1 No. Conder CSNB15s	225.0 litres
Catchment Area No. 3	1 No. Conder CSNB8s	120.0 litres

2.10 Silt Control

The proposed petrol interceptor from Conder Environmental also includes a silt storage capacity in addition to the oil storage capacity that allow silt to be collected in the interceptor prior to discharge to the proposed detention basins . This silt build-up can then be removed from the tanks. The interceptors will be specified at detailed design stage.

Table 2.10 – Petrol Interceptor Silt Storage Details

Catchment Reference	Petrol Interceptor Make & Model	Silt Storage Capacity (l)
Catchment Area No. 1	1 No. Conder CSNB135s	13,500.0 litres
Catchment Area No. 2	1 No. Conder CSNB15s	1500.0 litres
Catchment Area No. 3	1 No. Conder CSNB8s	800.0 litres

2.11 Construction & Operational Stage Run-Off

Both construction and operational phase surface-water drainage from the proposed development site will ultimately discharge into the adjacent stormwater watercourses. Where surface-water run-off occurs at the site during the construction phase, it will be managed and controlled prior to discharge into the environment by implementing standard environmental controls. Temporary banks shall be in place to ensure that runoff is directed to a temporary detention pond which shall be provided to reduce the amount of silt in the run-off. The location of these banks and temporary detention ponds will be indicated and confirmed in a Construction Stage Construction & Environmental Management Plan. The development will also include the construction of a gravity surface-water drainage network throughout the site. The surface-water drainage network will include the installation of dedicated attenuation facilities upstream of proposed outfall to the public network, to attenuate discharges to the undeveloped Greenfield run-off rates with the operation of proprietary hydro-brake flow-control devices. The attenuation facility is sized on the basis of a design storm with a 100-year return period and an additional 20% allowance for the effect of climate change.

The attenuation facilities will be in the form of a series of interlinked detention basins . They will be an off-line component of the drainage network into which runoff is diverted once flows reach a specified threshold.

3 *Foul Sewer System*

3.1 Foul Sewer Design

A Pre-Connection Enquiry was submitted to Irish Water. The Irish Water Reference Number for this enquiry is CDS22002703. The response to this Enquiry was issued by Irish Water on 25th September 2024. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network could be facilitated.

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

  Please note that it will be necessary to connect to the Uisce Éireann sewer network via existing privately owned infrastructure within the existing Castlepark estate. The arterial route of the private sewer network, between your connection point and the Uisce Éireann

infrastructure will be required to be taken in charge by Uisce Éireann at connection application stage. It will be necessary for the Applicant to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions from the owner of this infrastructure to connect.

Fig 3.0 Extract From Irish Water COF

The Confirmation of Feasibility document is included in Appendix A. The existing Castlelands estate has not yet been taken in charge and the applicant is the owner of all roads, common areas and service networks within the existing Castlelands estate

The Applicant has the relevant control and authority to undertake any infrastructure upgrades which may be identified by Uisce Eireann as part of the connection application. The Applicant is in a position to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions with regard to infrastructure connections to the development.

The foul sewer will be designed using the System 1 and Simulation Modules of the Micro-drainage package. The foul network design addresses present day design issues and can view velocities at Full Bore, Proportional Depth and 1/3 flow.

A model of the proposed foul drainage network will be built using the micro-drainage software applications. The model will be analysed and amended until the results met with the design criteria specified.

The network will be designed to achieve self-cleansing velocities at 1/3 flow whilst maintaining minimum gradients.

3.1.1 Development Breakdown

469 No. Dwellings

Section 3.6 of The Irish Water Code of Practice Wastewater Infrastructure states that for the gravity sewers shall be designed to carry a minimum wastewater volume of 6 times the dry weather flow (6DWF) which is to be taken as 446 litres per dwelling

Loading = (469) (446) / (24) (60) (60) = 2.420 litres/second

6DWF = 14.525 litres/second

122-Child Creche

Assume 60 No. Staff & 122 No. Children

From the EPA Code of Practice for Small Communities, Business, Leisure Centres and Hotels Loading = 60 L/Person/day

Loading = (182) (60) / (24) (60) (60) = 0.126 litres/second

6DWF = 0.756 litres/second

The overall quantity of wastewater for the proposed development is estimated at 78.25m^3 per day.

The overall quantity of wastewater for the proposed development is estimated at 44.15m^3 per day.

This is based on the unit schedule submitted by the architect. The foul waste within the development will be collected via an internal gravity network and will discharge to the existing foul sewer in the adjoining Castlepark estate.

All works will be in accordance with Irish Water specifications and requirements.

All works will be in accordance with Irish Water Code of Practice for Wastewater Supply & the Wastewater Infrastructure Standard Details Document Number: IW-CDS-5030-01.

4 *Water Supply*

As with the drainage network, a Pre-Connection Enquiry was submitted to Irish Water under Reference No. CDS22002703. This confirmed that, subject to a valid connection agreement being put in place, the proposed connection to the Irish Water network could be facilitated.

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

  Please note that it will be necessary to connect to the Uisce Éireann water network via existing privately owned infrastructure within the existing Castlepark estate. The arterial route of the private watermain network, between your connection point and the Uisce Éireann public infrastructure will be required to be taken in charge by Uisce Éireann at connection application stage. It will be necessary for the Applicant to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions from the owner of this infrastructure to connect.

The Confirmation of Feasibility document is included in Appendix A. As with the foul sewer, the Applicant has the relevant control and authority to undertake any infrastructure upgrades which may be identified by Uisce Eireann as part of the connection application. The Applicant is in a position to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions with regard to infrastructure connections to the development.

It is proposed to provide a new 100mm/150mm (internal diameter) HDPE connection to the public watermain on the adjacent Castlepark estate Road with associated valves and metering requirements. Internally within the development it is proposed to have a series of 100mm Ø branches and loops with associated hydrants, valves, and metering requirements.

Water distribution supply to each building will be sized to cater for the requirements of those particular uses. Metered connections will be made to the main in accordance with Irish Water specifications and details.

The layout of the proposed watermain network is shown on the Proposed Watermain Layout Plan DOSA Drawing No.'s 6621-2030, 6621-2031 & 6621-2032.

All works will be in accordance with Irish Water Code of Practice for Water Supply & the Water Infrastructure Standard Details Document Number: IW-CDS-5020-01.

5 Summary of Results

The storm water network was built and analysed using the Microdrainage Software application and were assessed for a 1 in 2 year storm & 1 in 100 year storm. A summary of the results is shown in Tables 5.1 below and in the Microdrainage outputs in the Appendices.

The global variables, pipeline and manhole schedules for both the surface water network and foul network were printed and are included in the Appendices. These show the basic pipe details such as pipe length, diameter, roughness coefficient, upstream invert, velocity, etc.

Table 5.1 Summary of Surcharge and Flooding

Attenuation Tank Reference	Storm Event	Results
Detention Basin No. 1	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Detention Basin No. 2	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge
Detention Basin No. 3	1 in 2 year	No surcharge of the stormwater network
	1 in 100 year	Surcharge

The stormwater system is designed to ensure no surcharge occurs during a 1 in 2-year return period event.

No flooding was predicted to occur for the 1 in 100-year return period event. Surcharging and flood risk occurred for a number of critical storm events but this is allowed and does not compromise the network.

Table 5.2 Outlet Control Summary

Attenuation Tank Reference	Hydrobrake Reference	Limiting Discharge (l/s)	Design Head (m)	Hydrobrake Diameter (mm)
Detention Basin Tank No. 1	MD4	35.30 l/sec	0.60	237
Detention Basin Tank No. 2	MD4	5.7 l/sec	0.50	113
Detention Basin Tank No. 3	MD4	3.50 l/sec	0.50	58

Table 5.3: Storage Tank Summary

Tank No.	Storage Type	Capacity (m^3)	Invert Level (m)	Maximum Storage Level (m)
Detention Basin No. 1	Grassed Slope	2655.0	58.234	58.834
Detention Basin No. 2	Grassed Slope	348.0	62.408	62.908
Detention Basin No. 3	Grassed Slope	196.0	58.100	58.600

The foul water network model was built and analysed using the Micro-drainage Software application and was assessed to ensure velocities maintained a self-cleansing velocity. The system will consist of an internal gravity network discharging to the existing Irish Water asset.

Appendix A – Irish Water Confirmation of Feasibility

CONFIRMATION OF FEASIBILITY

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Oifig Sheachadta na Cathrach Theas
Cathair Chorcaí

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South City
Delivery Office
Cork City

www.water.ie

Stephen O'Grady

DOSA
Joyce House
Barrack Square
Ballincollig
Co. Cork
P31 KP84

25 September 2024

Our Ref: CDS23009311 Pre-Connection Enquiry
Castle Park, Mallow, 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 469 unit(s) at Castle Park, Mallow, 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:

  Please note that it will be necessary to connect to the Uisce Éireann water network via existing privately owned infrastructure within the existing Castlepark estate. The arterial route of the private watermain network, between your connection point and the Uisce Éireann public infrastructure will be required to be taken in charge by Uisce Éireann at connection application stage. It will be necessary for the Applicant to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions from the owner of this infrastructure to connect.

  -

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

  Please note that it will be necessary to connect to the Uisce Éireann sewer network via existing privately owned infrastructure within the existing Castlepark estate. The arterial route of the private sewer network, between your connection point and the Uisce Éireann *infrastructure will be required to be taken in charge by Uisce Éireann at connection application stage. It will be necessary for the Applicant to obtain all necessary quality assurances, wayleaves, easements, confirmation of capacity and permissions from the owner of this infrastructure to connect.*

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/

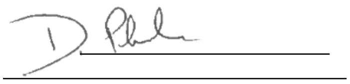
Where can you find more information?

- **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?

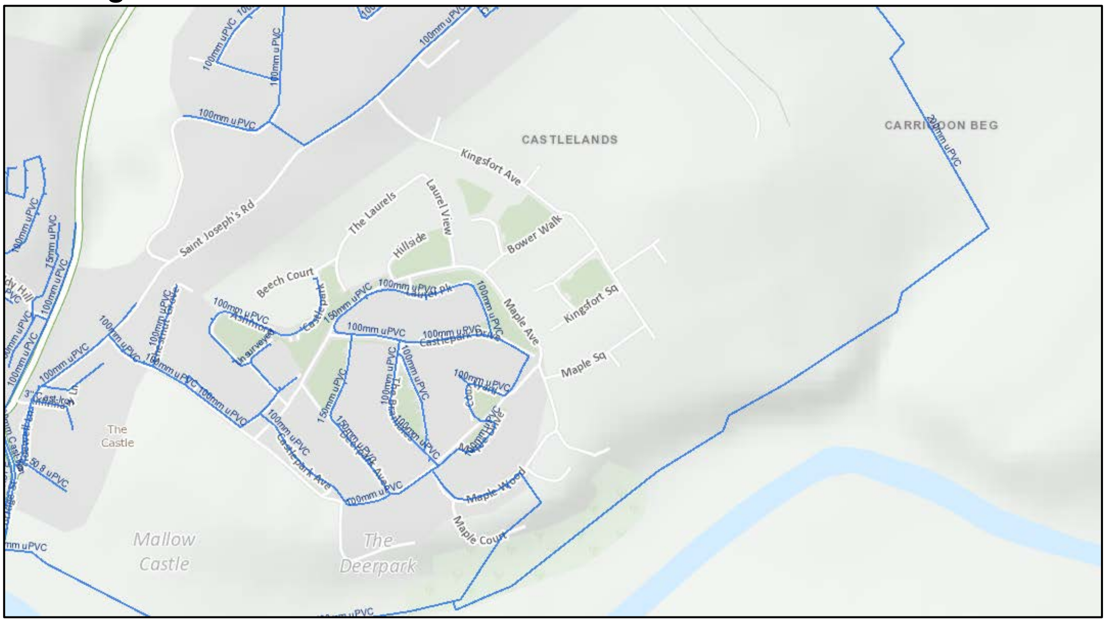
What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Uisce Éireann's network(s). • Before the Development can connect to Uisce 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)

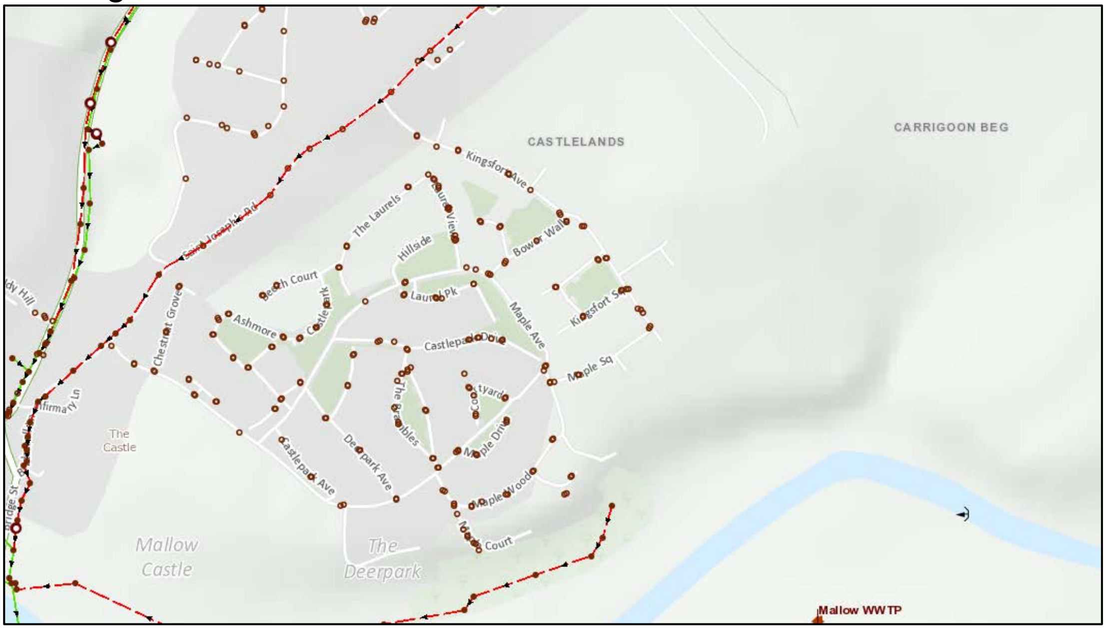
Section B – Details of Uisce Éireann's Network(s)

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.

Appendix B –Irish Water Statement of Design Acceptance

Dennis Hennigan
Green Banks
Ballyvolane
Co. Cork
T23AV6W

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

17 October 2024

Re: Design Submission for Site at, Ballincrossig, Glanmire, Cork (the "Development") (the "Design Submission") / Connection Reference No: CDS24003661

Dear Dennis Hennigan,

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, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann'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 Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Kyle Jackson
Email: kyle.jackson@water.ie

Yours sincerely,

Dermot Phelan
Connections Delivery Manager

Appendix A

Document Title & Revision

- [6621-2020-E]
- [6621-2021-F]
- [6621-2022-E]
- [6621-2023-D]
- [6621-2030-D]
- [6621-2031-E]
- [6621-2032-D]
- [6621-2060-C]
- [6621-2061-B]
- [6621-2062-B]
- [6621-2063-B]
- [6621-2064-B]

Standard Details/Code of Practice Exemption:

Not applicable

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

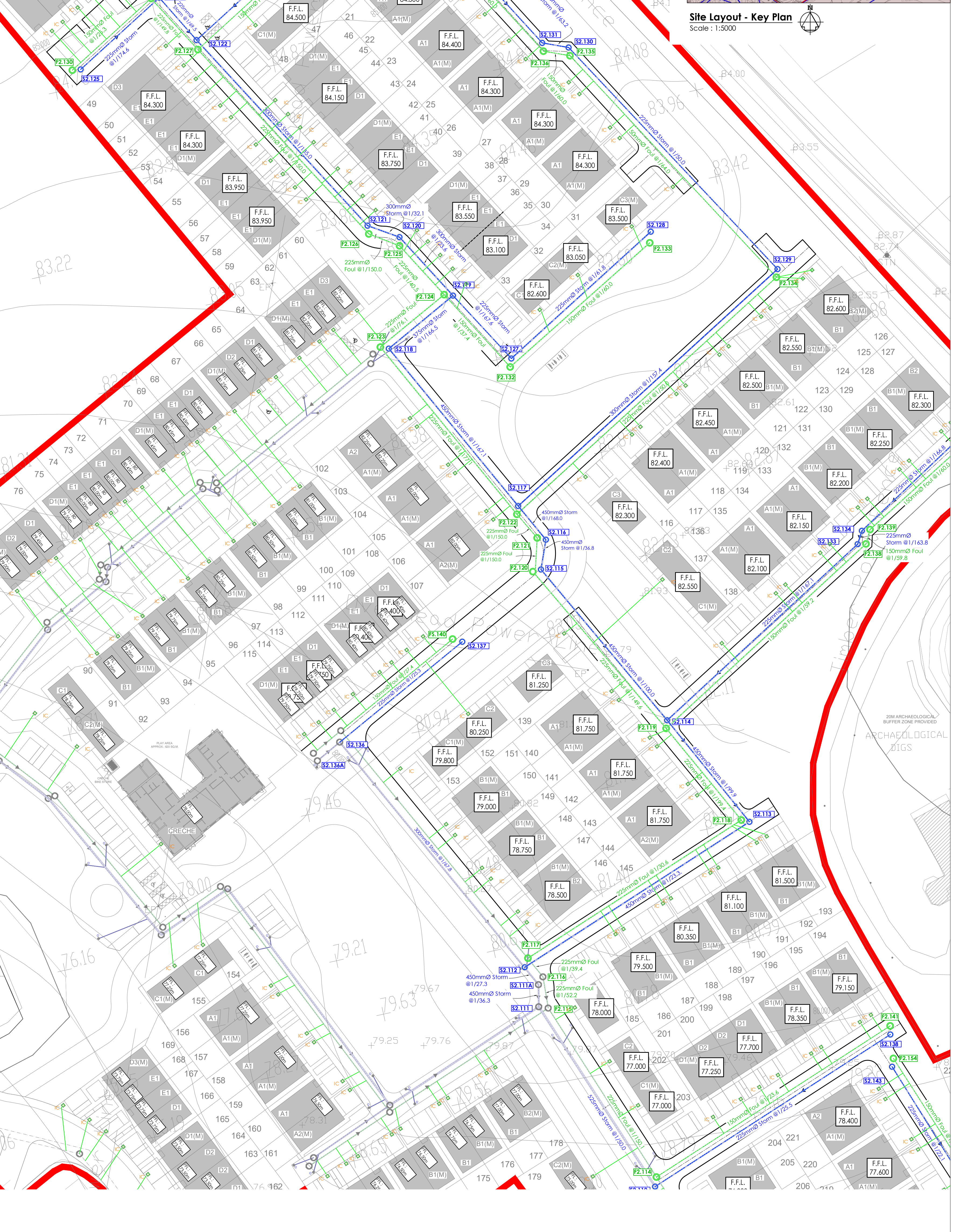
Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements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

Legend:

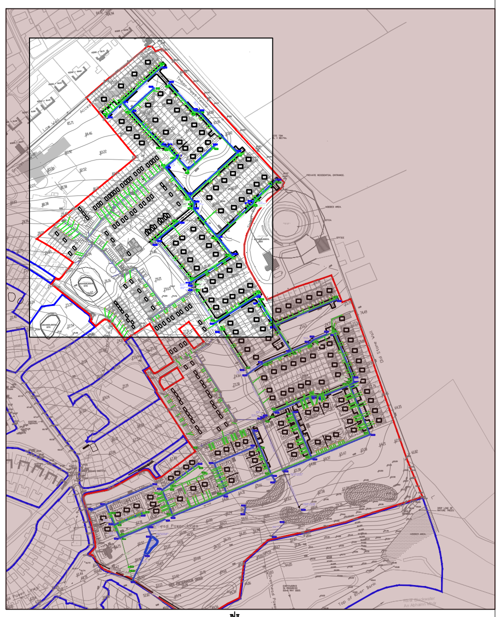
Wastewater Details:	Document No. IW-CDS-5030-01	
Denotes Foul Pipe	Waste Water Service Connection Responsibility :	STD-WW-01
F.001 Denotes Foul Manhole	Typical Layout for Sewer within New Developments	STD-WW-02
IC051 Denotes Inspection Chamber	Drain & Service Connection Pipework :	STD-WW-03
Denotes Foul Pipe Concrete encased	Typical Sewer / Service pipe Connection :	STD-WW-04
	STD-WW-06 Existing Planting	STD-WW-06
Denotes Ex. Foul Sewer	Restrictions on new planting adjacent to sewers	STD-WW-06A
Storm Water Details:	Trench Backfill & Bearing :	STD-WW-07
Denotes Connection Pipe	Concrete Bed, Haunch & Surround to Waste Water :	STD-WW-08
	Pre-cast Concrete Manhole :	STD-WW-10
Denotes Storm Pipe	Backdrop manholes:	STD-WW-12
S.001 Denotes Storm Manhole	Private Side Inspection Chamber :	STD-WW-13
Road Gully		
Denotes Ex. Storm Sewer		

Note:
Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5030-01
Pipe materials shall comply with Section 3.9 of Irish Water's Code of Practice.
All works to be constructed to conform with Irish Water's Code of Practice for Wastewater Infrastructure Document No. IW-CDS-5030-03.

1. All Foul pipes must be in compliance with Code of Practice for Wastewater Infrastructure - Section 3.13
2. Foul pipe to be 'WavSpec SN8' shall be structure wall construction Type A manufactured in accordance with EN13476-2, and comprising PVC-U smooth internal and external layers with either a foamed or a recycled PVC-U core
3. 'WavSpec SN8' shall be manufactured in accordance with Quality Management system IS EN ISO 9001: 2008 and Environmental Quality System IS EN ISO 14001:2004
4. Separation distances must be in compliance with Standard details & Code of Practice for Wastewater Infrastructure
5. Manhole covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete
6. All new trees/shrubs planting will comply with minimum planting distances as per standard detail STD-WW-06A
7. Stormwater pipe will be a JFC Corripipe twin wall SN6/SN8 polyethylene drainage pipe. Corripipe is a twin wall polyethylene drainage pipe manufactured from a black high density polyethylene by a twin extrusion process.



Proposed Drainage Layout 1 of 3
Scale : 1:500



Site Layout - Key Plan
Scale : 1:5000

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Ballincollig
Cork
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021 4871781
info@dosa.ie
www.dosa.ie

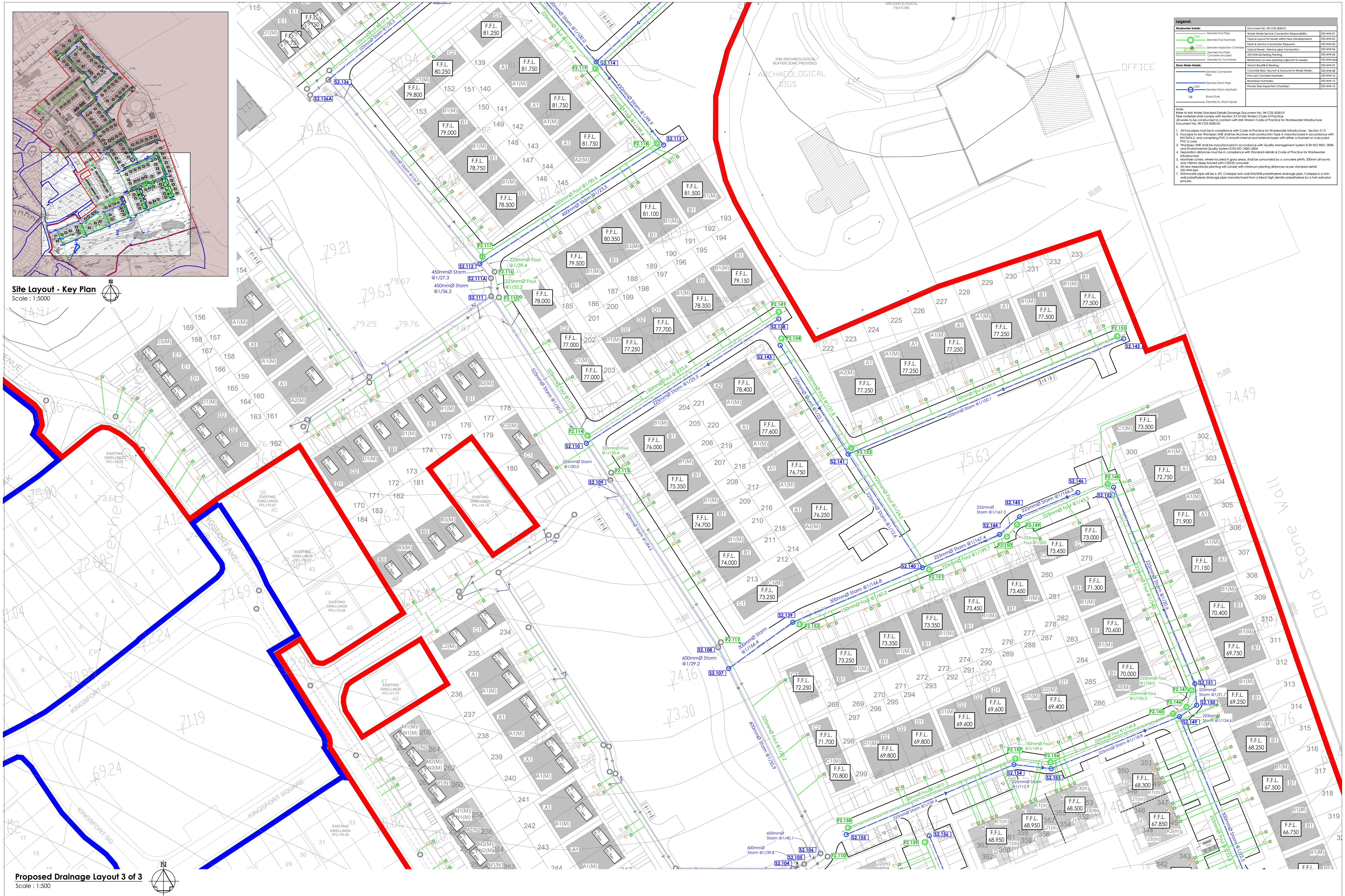
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.'24	Issued for LRD Application

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
LRD Proposed Drainage Layout 1 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2020	E



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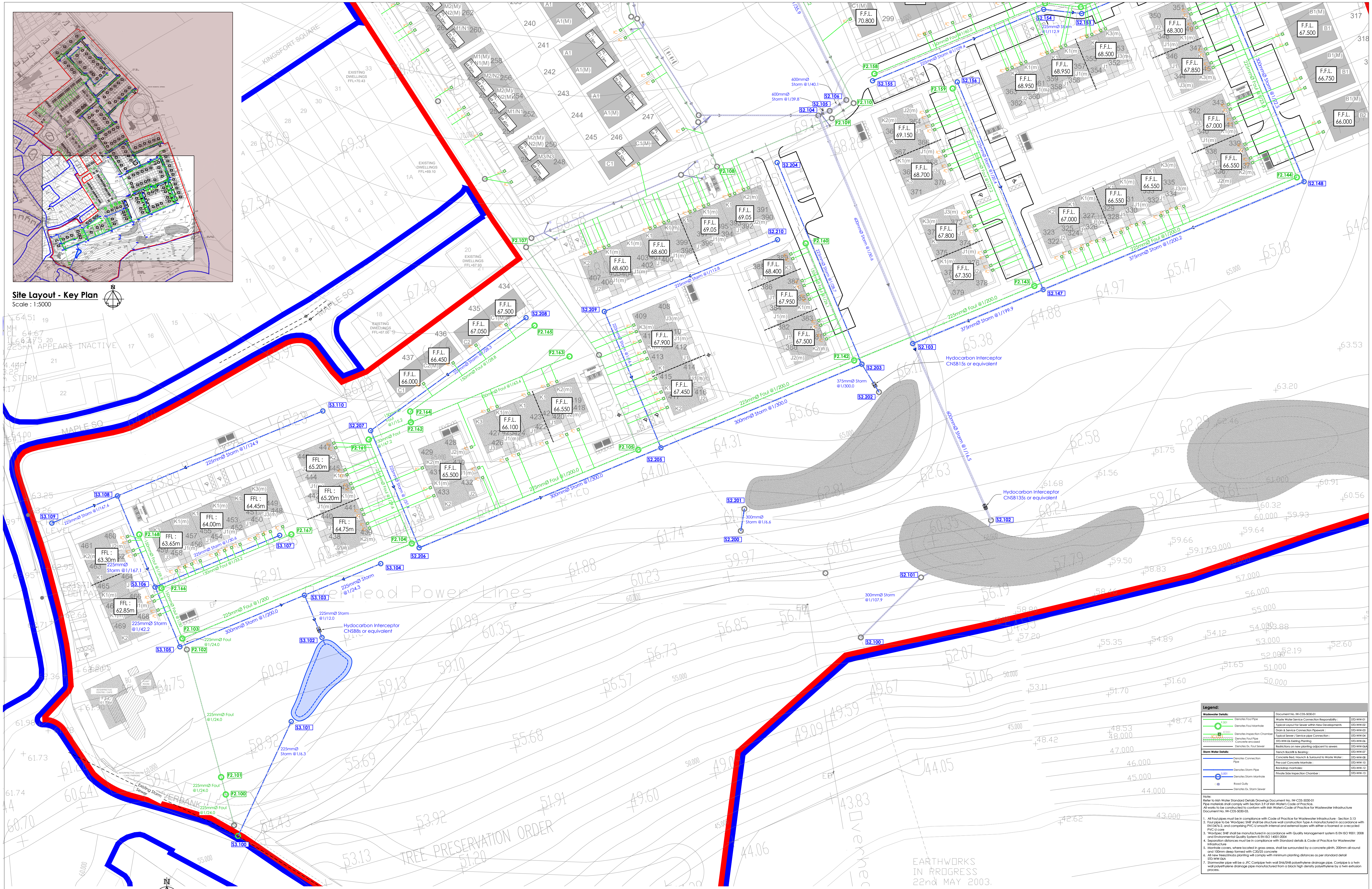
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
F	K.M.	S.O'G	S.O'G	01.10.24	Revised & Issued for LRD Application

CLIENT	Reside (Castlepark) Ltd.
DRAWING TITLE	LRD Proposed Drainage Layout 2 of 3
PROJECT	Castlepark, Mallow, Co. Cork
SHEET	A1
SCALE	1:500
PROJECT NO.	6621
DRAWING NO.	2021
STATUS/ISSUE	F



Proposed Drainage Layout 3 of 3
Scale : 1:500

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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
LRD Proposed Drainage Layout 3 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2022	E

US/MH Name	Pipe Length (m)	Fall (m)	Slope (1:X)	US/IL (m)	DS/IL (m)	Pipe DIA (mm)
F2.129	73.270	1.221	60.0	83.150	81.929	150
F2.130	25.825	1.021	25.3	82.950	81.929	150
F2.128	17.075	0.114	149.8	81.929	81.815	225
F2.131	42.945	0.716	60.0	83.000	82.284	150
F2.127	62.450	0.416	150.1	81.815	81.399	225
F2.126	5.170	0.034	152.1	81.399	81.365	225
F2.125	18.830	0.465	40.5	81.365	80.900	225
F2.133	46.605	0.777	60.0	82.300	81.523	150
F2.132	23.315	0.623	37.4	81.523	80.900	150
F2.124	19.030	0.250	76.1	80.900	80.650	225
F2.123	53.125	0.300	177.1	80.650	80.350	225
F2.137	49.610	0.827	60.0	82.850	82.023	150
F2.136	6.505	0.108	60.2	82.023	81.915	150
F2.135	74.525	1.165	64.0	81.915	80.750	150
F2.134	85.135	1.703	50.0	80.750	79.047	225
F2.122	8.575	0.057	150.4	79.047	78.990	225
F2.121	8.295	0.055	150.8	78.990	78.935	225
F2.120	48.930	0.328	149.3	78.935	78.607	225
F2.140	38.370	0.640	60.0	80.450	79.810	150
F2.139	4.485	0.075	59.8	79.810	79.735	150
F2.138	66.765	1.128	59.2	79.735	78.607	150
F2.119	29.910	0.150	199.4	78.607	78.457	225
F2.118	61.485	2.008	30.6	78.457	76.449	225
F2.117	5.905	0.150	39.4	76.449	76.299	225
F2.116	7.825	0.150	52.2	76.299	76.149	225
F2.115	49.375	0.329	150.1	73.460	73.131	225
F2.141	68.495	2.900	23.6	77.350	74.450	150
F2.114	13.385	0.089	150.4	73.131	73.042	225
F2.113	60.704	1.642	37.0	73.042	71.400	225
F2.111	72.220	3.250	22.2	71.400	68.150	225
F2.110	7.845	0.150	52.3	68.150	68.000	225
F2.109	36.705	0.500	73.4	68.000	67.500	225
F2.108	61.130	0.850	71.9	67.500	66.650	225
F2.107	38.358	0.950	40.4	66.650	65.700	225
F2.106	28.170	1.050	26.8	65.700	64.650	225
F2.154	38.155	1.750	21.8	76.650	74.900	150
F2.155	87.145	1.452	60.0	75.550	74.098	150
F2.153	43.415	1.809	24.0	72.787	70.978	225
F2.152	43.325	0.722	60.0	71.700	70.978	150
F2.151	25.755	0.129	199.7	70.978	70.849	225
F2.150	5.810	0.029	200.3	70.849	70.820	225
F2.149	28.475	0.654	43.5	70.820	70.166	225
F2.148	67.060	2.794	24.0	70.166	67.372	225
F2.147	5.336	0.222	24.0	67.372	67.150	225
F2.146	4.515	0.023	196.3	67.150	67.127	225
F2.158	54.485	0.908	60.0	68.100	67.192	150
F2.157	10.625	0.071	149.6	67.192	67.121	150
F2.156	39.705	0.265	149.8	67.121	66.856	225
F2.145	68.055	2.856	23.8	66.856	64.000	225
F2.144	83.800	0.419	200.0	64.000	63.581	225
F2.159	88.345	3.250	27.2	67.400	64.150	150
F2.143	68.915	0.345	200.0	63.581	63.236	225
F2.160	35.265	1.350	26.1	66.500	65.150	150
F2.142	68.915	0.345	200.0	63.236	62.892	225
F2.105	72.305	0.362	200.0	62.892	62.530	225
F2.163	50.730	0.800	63.4	64.750	63.950	150
F2.165	44.620	1.550	28.8	65.750	64.200	150
F2.164	6.065	0.400	15.2	64.200	63.800	150
F2.162	13.437	0.200	67.2	63.800	63.600	150
F2.161	28.165	0.952	29.6	63.600	62.648	225
F2.104	73.250	0.366	200.0	62.530	62.164	225
F2.167	41.465	1.250	33.2	63.250	62.000	150
F2.168	17.145	0.286	59.9	61.400	61.114	150
F2.166	13.950	0.093	150.0	61.114	61.021	150
F2.103	5.640	0.235	24.0	61.021	60.786	225
F2.102	37.015	1.542	24.0	59.042	57.500	225
F2.101	5.301	0.221	24.0	54.721	54.500	225
F2.100	9.405	0.392	24.0	52.562	52.170	225

Foul Sewer Pipe Schedule

US/MH Name	US/CL (m)	US/IL (m)	Depth (m)
F2.100	56.000	52.562	3.438
F2.101	59.000	54.721	4.279
F2.102	62.500	59.042	3.458
F2.103	63.000	61.021	1.979
F2.104	64.500	62.530	1.970
F2.105	66.500	62.892	3.608
F2.106	67.550	65.700	1.850
F2.107	68.500	66.650	1.850
F2.108	69.350	67.500	1.850
F2.109	69.850	68.000	1.850
F2.110	70.000	68.150	1.850
F2.111	73.250	71.400	1.850
F2.113	75.750	73.042	2.708
F2.114	76.300	73.131	3.169
F2.115	78.000	73.460	4.540
F2.116	78.150	76.299	1.851
F2.117	78.300	76.449	1.851
F2.118	81.350	78.457	2.893
F2.119	81.750	78.607	3.143
F2.120	81.700	78.935	2.765
F2.121	82.000	78.990	3.010
F2.122	82.200	79.047	3.153
F2.123	82.500	80.650	1.850
F2.124	82.750	80.900	1.850
F2.125	83.450	81.365	2.085
F2.126	83.550	81.399	2.151
F2.127	84.400	81.815	2.585
F2.128	84.650	81.929	2.721
F2.129	85.000	83.150	1.850
F2.130	84.800	82.950	1.850
F2.131	84.350	83.000	1.350
F2.132	82.600	81.523	1.077
F2.133	83.350	82.300	1.050
F2.134	82.600	80.750	1.850
F2.135	84.100	81.915	2.185
F2.136	84.200	82.023	2.177
F2.137	84.700	82.850	1.850
F2.138	82.050	79.735	2.315
F2.139	82.100	79.810	2.290
F2.140	82.300	80.450	1.850
F2.141	79.200	77.350	1.850
F2.142	67.000	63.236	3.764
F2.143	66.000	63.581	2.419
F2.144	65.500	64.000	1.500
F2.145	69.050	66.856	2.194
F2.146	69.000	67.150	1.850
F2.147	69.300	67.372	1.928
F2.148	72.500	70.166	2.334
F2.149	73.450	70.820	2.630
F2.150	73.400	70.849	2.551
F2.151	73.275	70.978	2.297
F2.152	73.050	71.700	1.350
F2.153	76.750	72.787	3.963
F2.154	78.500	76.650	1.850
F2.155	77.400	75.550	1.850
F2.156	69.400	67.121	2.279
F2.157	69.500	67.192	2.308
F2.158	69.950	68.100	1.850
F2.159	69.250	67.400	1.850
F2.160	68.350	66.500	1.850
F2.161	65.450	63.600	1.850
F2.162	65.300	63.800	1.500
F2.163	66.100	64.750	1.350
F2.164	65.700	64.200	1.500
F2.165	67.250	65.750	1.500
F2.166	63.500	61.114	2.386
F2.167	64.600	63.250	1.350
F2.168	63.250	61.400	1.850

Foul Sewer Manhole Schedule

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
S2.138	68.925	2.700	25.5	77.500	74.800	225
S2.110	13.200	0.264	50.0	72.423	72.159	525
S2.109	59.880	0.709	84.5	72.159	71.450	600
S2.108	7.300	0.250	29.2	71.450	71.200	600
S2.143	38.590	1.750	22.1	77.000	75.250	225
S2.142	89.845	0.898	100.1	75.900	75.002	225
S2.141	40.825	3.252	12.6	75.002	71.750	225
S2.146	18.955	0.114	166.3	71.500	71.386	225
S2.145	8.030	0.048	167.3	71.386	71.338	225
S2.144	25.270	0.151	167.4	71.338	71.187	225
S2.140	42.189	0.253	166.8	71.187	70.934	300
S2.139	23.800	0.143	166.4	70.934	70.791	375
S2.107	96.615	2.692	35.9	70.791	68.099	600
S2.106	5.855	0.146	40.1	68.099	67.953	600
S2.105	3.500	0.088	39.8	67.953	67.865	600
S2.104	96.945	3.166	30.6	67.865	64.699	600
S2.152	63.950	3.100	20.6	71.000	67.900	225
S2.151	6.513	0.300	21.7	67.900	67.600	225
S2.150	6.230	0.050	124.6	67.600	67.550	225
S2.155	54.675	0.500	109.4	68.500	68.000	225
S2.154	11.285	0.100	112.9	68.000	67.900	225
S2.153	41.595	0.350	118.8	67.900	67.550	225
S2.149	68.520	3.050	22.5	67.550	64.500	225
S2.148	83.280	0.416	200.2	64.500	64.084	375
S2.156	66.295	3.250	20.4	67.750	64.500	225
S2.147	76.350	0.382	199.9	64.084	63.702	375
S2.103	85.715	5.202	16.5	63.702	58.500	600
S2.102	26.630	0.266	100.1	58.500	58.234	675
S2.101	25.090	0.251	100.0	58.234	57.983	300

Storm Sewer Pipe Schedule - Catchment Area 01

Storm Sewer Manhole Schedule - Catchment Area 01

US/MH Name	Pipe Length (m)	Fall (m)	Slope (1:X)	US/IL (m)	DS/IL (m)	Pipe DIA (mm)
S2.208	56.660	2.000	28.3	66.000	64.000	225
S2.207	37.400	1.000	37.4	64.000	63.000	225
S2.206	77.280	0.258	300.0	63.000	62.742	300
S2.210	84.575	0.750	112.8	67.250	66.500	225
S2.209	41.415	2.500	16.6	66.500	64.000	225
S2.205	90.650	0.302	300.0	62.742	62.440	300
S2.204	64.500	2.250	28.7	67.750	65.500	225
S2.203	9.645	0.032	301.4	62.440	62.408	375
S2.202	3.000	0.010	300.0	62.408	62.398	375
S2.201	6.575	1.000	6.6	62.398	61.398	300

Storm Sewer Pipe Schedule - Catchment Area 02

US/MH Name	US/CL (m)	US/IL (m)	Depth (m)
S2.201	64.000	62.398	1.602
S2.202	65.500	62.408	3.092
S2.203	67.000	62.440	4.560
S2.204	69.250	67.750	1.500
S2.205	65.500	62.742	2.758
S2.206	64.500	63.000	1.500
S2.207	65.500	64.000	1.500
S2.208	67.500	66.000	1.500
S2.209	68.000	66.500	1.500
S2.210	68.750	67.250	1.500

Storm Sewer Manhole Schedule - Catchment Area 02

US/MH Name	Pipe Length (m)	Fall (m)	Slope (1:X)	US/IL (m)	DS/IL (m)	Pipe DIA (mm)
S3.110	65.550	0.525	124.9	62.150	61.625	225
S3.109	20.950	0.125	167.6	61.750	61.625	225
S3.108	29.075	0.174	167.1	61.625	61.451	225
S3.107	39.745	1.300	30.6	62.800	61.500	225
S3.106	19.050	0.451	42.2	61.451	61.000	225
S3.105	39.820	0.199	200.0	61.000	60.801	300
S3.104	24.345	1.000	24.3	62.500	61.500	225
S3.103	15.620	1.302	12.0	59.402	58.100	300
S3.102	5.000	0.050	100.0	58.100	58.050	300
S3.101	37.350	5.883	6.3	58.050	52.167	225

Storm Sewer Pipe Schedule - Catchment Area 03

US/MH Name	US/CL (m)	US/IL (m)	Depth (m)
S3.101	59.000	58.050	0.950
S3.102	59.500	58.100	1.400
S3.103	63.000	59.402	3.598
S3.104	64.000	62.500	1.500
S3.105	62.500	61.000	1.500
S3.106	63.000	61.451	1.549
S3.107	64.300	62.800	1.500
S3.108	63.800	61.625	2.175
S3.109	63.250	61.750	1.500
S3.110	63.650	62.150	1.500

Storm Sewer Manhole Schedule - Catchment Area 03

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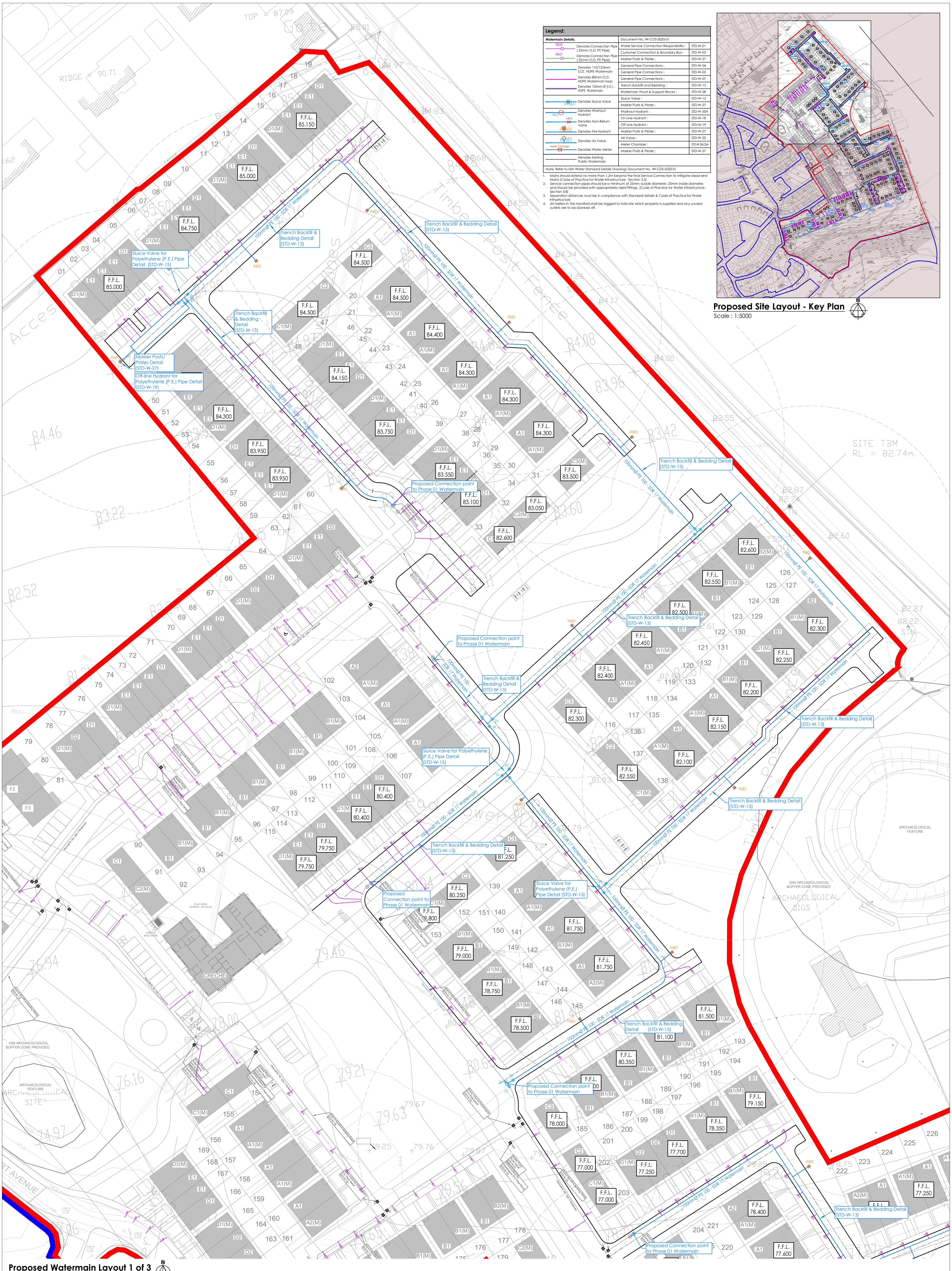
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
D	A.G.	S.O'G	S.O'G	17.10.24	Issued for LRD Application
C	K.M.	S.O'G	S.O'G	27.09.24	Issued for LRD Application
B	G.S.	S.O'G	S.O'G	13.12.23	Issued for Section 32B Application
A	G.S.	S.O'G	L.O'T	05.12.23	Issued for Pre Planning Application

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed Storm & Fouls Pipe & Manhole Schedules

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	NTS	6621	2023	D



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
Denotes Connection Pipe (25mm O.D. PE Pipe) / Denotes Connection Pipe (32mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain / Denotes 80mm O.D. HDPE Watermain loop / Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-04
	General Pipe Connections :	STD-W-05
	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
Denotes Washout Hydrant / Denotes Non-Return Valve / Denotes Fire Hydrant	Washout Hydrant :	STD-W-30A
	On Line Hydrant :	STD-W-18
	Off Line Hydrant :	STD-W-19
	Marker Posts & Plates :	STD-W-27
Denotes Air Valve / Denotes Water Meter	Air Valve :	STD-W-22
	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Site Layout - Key Plan
Scale : 1:5000

Proposed Watermain Layout 1 of 3
Scale : 1:5000

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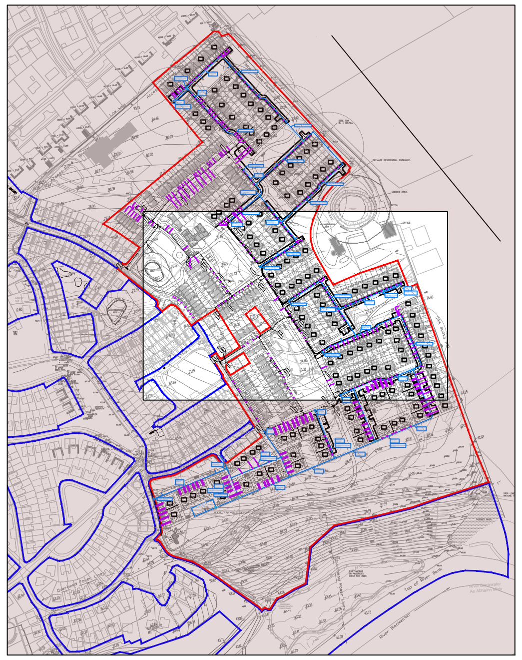
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
D	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

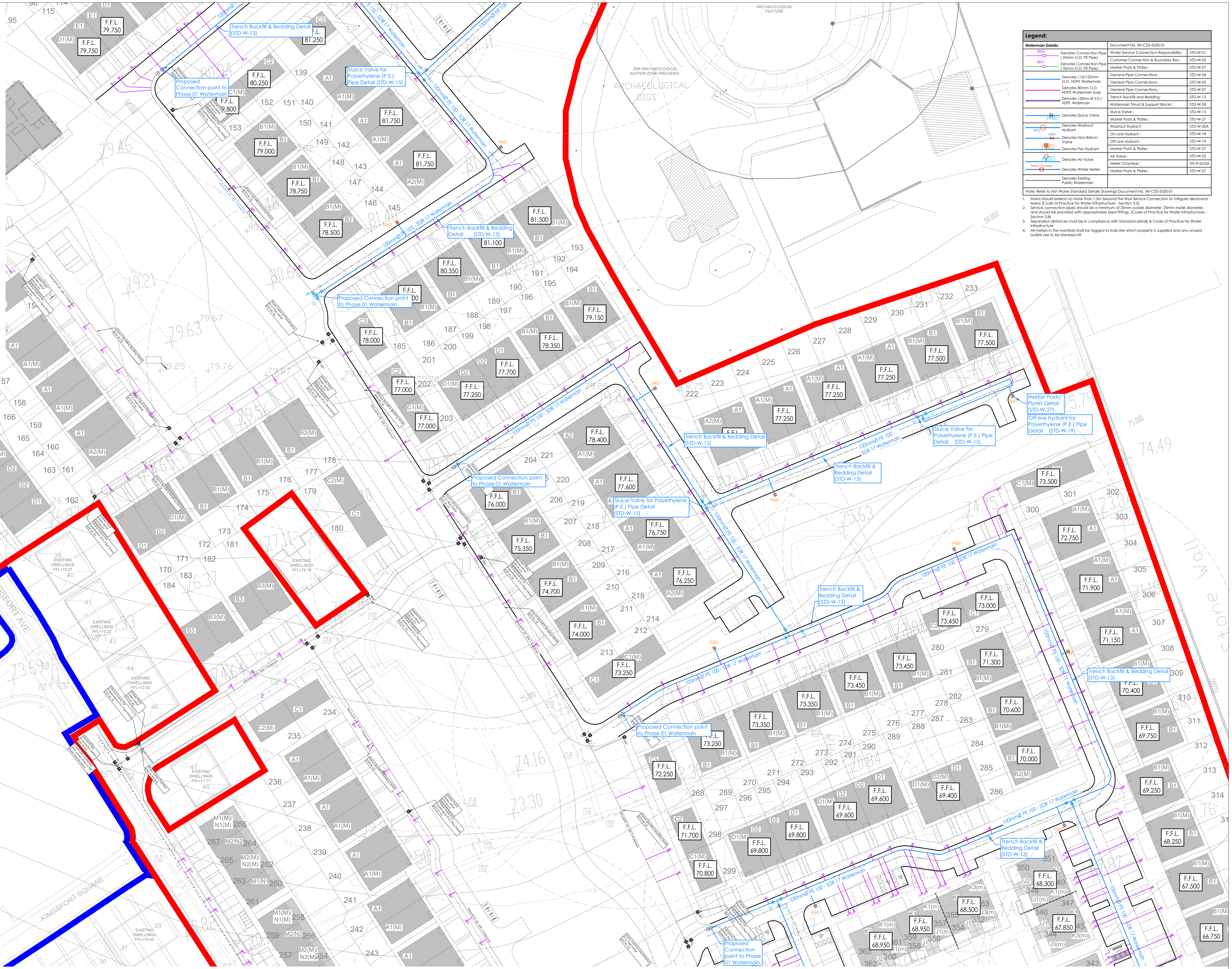
DRAWING TITLE
Proposed Drainage Layout 1 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2030	D



Site Layout - Key Plan

Scale : 1:5000



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
BB050 Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
BB051 Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-05
Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
SV001 Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
WO Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
NRV Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
FH003 Denotes Fire Hydrant	Off Line Hydrant :	STD-W-19
	Marker Posts & Plates :	STD-W-27
AV001 Denotes Air Valve	Air Valve :	STD-W-22
Meter Chamber Denotes Water Meter	Meter Chamber :	STD-W-26/26A
	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout 3 of 3

Scale : 1:500

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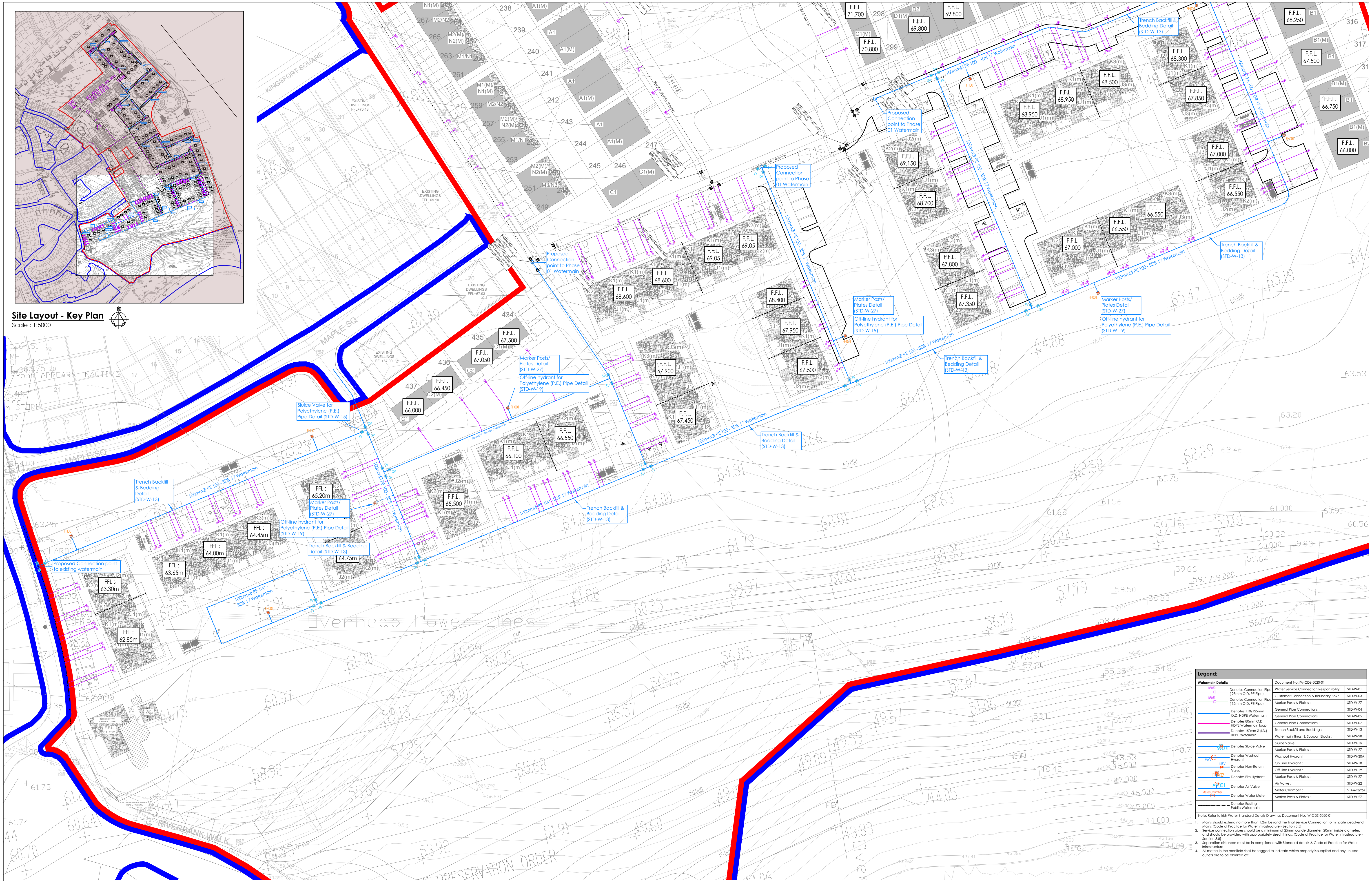
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
E	K.M.	S.O'G	S.O'G	16.10.24	Revised & Issued for LRD Application

CLIENT	Reside (Castlepark) Ltd.
PROJECT	Castlepark, Mallow, Co. Cork
DRAWING TITLE	Proposed Watermain Layout 2 of 3
SHEET	A1
SCALE	1:500
PROJECT NO.	6621
DRAWING NO.	2031
STATUS/ISSUE	E



Legend:

Watermain Details:	Document No. IW-CDS-5020-01	
Denotes Connection Pipe (25mm O.D. PE Pipe)	Water Service Connection Responsibility :	STD-W-01
Denotes Connection Pipe (32mm O.D. PE Pipe)	Customer Connection & Boundary Box :	STD-W-03
	Marker Posts & Plates :	STD-W-27
Denotes 110/125mm O.D. HDPE Watermain	General Pipe Connections :	STD-W-04
Denotes 80mm O.D. HDPE Watermain loop	General Pipe Connections :	STD-W-05
Denotes 150mm Ø (I.D.) - HDPE Watermain	General Pipe Connections :	STD-W-07
	Trench Backfill and Bedding :	STD-W-13
	Watermain Thrust & Support Blocks :	STD-W-28
Denotes Sluice Valve	Sluice Valve :	STD-W-15
	Marker Posts & Plates :	STD-W-27
Denotes Washout Hydrant	Washout Hydrant :	STD-W-30A
Denotes Non-Return Valve	On Line Hydrant :	STD-W-18
	Off Line Hydrant :	STD-W-19
Denotes Fire Hydrant	Marker Posts & Plates :	STD-W-27
Denotes Air Valve	Air Valve :	STD-W-22
	Meter Chamber :	STD-W-26/26A
Denotes Water Meter	Marker Posts & Plates :	STD-W-27
Denotes Existing Public Watermain		

Note: Refer to Irish Water Standard Details Drawings Document No. IW-CDS-5020-01

1. Mains should extend no more than 1.2m beyond the final Service Connection to mitigate dead-end Mains (Code of Practice for Water Infrastructure - Section 3.5)
2. Service connection pipes should be a minimum of 25mm ouside diameter, 20mm inside diameter, and should be provided with appropriately sized fittings. (Code of Practice for Water Infrastructure - Section 3.8)
3. Separation distances must be in compliance with Standard details & Code of Practice for Water Infrastructure
4. All meters in the manifold shall be tagged to indicate which property is supplied and any unused outlets are to be blanked off.

Proposed Watermain Layout 3 of 3

Scale : 1:500

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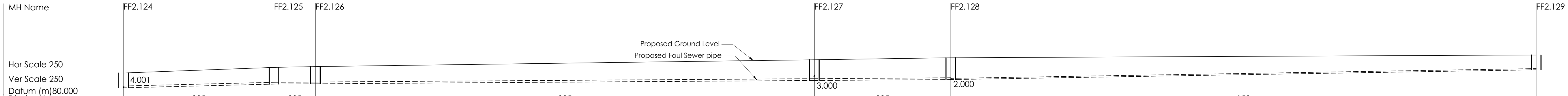
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
D	K.M.	S.O'G	S.O'G	16.10.24	Issued for LRD Application

CLIENT: Reside (Castlepark) Ltd.

PROJECT: Castlepark, Mallow, Co. Cork

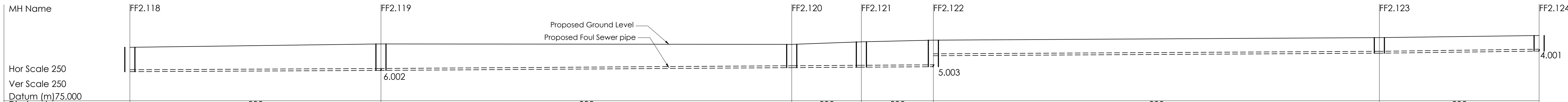
DRAWING TITLE: Proposed Watermain Layout 3 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2032	D



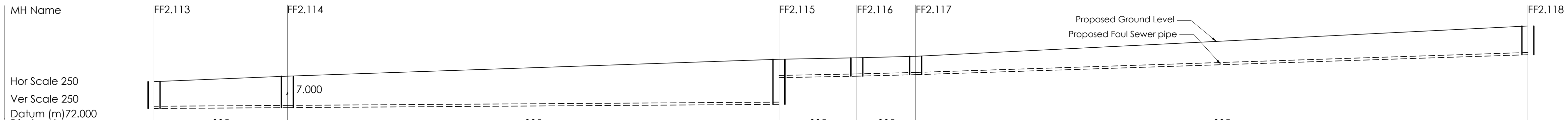
MH Name	FF2.124		FF2.125		FF2.126		FF2.127		FF2.128		FF2.129
Dia (mm)		225		225		225		225		150	
Slope (1:X)		40.5		152.1		150.1		149.8		60.0	
Cover Level (m)	82.750		83.450		83.550		84.400		84.650		85.000
Invert Level (m)	80.900		81.365		81.399		81.815		81.929		83.150
Length (m)		18.830		5.170		62.450		17.075		73.270	

Longitudinal Foul Sewer Section MH's FF2.124- FF2.129
Scale 1:250



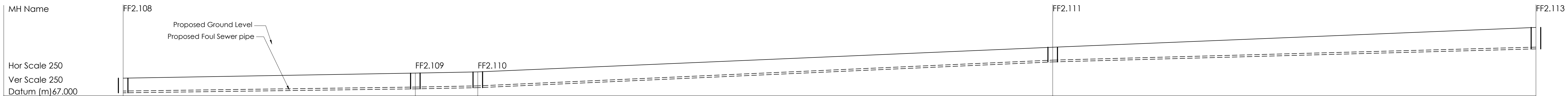
MH Name	FF2.118		FF2.119		FF2.120		FF2.121		FF2.122		FF2.123		FF2.124
Dia (mm)		225		225		225		225		225		225	
Slope (1:X)		199.4		149.3		150.8		150.4		177.1		76.1	
Cover Level (m)	81.350		81.750		81.700		82.000		82.200		82.500		82.750
Invert Level (m)	78.457		78.607		78.935		78.990		80.350		80.650		80.900
Length (m)		29.910		48.930		8.295		8.575		53.125		19.030	

Longitudinal Foul Sewer Section MH's FF2.118- FF2.124
Scale 1:250



MH Name	FF2.113		FF2.114		FF2.115		FF2.116		FF2.117		FF2.118
Dia (mm)		225		225		225		225		225	
Slope (1:X)		150.4		150.1		52.2		39.4		30.6	
Cover Level (m)	75.750		76.300		78.000		78.150		78.300		81.350
Invert Level (m)	73.042		73.131		76.149		76.299		76.449		78.457
Length (m)		13.385		49.375		7.825		5.905		61.485	

Longitudinal Foul Sewer Section MH's FF2.113- FF2.118
Scale 1:250



MH Name	FF2.108		FF2.109		FF2.110		FF2.111		FF2.113
Dia (mm)		225		225		225		225	
Slope (1:X)		73.4		52.3		22.2		37.0	
Cover Level (m)	69.350		69.850		70.000		73.250		75.750
Invert Level (m)	67.500		68.000		68.150		71.400		73.042
Length (m)		36.705		7.845		72.220		60.704	

Longitudinal Foul Sewer Section MH's FF2.108- FF2.113
Scale 1:250

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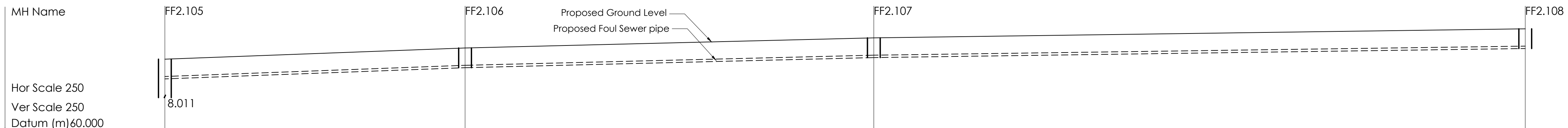
C	A.G.	S.O'G	S.O'G	17.10.24	Issued for LRD Application
B	D.O'S	S.O'G	L.O'T	27.09.24	Issued For LRD Planning application

CLIENT: Reside (Castlepark) Ltd.

PROJECT: Castlepark, Mallow, Co. Cork

DRAWING TITLE: Proposed Foul Sewer Longitudinal Sections (1 of 5)

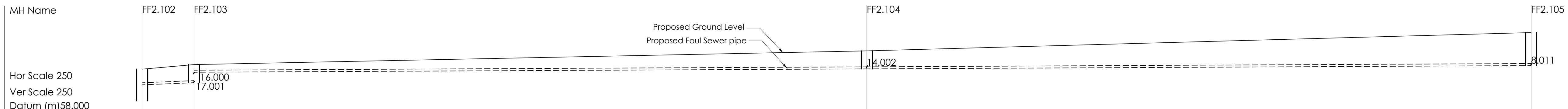
SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6621	2060	C



MH Name	FF2.105	FF2.106	FF2.107	FF2.108
Cover Level (m)	66.500	67.550	68.500	69.350
Invert Level (m)	64.650	65.700	66.650	67.500

Pipe	FF2.105–FF2.106	FF2.106–FF2.107	FF2.107–FF2.108
Dia (mm)	225	225	225
Slope (1:X)	26.8	40.4	71.9
Length (m)	28.170	38.358	61.130

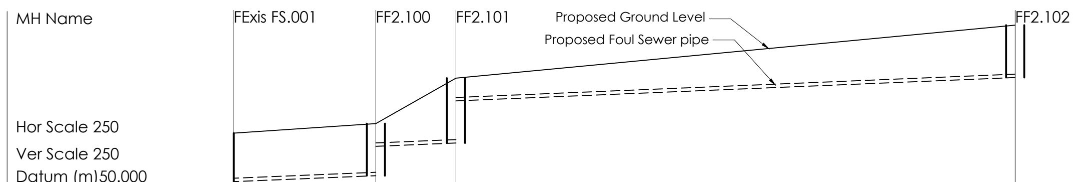
Longitudinal Foul Sewer Section MH's FF2.105- FF2.108
Scale 1:250



MH Name	FF2.102	FF2.103	FF2.104	FF2.105
Cover Level (m)	62.500	63.000	64.500	66.500
Invert Level (m)	60.786	62.164	62.530	62.892

Pipe	FF2.102–FF2.103	FF2.103–FF2.104	FF2.104–FF2.105
Dia (mm)	225	225	225
Slope (1:X)	24.0	200.0	200.0
Length (m)	5.640	73.250	72.305

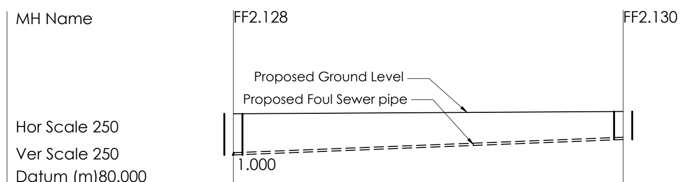
Longitudinal Foul Sewer Section MH's FF2.102- FF2.105
Scale 1:250



MH Name	FExis FS.001	FF2.100	FF2.101	FF2.102
Cover Level (m)	55.370	56.000	59.000	62.500
Invert Level (m)	52.170	54.500	57.500	59.042

Pipe	FExis FS.001–FF2.100	FF2.100–FF2.101	FF2.101–FF2.102
Dia (mm)	225	225	225
Slope (1:X)	24.0	24.0	24.0
Length (m)	9.405	5.301	37.015

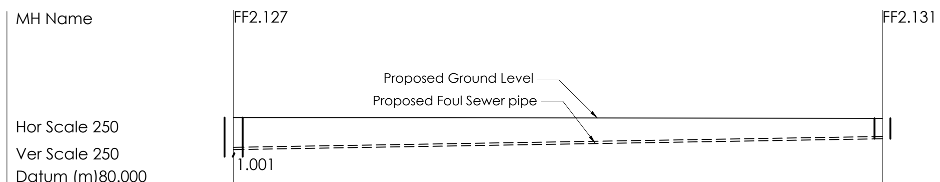
Longitudinal Foul Sewer Section MH's FF2.001- FF2.102
Scale 1:250



MH Name	FF2.128	FF2.130
Cover Level (m)	84.650	84.800
Invert Level (m)	81.929	82.950

Pipe	FF2.128–FF2.130
Dia (mm)	150
Slope (1:X)	25.3
Length (m)	25.825

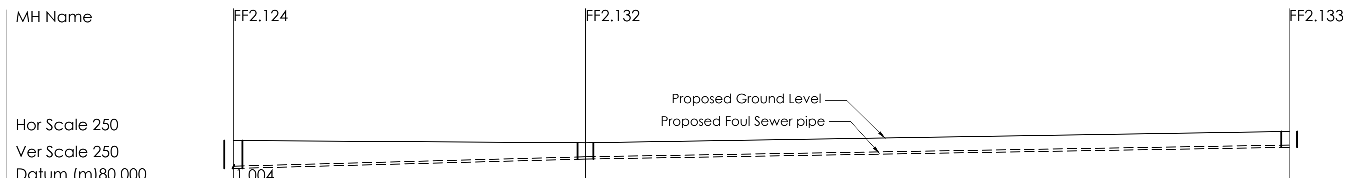
Longitudinal Foul Sewer Section MH's FF2.128- FF2.130
Scale 1:250



MH Name	FF2.127	FF2.131
Cover Level (m)	84.400	84.350
Invert Level (m)	82.284	83.000

Pipe	FF2.127–FF2.131
Dia (mm)	150
Slope (1:X)	60.0
Length (m)	42.945

Longitudinal Foul Sewer Section MH's FF2.127- FF2.131
Scale 1:250



MH Name	FF2.124	FF2.132	FF2.133
Cover Level (m)	82.750	82.600	83.350
Invert Level (m)	80.900	81.523	82.300

Pipe	FF2.124–FF2.132	FF2.132–FF2.133
Dia (mm)	150	150
Slope (1:X)	37.4	60.0
Length (m)	23.315	46.605

Longitudinal Foul Sewer Section MH's FF2.124- FF2.133
Scale 1:250

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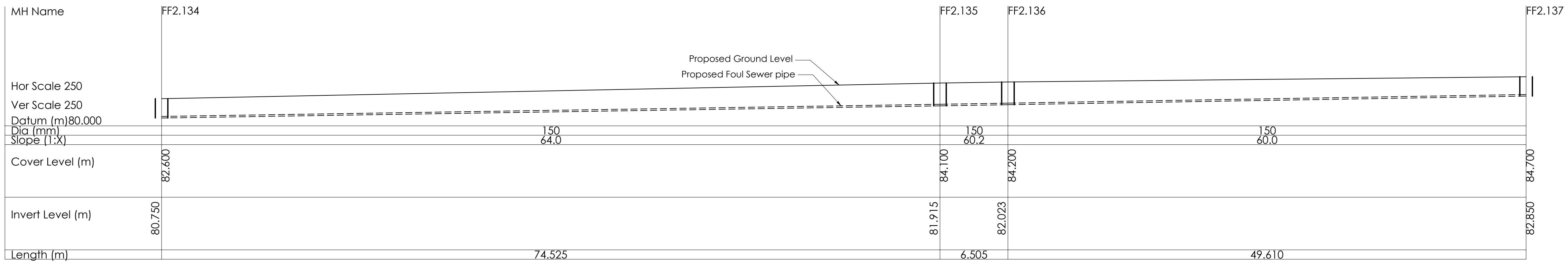
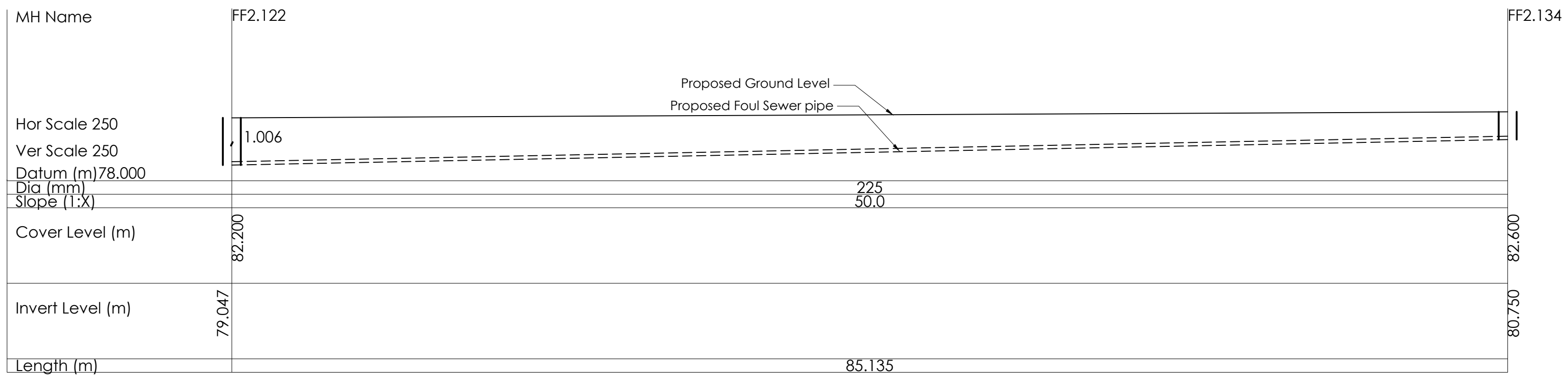
B	D.O'S	S.O'G	L.O'T	27.09.24	Issued For LRD Planning application

CLIENT: Reside (Castlepark) Ltd.
PROJECT: Castlepark, Mallow, Co. Cork
DRAWING TITLE: Proposed Foul Sewer Longitudinal Sections (2 of 5)
SHEET: A1
SCALE: 1:250
PROJECT NO. 6621 _ DRAWING NO. 2061 _ STATUS/ISSUE B



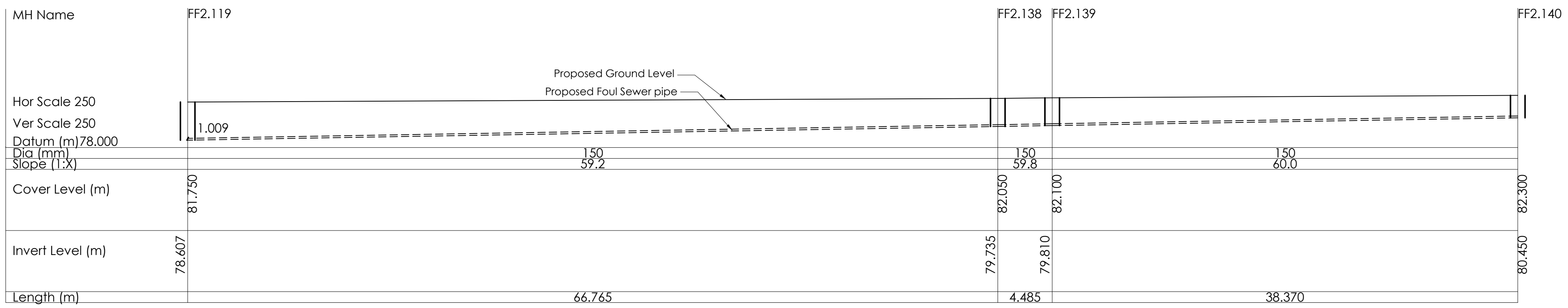
Longitudinal Foul Sewer Section MH's FF2.134- FF2.137

Scale 1:250



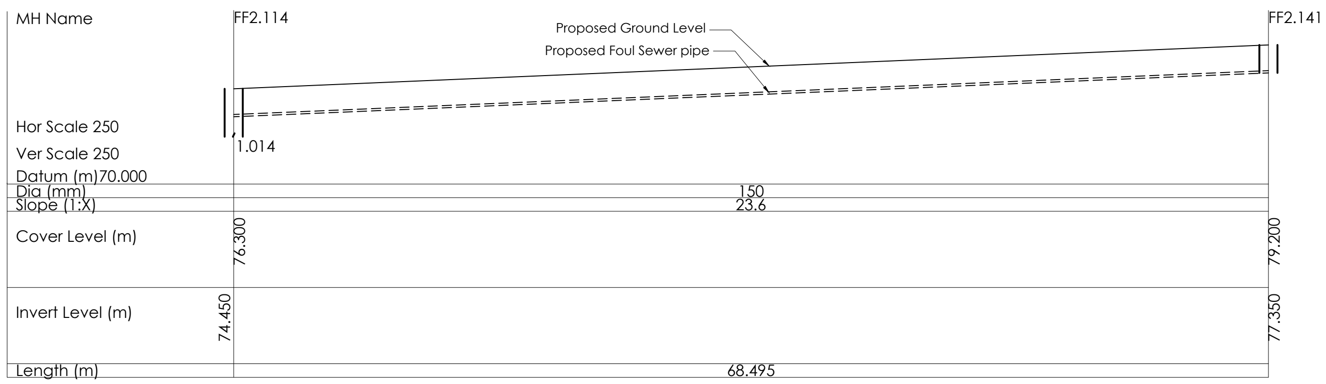
Longitudinal Foul Sewer Section MH's FF2.122- FF2.134

Scale 1:250



Longitudinal Foul Sewer Section MH's FF2.119- FF2.140

Scale 1:250



Longitudinal Foul Sewer Section MH's FF2.114- FF2.141

Scale 1:250

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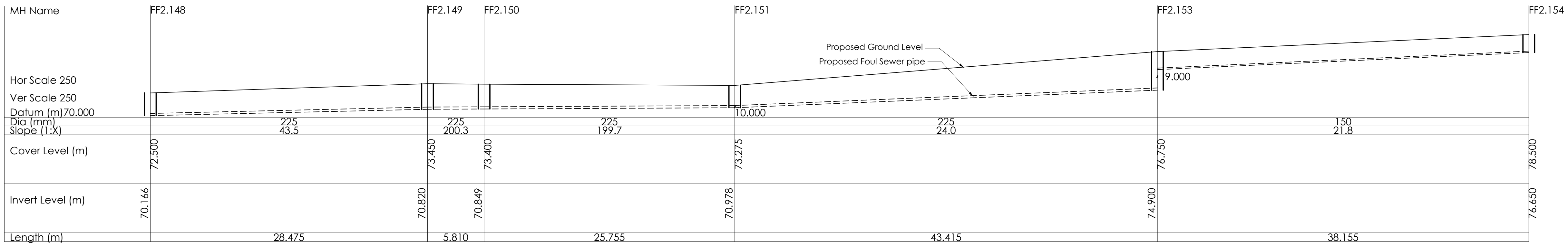
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
B	D.O'S	S.O'G	L.O'T	27.09.24	Issued For LRD Planning application

CLIENT
Reside (Castlepark) Ltd.

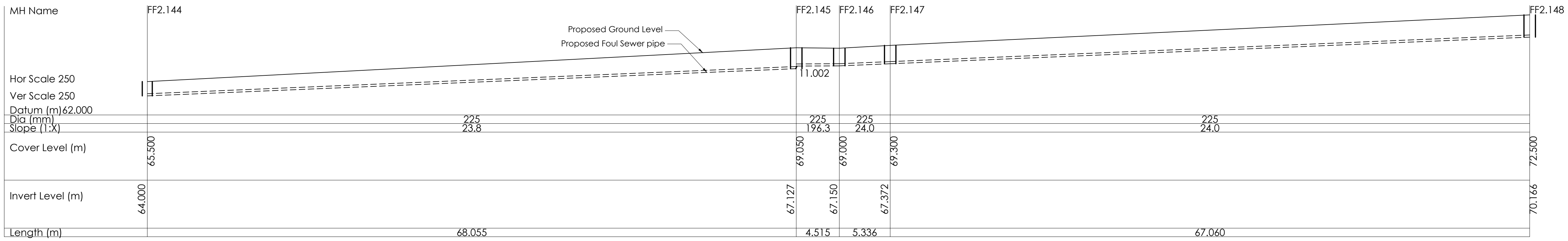
PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed Foul Sewer Longitudinal Sections (3 of 5)

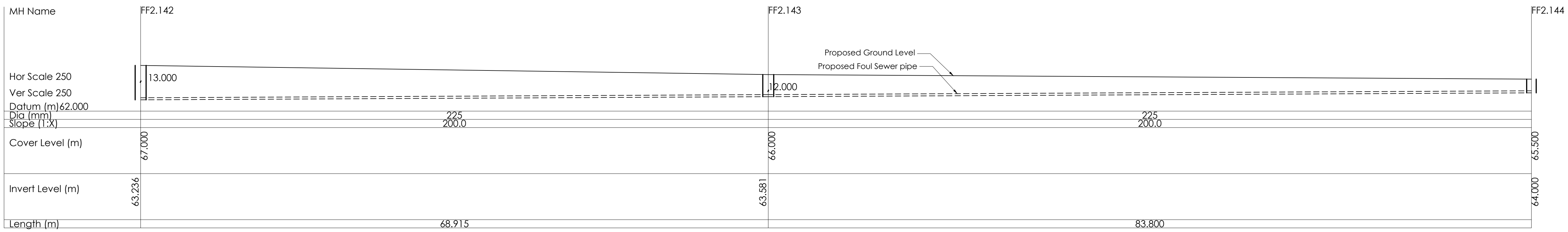
SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6621	2062	B



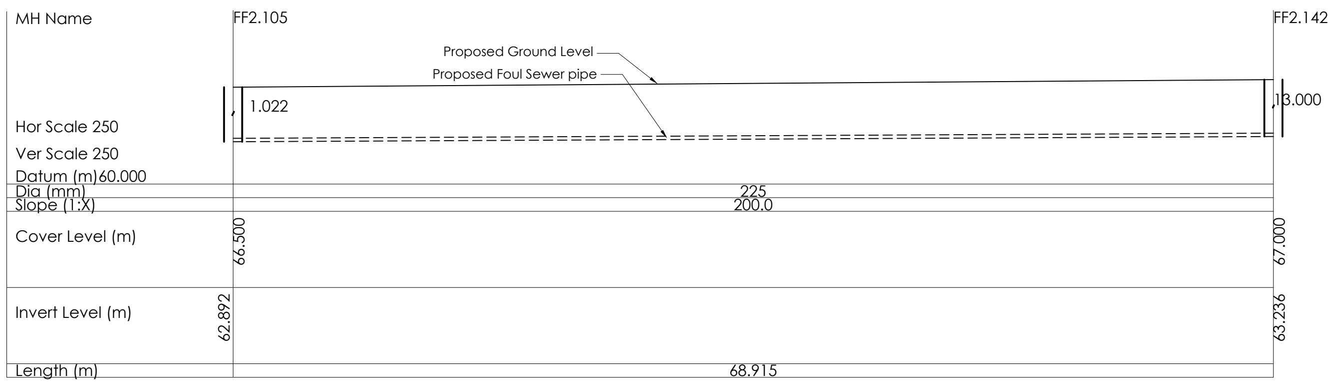
Longitudinal Foul Sewer Section MH's FF2.148- FF2.154
Scale 1:250



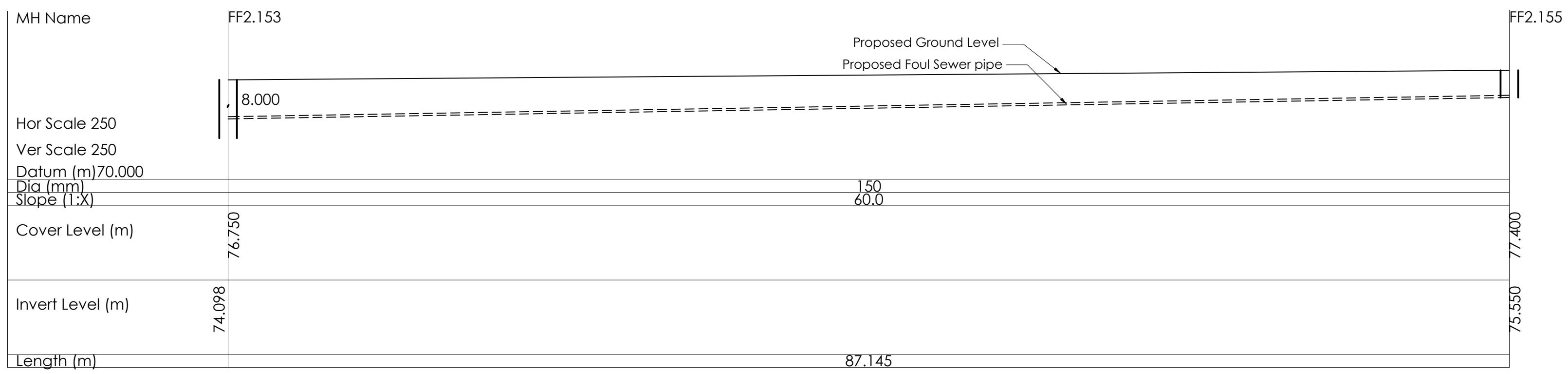
Longitudinal Foul Sewer Section MH's FF2.144- FF2.148
Scale 1:250



Longitudinal Foul Sewer Section MH's FF2.142- FF2.144
Scale 1:250



Longitudinal Foul Sewer Section MH's FF2.105- FF2.142
Scale 1:250



Longitudinal Foul Sewer Section MH's FF2.153- FF2.155
Scale 1:250

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B	D.O'S	S.O'G	L.O'T	27.09.24	Issued For LRD Planning application

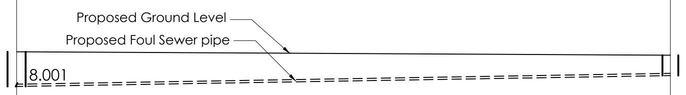
CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed Foul Sewer Longitudinal Sections (4 of 5)

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6621	2063	B

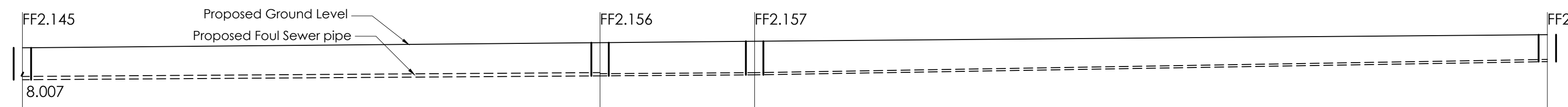
Hor Scale 250
Ver Scale 250
Datum (m)70.000



MH Name	FF2.151		FF2.152
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	73.275		73.050
Invert Level (m)	70.978		71.700
Length (m)		43.325	

Longitudinal Foul Sewer Section MH's FF2.151- FF2.152
Scale 1:250

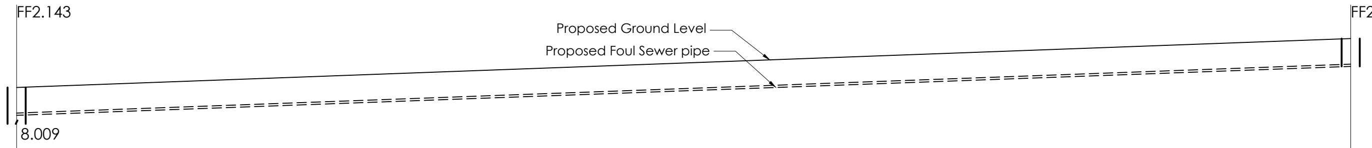
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.145		FF2.156		FF2.157		FF2.158
Dia (mm)		225		150		150	
Slope (1:X)		149.8		149.6		60.0	
Cover Level (m)	69.050		69.400		69.500		69.950
Invert Level (m)	66.856		67.121		67.192		68.100
Length (m)		39.705		10.625		54.485	

Longitudinal Foul Sewer Section MH's FF2.145- FF2.158
Scale 1:250

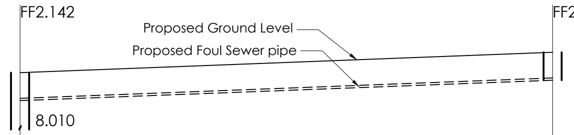
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.143		FF2.159
Dia (mm)		150	
Slope (1:X)		27.2	
Cover Level (m)	66.000		69.250
Invert Level (m)	64.150		67.400
Length (m)		88.345	

Longitudinal Foul Sewer Section MH's FF2.133- FF2.159
Scale 1:250

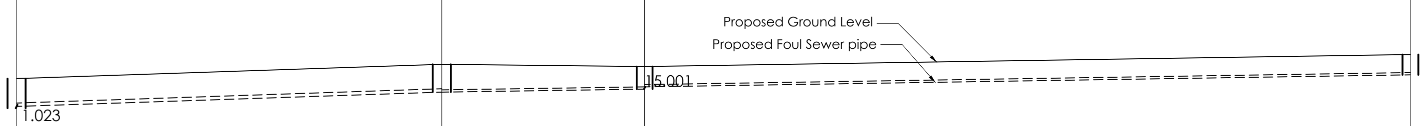
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.142		FF2.160
Dia (mm)		150	
Slope (1:X)		26.1	
Cover Level (m)	67.000		68.350
Invert Level (m)	65.150		66.500
Length (m)		35.265	

Longitudinal Foul Sewer Section MH's FF2.142- FF2.160
Scale 1:250

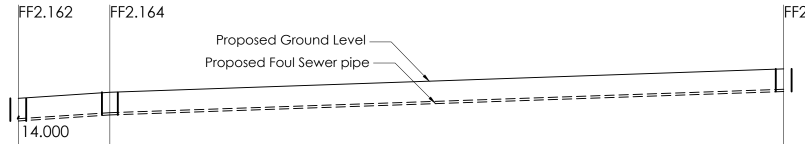
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.104		FF2.161		FF2.162		FF2.163
Dia (mm)		225		150		150	
Slope (1:X)		29.6		67.2		63.4	
Cover Level (m)	64.500		65.450		65.300		66.100
Invert Level (m)	62.648		63.600		63.950		64.750
Length (m)		28.165		13.437		50.730	

Longitudinal Foul Sewer Section MH's FF2.104- FF2.163
Scale 1:250

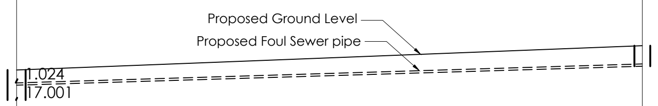
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.162		FF2.164		FF2.165
Dia (mm)		150		150	
Slope (1:X)		15.2		28.8	
Cover Level (m)	65.300		65.700		67.250
Invert Level (m)	63.800		64.200		65.750
Length (m)		6.065		44.620	

Longitudinal Foul Sewer Section MH's FF2.162- FF2.165
Scale 1:250

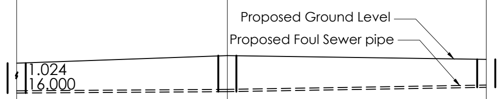
Hor Scale 250
Ver Scale 250
Datum (m)60.000



MH Name	FF2.103		FF2.167
Dia (mm)		150	
Slope (1:X)		33.2	
Cover Level (m)	63.000		64.600
Invert Level (m)	62.000		63.250
Length (m)		41.465	

Longitudinal Foul Sewer Section MH's FF2.103- FF2.167
Scale 1:250

Hor Scale 250
Ver Scale 250
Datum (m)70.000



MH Name	FF2.103		FF2.166		FF2.168
Dia (mm)		150		150	
Slope (1:X)		150.0		59.9	
Cover Level (m)	63.000		63.500		63.250
Invert Level (m)	61.021		61.114		61.400
Length (m)		13.950		17.145	

Longitudinal Foul Sewer Section MH's FF2.103- FF2.168
Scale 1:250

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CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed Foul Sewer Longitudinal Sections (5 of 5)

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:250	6621	2064	B

Appendix C – Allowable Runoff QBAR Values

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	12.777	Urban	0.000
SAAR (mm)	1000	Region Number	Ireland South

Results	**l/s**
QBAR Rural	35.3
QBAR Urban	35.3
Q100 years	65.0
Q1 year	30.0
Q30 years	56.2
Q100 years	65.0

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	2.061	Urban	0.000
SAAR (mm)	1000	Region Number	Ireland South

Results	**l/s**
QBAR Rural	5.7
QBAR Urban	5.7
Q100 years	10.5
Q1 year	4.8
Q30 years	9.1
Q100 years	10.5

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	1.257	Urban	0.000
SAAR (mm)	1000	Region Number	Ireland South

Results	**l/s**
QBAR Rural	3.5
QBAR Urban	3.5
Q100 years	6.4
Q1 year	3.0
Q30 years	5.5
Q100 years	6.4

Appendix D – 1 in 2 Year Design Sheets

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	2.181	4-8	4.090	8-12	0.490

Total Area Contributing (ha) = 6.762

Total Pipe Volume (m³) = 249.959

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	69.590	0.350	198.8	0.200	5.00	0.0	0.600	o	225
S2.000	26.185	0.150	174.6	0.080	5.00	0.0	0.600	o	225
S1.001	13.900	0.200	69.5	0.035	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	6.26	83.500	0.200	0.0	0.0	0.0	0.92	36.7	27.1
S2.000	50.00	5.44	83.300	0.080	0.0	0.0	0.0	0.99	39.2	10.8
S1.001	50.00	6.40	83.150	0.315	0.0	0.0	0.0	1.57	62.5	42.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	56.765	0.340	167.0	0.054	5.00	0.0	0.600	o	225
S1.002	62.105	0.460	135.0	0.229	0.00	0.0	0.600	o	300
S1.003	8.034	0.250	32.1	0.020	0.00	0.0	0.600	o	300
S1.004	19.490	0.826	23.6	0.049	0.00	0.0	0.600	o	300
S4.000	46.320	0.750	61.8	0.048	5.00	0.0	0.600	o	225
S4.001	21.120	0.126	167.6	0.019	0.00	0.0	0.600	o	225
S1.005	20.480	0.123	166.5	0.025	0.00	0.0	0.600	o	375
S1.006	50.120	0.300	167.1	0.130	0.00	0.0	0.600	o	450
S5.000	49.250	0.500	98.5	0.135	5.00	0.0	0.600	o	225
S5.001	6.315	0.100	63.2	0.001	0.00	0.0	0.600	o	225
S5.002	74.945	1.500	50.0	0.095	0.00	0.0	0.600	o	225
S5.003	86.440	0.549	157.4	0.226	0.00	0.0	0.600	o	300
S1.007	10.750	0.064	168.0	0.005	0.00	0.0	0.600	o	450
S1.008	7.405	0.201	36.8	0.005	0.00	0.0	0.600	o	450
S1.009	48.415	0.484	100.0	0.079	0.00	0.0	0.600	o	450

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.94	82.850	0.054	0.0	0.0	0.0	1.01	40.1	7.3
S1.002	50.00	7.17	82.510	0.598	0.0	0.0	0.0	1.35	95.5	81.0
S1.003	50.00	7.22	82.050	0.618	0.0	0.0	0.0	2.78	196.7	83.7
S1.004	50.00	7.32	81.800	0.667	0.0	0.0	0.0	3.25	229.8	90.3
S4.000	50.00	5.46	81.850	0.048	0.0	0.0	0.0	1.67	66.3	6.5
S4.001	50.00	5.81	81.100	0.067	0.0	0.0	0.0	1.01	40.0	9.1
S1.005	50.00	7.56	80.974	0.759	0.0	0.0	0.0	1.40	154.8	102.8
S1.006	50.00	8.09	80.851	0.889	0.0	0.0	0.0	1.57	249.7	120.4
S5.000	50.00	5.62	83.200	0.135	0.0	0.0	0.0	1.32	52.4	18.3
S5.001	50.00	5.69	82.700	0.136	0.0	0.0	0.0	1.65	65.5	18.4
S5.002	50.00	6.36	82.600	0.231	0.0	0.0	0.0	1.85	73.8	31.3
S5.003	50.00	7.51	81.100	0.457	0.0	0.0	0.0	1.25	88.4	61.9
S1.007	50.00	8.21	80.551	1.351	0.0	0.0	0.0	1.57	249.0	182.9
S1.008	50.00	8.24	80.487	1.356	0.0	0.0	0.0	3.36	534.1	183.6
S1.009	50.00	8.64	80.286	1.435	0.0	0.0	0.0	2.03	323.3	194.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S6.000	41.695	0.250	166.8	0.105	5.00	0.0	0.600	o	225
S6.001	3.440	0.021	163.8	0.005	0.00	0.0	0.600	o	225
S6.002	63.845	0.382	167.1	0.121	0.00	0.0	0.600	o	225
S1.010	32.155	0.322	99.9	0.072	0.00	0.0	0.600	o	450
S1.011	65.870	2.830	23.3	0.163	0.00	0.0	0.600	o	450
S7.000	38.995	1.543	25.3	0.104	5.00	0.0	0.600	o	225
S8.000	7.155	0.043	166.4	0.050	5.00	0.0	0.600	o	225
S7.001	71.700	1.057	67.8	0.141	0.00	0.0	0.600	o	300
S1.012	5.450	0.200	27.3	0.001	0.00	0.0	0.600	o	450
S1.013	5.450	0.150	36.3	0.001	0.00	0.0	0.600	o	450
S1.014	52.685	1.054	50.0	2.179	0.00	0.0	0.600	o	525
S9.000	68.925	2.700	25.5	0.165	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	50.00	5.69	80.800	0.105	0.0	0.0	0.0	1.01	40.1	14.2
S6.001	50.00	5.74	80.550	0.110	0.0	0.0	0.0	1.02	40.5	14.9
S6.002	50.00	6.80	80.529	0.231	0.0	0.0	0.0	1.01	40.1	31.3
S1.010	50.00	8.90	79.802	1.738	0.0	0.0	0.0	2.03	323.6	235.3
S1.011	50.00	9.16	79.480	1.901	0.0	0.0	0.0	4.23	672.4	257.4
S7.000	50.00	5.25	79.250	0.104	0.0	0.0	0.0	2.61	103.9	14.1
S8.000	50.00	5.12	77.750	0.050	0.0	0.0	0.0	1.01	40.2	6.8
S7.001	50.00	5.87	77.707	0.295	0.0	0.0	0.0	1.91	135.1	39.9
S1.012	50.00	9.19	76.650	2.197	0.0	0.0	0.0	3.91	621.3	297.5
S1.013	50.00	9.21	76.450	2.198	0.0	0.0	0.0	3.38	537.8	297.6
S1.014	50.00	9.49	73.477	4.377	0.0	0.0	0.0	3.17	687.0	592.7
S9.000	50.00	5.44	77.500	0.165	0.0	0.0	0.0	2.60	103.4	22.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.015	13.200	0.264	50.0	0.005	0.00	0.0	0.600	o	525
S1.016	59.880	0.709	84.5	0.169	0.00	0.0	0.600	o	600
S1.017	7.300	0.250	29.2	0.000	0.00	0.0	0.600	o	600
S10.000	38.590	1.750	22.1	0.095	5.00	0.0	0.600	o	225
S11.000	89.845	0.898	100.1	0.222	5.00	0.0	0.600	o	225
S10.001	40.825	3.252	12.6	0.078	0.00	0.0	0.600	o	225
S12.000	18.955	0.114	166.3	0.046	5.00	0.0	0.600	o	225
S12.001	8.030	0.048	167.3	0.005	0.00	0.0	0.600	o	225
S12.002	25.270	0.151	167.4	0.056	0.00	0.0	0.600	o	225
S10.002	42.189	0.253	166.8	0.107	0.00	0.0	0.600	o	300
S10.003	23.800	0.143	166.4	0.050	0.00	0.0	0.600	o	375
S1.018	96.615	2.692	35.9	0.005	0.00	0.0	0.600	o	600
S1.019	5.855	0.146	40.1	0.005	0.00	0.0	0.600	o	600
S1.020	3.500	0.088	39.8	0.000	0.00	0.0	0.600	o	600

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.015	50.00	9.56	72.423	4.547	0.0	0.0	0.0	3.17	686.9	615.7
S1.016	50.00	9.94	72.159	4.716	0.0	0.0	0.0	2.65	749.6	638.6
S1.017	50.00	9.96	71.450	4.716	0.0	0.0	0.0	4.52	1277.4	638.6
S10.000	50.00	5.23	77.000	0.095	0.0	0.0	0.0	2.80	111.3	12.9
S11.000	50.00	6.15	75.900	0.222	0.0	0.0	0.0	1.31	52.0	30.1
S10.001	50.00	6.33	75.002	0.395	0.0	0.0	0.0	3.71	147.6	53.5
S12.000	50.00	5.31	71.500	0.046	0.0	0.0	0.0	1.01	40.2	6.2
S12.001	50.00	5.45	71.386	0.051	0.0	0.0	0.0	1.01	40.1	6.9
S12.002	50.00	5.86	71.338	0.107	0.0	0.0	0.0	1.01	40.1	14.5
S10.002	50.00	6.91	71.187	0.609	0.0	0.0	0.0	1.21	85.9	82.5
S10.003	50.00	7.19	70.934	0.659	0.0	0.0	0.0	1.40	154.8	89.2
S1.018	50.00	10.36	70.791	5.380	0.0	0.0	0.0	4.07	1151.9	728.5
S1.019	50.00	10.38	68.099	5.385	0.0	0.0	0.0	3.85	1089.5	729.2
S1.020	50.00	10.40	67.953	5.385	0.0	0.0	0.0	3.87	1094.0	729.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.021	96.945	3.166	30.6	0.395	0.00	0.0	0.600	o	600
S13.000	63.950	3.100	20.6	0.204	5.00	0.0	0.600	o	225
S13.001	6.513	0.300	21.7	0.005	0.00	0.0	0.600	o	225
S13.002	6.230	0.050	124.6	0.001	0.00	0.0	0.600	o	225
S14.000	54.675	0.500	109.4	0.130	5.00	0.0	0.600	o	225
S14.001	11.285	0.100	112.9	0.045	0.00	0.0	0.600	o	225
S14.002	41.595	0.350	118.8	0.089	0.00	0.0	0.600	o	225
S13.003	68.520	3.050	22.5	0.230	0.00	0.0	0.600	o	225
S13.004	83.280	0.416	200.2	0.093	0.00	0.0	0.600	o	375
S15.000	66.295	3.250	20.4	0.185	5.00	0.0	0.600	o	225
S13.005	76.350	0.382	199.9	0.000	0.00	0.0	0.600	o	375
S1.022	85.715	5.202	16.5	0.000	0.00	0.0	0.600	o	600
S1.023	26.630	0.266	100.1	0.000	0.00	0.0	0.600	o	675
S1.024	25.090	4.234	5.9	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.021	50.00	10.77	67.865	5.780	0.0	0.0	0.0	4.41	1247.3	782.7
S13.000	50.00	5.37	71.000	0.204	0.0	0.0	0.0	2.89	115.1	27.6
S13.001	50.00	5.41	67.900	0.209	0.0	0.0	0.0	2.82	112.2	28.3
S13.002	50.00	5.50	67.600	0.210	0.0	0.0	0.0	1.17	46.5	28.4
S14.000	50.00	5.73	68.500	0.130	0.0	0.0	0.0	1.25	49.7	17.6
S14.001	50.00	5.88	68.000	0.175	0.0	0.0	0.0	1.23	48.9	23.7
S14.002	50.00	6.46	67.900	0.264	0.0	0.0	0.0	1.20	47.6	35.7
S13.003	50.00	6.87	67.550	0.704	0.0	0.0	0.0	2.77	110.2	95.3
S13.004	50.00	7.96	64.500	0.797	0.0	0.0	0.0	1.28	141.0	107.9
S15.000	50.00	5.38	67.750	0.185	0.0	0.0	0.0	2.91	115.7	25.1
S13.005	50.00	8.96	64.084	0.982	0.0	0.0	0.0	1.28	141.1	133.0
S1.022	50.00	11.00	63.702	6.762	0.0	0.0	0.0	6.02	1701.7	915.7
S1.023	50.00	11.17	58.500	6.762	0.0	0.0	0.0	2.62	937.4	915.7
S1.024	50.00	5.06	58.234	0.000	35.3	0.0	0.0	6.50	459.4	35.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN (Pipe Out)	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN (Pipes In)	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SS2.124	85.000	1.500	1050	S1.000	83.500	225				
SS2.125	84.800	1.500	1050	S2.000	83.300	225				
SS2.123	84.650	1.500	1050	S1.001	83.150	225	S1.000	83.150	225	
							S2.000	83.150	225	
SS2.126	84.350	1.500	1050	S3.000	82.850	225				
SS2.122	84.400	1.890	1200	S1.002	82.510	300	S1.001	82.950	225	365
							S3.000	82.510	225	
SS2.121	83.550	1.500	1050	S1.003	82.050	300	S1.002	82.050	300	
SS2.120	83.300	1.500	1050	S1.004	81.800	300	S1.003	81.800	300	
SS2.128	83.350	1.500	1050	S4.000	81.850	225				
SS2.127	82.600	1.500	1050	S4.001	81.100	225	S4.000	81.100	225	
SS2.119	82.750	1.776	1350	S1.005	80.974	375	S1.004	80.974	300	
							S4.001	80.974	225	
SS2.118	82.500	1.649	1350	S1.006	80.851	450	S1.005	80.851	375	
SS2.132	84.700	1.500	1050	S5.000	83.200	225				
SS2.131	84.200	1.500	1050	S5.001	82.700	225	S5.000	82.700	225	
SS2.130	84.100	1.500	1050	S5.002	82.600	225	S5.001	82.600	225	
SS2.129	82.600	1.500	1050	S5.003	81.100	300	S5.002	81.100	225	
SS2.117	82.200	1.649	1350	S1.007	80.551	450	S1.006	80.551	450	
							S5.003	80.551	300	
SS2.116	82.000	1.513	1350	S1.008	80.487	450	S1.007	80.487	450	
SS2.115	81.800	1.514	1350	S1.009	80.286	450	S1.008	80.286	450	
SS2.135	82.300	1.500	1050	S6.000	80.800	225				
SS2.134	82.100	1.550	1050	S6.001	80.550	225	S6.000	80.550	225	
SS2.133	82.050	1.521	1050	S6.002	80.529	225	S6.001	80.529	225	
SS2.114	81.750	1.948	1350	S1.010	79.802	450	S1.009	79.802	450	
							S6.002	80.147	225	120
SS2.113	81.350	1.870	1350	S1.011	79.480	450	S1.010	79.480	450	
SS2.137	80.750	1.500	1050	S7.000	79.250	225				
SS2.136	79.250	1.500	1050	S8.000	77.750	225				
SS2.135	79.500	1.793	1050	S7.001	77.707	300	S7.000	77.707	225	
							S8.000	77.707	225	
SS2.112	78.300	1.650	1350	S1.012	76.650	450	S1.011	76.650	450	
							S7.001	76.650	300	
SS2.111A	78.150	1.700	1350	S1.013	76.450	450	S1.012	76.450	450	
SS2.111	78.000	4.523	1500	S1.014	73.477	525	S1.013	76.300	450	2748
SS2.138	79.000	1.500	1050	S9.000	77.500	225				
SS2.110	76.300	3.877	1500	S1.015	72.423	525	S1.014	72.423	525	
							S9.000	74.800	225	2077
SS2.109	75.750	3.591	1500	S1.016	72.159	600	S1.015	72.159	525	
SS2.108	73.250	1.800	1500	S1.017	71.450	600	S1.016	71.450	600	
SS2.143	78.500	1.500	1050	S10.000	77.000	225				
SS2.142	77.400	1.500	1050	S11.000	75.900	225				
SS2.141	76.750	1.748	1200	S10.001	75.002	225	S10.000	75.250	225	248
							S11.000	75.002	225	
SS2.146	73.000	1.500	1050	S12.000	71.500	225				

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS2.145	73.450	2.064	1200	S12.001	71.386	225	S12.000	71.386	225	
SS2.144	73.400	2.062	1200	S12.002	71.338	225	S12.001	71.338	225	
SS2.140	73.300	2.113	1200	S10.002	71.187	300	S10.001	71.750	225	488
							S12.002	71.187	225	
SS2.139	73.050	2.116	1350	S10.003	70.934	375	S10.002	70.934	300	
SS2.107	73.000	2.209	1500	S1.018	70.791	600	S1.017	71.200	600	409
							S10.003	70.791	375	
SS2.106	69.900	1.801	1500	S1.019	68.099	600	S1.018	68.099	600	
SS2.105	69.850	1.897	1500	S1.020	67.953	600	S1.019	67.953	600	
SS2.104	69.400	1.535	1500	S1.021	67.865	600	S1.020	67.865	600	
SS2.152	72.500	1.500	1050	S13.000	71.000	225				
SS2.151	69.400	1.500	1050	S13.001	67.900	225	S13.000	67.900	225	
SS2.150	69.100	1.500	1050	S13.002	67.600	225	S13.001	67.600	225	
SS2.155	70.000	1.500	1050	S14.000	68.500	225				
SS2.154	69.500	1.500	1050	S14.001	68.000	225	S14.000	68.000	225	
SS2.153	69.400	1.500	1050	S14.002	67.900	225	S14.001	67.900	225	
SS2.149	69.050	1.500	1050	S13.003	67.550	225	S13.002	67.550	225	
							S14.002	67.550	225	
SS2.148	66.000	1.500	1350	S13.004	64.500	375	S13.003	64.500	225	
SS2.156	69.250	1.500	1050	S15.000	67.750	225				
SS2.147	66.000	1.916	1350	S13.005	64.084	375	S13.004	64.084	375	
							S15.000	64.500	225	266
SS2.103	66.500	2.798	1500	S1.022	63.702	600	S1.021	64.699	600	997
							S13.005	63.702	375	
SS2.102	60.000	1.500	1500	S1.023	58.500	675	S1.022	58.500	600	
SS2.101	59.500	1.266	1500	S1.024	58.234	300	S1.023	58.234	675	
SS2.100	55.000	1.000	0		OUTFALL		S1.024	54.000	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS2.124	85.000	83.500	1.275	1050
S2.000	o	225	SS2.125	84.800	83.300	1.275	1050
S1.001	o	225	SS2.123	84.650	83.150	1.275	1050
S3.000	o	225	SS2.126	84.350	82.850	1.275	1050
S1.002	o	300	SS2.122	84.400	82.510	1.590	1200
S1.003	o	300	SS2.121	83.550	82.050	1.200	1050
S1.004	o	300	SS2.120	83.300	81.800	1.200	1050
S4.000	o	225	SS2.128	83.350	81.850	1.275	1050
S4.001	o	225	SS2.127	82.600	81.100	1.275	1050
S1.005	o	375	SS2.119	82.750	80.974	1.401	1350
S1.006	o	450	SS2.118	82.500	80.851	1.199	1350
S5.000	o	225	SS2.132	84.700	83.200	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	69.590	198.8	SS2.123	84.650	83.150	1.275	1050
S2.000	26.185	174.6	SS2.123	84.650	83.150	1.275	1050
S1.001	13.900	69.5	SS2.122	84.400	82.950	1.225	1200
S3.000	56.765	167.0	SS2.122	84.400	82.510	1.665	1200
S1.002	62.105	135.0	SS2.121	83.550	82.050	1.200	1050
S1.003	8.034	32.1	SS2.120	83.300	81.800	1.200	1050
S1.004	19.490	23.6	SS2.119	82.750	80.974	1.476	1350
S4.000	46.320	61.8	SS2.127	82.600	81.100	1.275	1050
S4.001	21.120	167.6	SS2.119	82.750	80.974	1.551	1350
S1.005	20.480	166.5	SS2.118	82.500	80.851	1.274	1350
S1.006	50.120	167.1	SS2.117	82.200	80.551	1.199	1350
S5.000	49.250	98.5	SS2.131	84.200	82.700	1.275	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.001	o	225	SS2.131	84.200	82.700	1.275	1050
S5.002	o	225	SS2.130	84.100	82.600	1.275	1050
S5.003	o	300	SS2.129	82.600	81.100	1.200	1050
S1.007	o	450	SS2.117	82.200	80.551	1.199	1350
S1.008	o	450	SS2.116	82.000	80.487	1.063	1350
S1.009	o	450	SS2.115	81.800	80.286	1.064	1350
S6.000	o	225	SS2.135	82.300	80.800	1.275	1050
S6.001	o	225	SS2.134	82.100	80.550	1.325	1050
S6.002	o	225	SS2.133	82.050	80.529	1.296	1050
S1.010	o	450	SS2.114	81.750	79.802	1.498	1350
S1.011	o	450	SS2.113	81.350	79.480	1.420	1350
S7.000	o	225	SS2.137	80.750	79.250	1.275	1050
S8.000	o	225	SS2.136	79.250	77.750	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.001	6.315	63.2	SS2.130	84.100	82.600	1.275	1050
S5.002	74.945	50.0	SS2.129	82.600	81.100	1.275	1050
S5.003	86.440	157.4	SS2.117	82.200	80.551	1.349	1350
S1.007	10.750	168.0	SS2.116	82.000	80.487	1.063	1350
S1.008	7.405	36.8	SS2.115	81.800	80.286	1.064	1350
S1.009	48.415	100.0	SS2.114	81.750	79.802	1.498	1350
S6.000	41.695	166.8	SS2.134	82.100	80.550	1.325	1050
S6.001	3.440	163.8	SS2.133	82.050	80.529	1.296	1050
S6.002	63.845	167.1	SS2.114	81.750	80.147	1.378	1350
S1.010	32.155	99.9	SS2.113	81.350	79.480	1.420	1350
S1.011	65.870	23.3	SS2.112	78.300	76.650	1.200	1350
S7.000	38.995	25.3	SS2.135	79.500	77.707	1.568	1050
S8.000	7.155	166.4	SS2.135	79.500	77.707	1.568	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S7.001	o	300	SS2.135	79.500	77.707	1.493	1050
S1.012	o	450	SS2.112	78.300	76.650	1.200	1350
S1.013	o	450	SS2.111A	78.150	76.450	1.250	1350
S1.014	o	525	SS2.111	78.000	73.477	3.998	1500
S9.000	o	225	SS2.138	79.000	77.500	1.275	1050
S1.015	o	525	SS2.110	76.300	72.423	3.352	1500
S1.016	o	600	SS2.109	75.750	72.159	2.991	1500
S1.017	o	600	SS2.108	73.250	71.450	1.200	1500
S10.000	o	225	SS2.143	78.500	77.000	1.275	1050
S11.000	o	225	SS2.142	77.400	75.900	1.275	1050
S10.001	o	225	SS2.141	76.750	75.002	1.523	1200
S12.000	o	225	SS2.146	73.000	71.500	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S7.001	71.700	67.8	SS2.112	78.300	76.650	1.350	1350
S1.012	5.450	27.3	SS2.111A	78.150	76.450	1.250	1350
S1.013	5.450	36.3	SS2.111	78.000	76.300	1.250	1500
S1.014	52.685	50.0	SS2.110	76.300	72.423	3.352	1500
S9.000	68.925	25.5	SS2.110	76.300	74.800	1.275	1500
S1.015	13.200	50.0	SS2.109	75.750	72.159	3.066	1500
S1.016	59.880	84.5	SS2.108	73.250	71.450	1.200	1500
S1.017	7.300	29.2	SS2.107	73.000	71.200	1.200	1500
S10.000	38.590	22.1	SS2.141	76.750	75.250	1.275	1200
S11.000	89.845	100.1	SS2.141	76.750	75.002	1.523	1200
S10.001	40.825	12.6	SS2.140	73.300	71.750	1.325	1200
S12.000	18.955	166.3	SS2.145	73.450	71.386	1.839	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S12.001	o	225	SS2.145	73.450	71.386	1.839	1200
S12.002	o	225	SS2.144	73.400	71.338	1.837	1200
S10.002	o	300	SS2.140	73.300	71.187	1.813	1200
S10.003	o	375	SS2.139	73.050	70.934	1.741	1350
S1.018	o	600	SS2.107	73.000	70.791	1.609	1500
S1.019	o	600	SS2.106	69.900	68.099	1.201	1500
S1.020	o	600	SS2.105	69.850	67.953	1.297	1500
S1.021	o	600	SS2.104	69.400	67.865	0.935	1500
S13.000	o	225	SS2.152	72.500	71.000	1.275	1050
S13.001	o	225	SS2.151	69.400	67.900	1.275	1050
S13.002	o	225	SS2.150	69.100	67.600	1.275	1050
S14.000	o	225	SS2.155	70.000	68.500	1.275	1050
S14.001	o	225	SS2.154	69.500	68.000	1.275	1050
S14.002	o	225	SS2.153	69.400	67.900	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S12.001	8.030	167.3	SS2.144	73.400	71.338	1.837	1200
S12.002	25.270	167.4	SS2.140	73.300	71.187	1.888	1200
S10.002	42.189	166.8	SS2.139	73.050	70.934	1.816	1350
S10.003	23.800	166.4	SS2.107	73.000	70.791	1.834	1500
S1.018	96.615	35.9	SS2.106	69.900	68.099	1.201	1500
S1.019	5.855	40.1	SS2.105	69.850	67.953	1.297	1500
S1.020	3.500	39.8	SS2.104	69.400	67.865	0.935	1500
S1.021	96.945	30.6	SS2.103	66.500	64.699	1.201	1500
S13.000	63.950	20.6	SS2.151	69.400	67.900	1.275	1050
S13.001	6.513	21.7	SS2.150	69.100	67.600	1.275	1050
S13.002	6.230	124.6	SS2.149	69.050	67.550	1.275	1050
S14.000	54.675	109.4	SS2.154	69.500	68.000	1.275	1050
S14.001	11.285	112.9	SS2.153	69.400	67.900	1.275	1050
S14.002	41.595	118.8	SS2.149	69.050	67.550	1.275	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S13.003	o	225	SS2.149	69.050	67.550	1.275	1050
S13.004	o	375	SS2.148	66.000	64.500	1.125	1350
S15.000	o	225	SS2.156	69.250	67.750	1.275	1050
S13.005	o	375	SS2.147	66.000	64.084	1.541	1350
S1.022	o	600	SS2.103	66.500	63.702	2.198	1500
S1.023	o	675	SS2.102	60.000	58.500	0.825	1500
S1.024	o	300	SS2.101	59.500	58.234	0.966	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S13.003	68.520	22.5	SS2.148	66.000	64.500	1.275	1350
S13.004	83.280	200.2	SS2.147	66.000	64.084	1.541	1350
S15.000	66.295	20.4	SS2.147	66.000	64.500	1.275	1350
S13.005	76.350	199.9	SS2.103	66.500	63.702	2.423	1500
S1.022	85.715	16.5	SS2.102	60.000	58.500	0.900	1500
S1.023	26.630	100.1	SS2.101	59.500	58.234	0.591	1500
S1.024	25.090	5.9	SS2.100	55.000	54.000	0.700	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.024	SS2.100	55.000	54.000	54.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS2.101, DS/PN: S1.024, Volume (m³): 11.2

Design Head (m)	1.000	Diameter (mm)	237
Design Flow (l/s)	35.3	Invert Level (m)	58.234
Hydro-Brake® Type	Md5 SW Only		

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	8.5	1.200	37.7	3.000	58.6	7.000	89.4
0.200	20.9	1.400	40.3	3.500	63.2	7.500	92.6
0.300	29.8	1.600	42.9	4.000	67.6	8.000	95.6
0.400	33.4	1.800	45.4	4.500	71.7	8.500	98.6
0.500	34.3	2.000	47.8	5.000	75.6	9.000	101.4
0.600	34.1	2.200	50.1	5.500	79.3	9.500	104.2
0.800	34.0	2.400	52.4	6.000	82.8		
1.000	35.4	2.600	54.5	6.500	86.2		

Storage Structures for Storm

Tank or Pond Manhole: SS2.101, DS/PN: S1.024

Invert Level (m) 58.234

Depth (m)	**Area (m^2)**	**Depth (m)**	**Area (m^2)**
0.000	2655.0	1.000	2655.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	2	0%					
S2.000	15 Winter	2	0%					
S1.001	15 Winter	2	0%					
S3.000	15 Winter	2	0%					
S1.002	15 Winter	2	0%					
S1.003	15 Winter	2	0%					
S1.004	15 Winter	2	0%					
S4.000	15 Winter	2	0%					
S4.001	15 Winter	2	0%					
S1.005	15 Winter	2	0%					
S1.006	15 Winter	2	0%					
S5.000	15 Winter	2	0%					
S5.001	15 Winter	2	0%					
S5.002	15 Winter	2	0%					
S5.003	15 Winter	2	0%					
S1.007	15 Winter	2	0%					
S1.008	15 Winter	2	0%					
S1.009	15 Winter	2	0%					
S6.000	15 Winter	2	0%					
S6.001	15 Winter	2	0%					
S6.002	15 Winter	2	0%					
S1.010	15 Winter	2	0%					
S1.011	15 Winter	2	0%					
S7.000	15 Winter	2	0%					
S8.000	15 Winter	2	0%					
S7.001	15 Winter	2	0%					
S1.012	15 Winter	2	0%					
S1.013	15 Winter	2	0%	2/15 Winter				
S1.014	15 Winter	2	0%					
S9.000	15 Winter	2	0%					
S1.015	15 Winter	2	0%	2/15 Summer				
S1.016	15 Winter	2	0%					
S1.017	15 Winter	2	0%					
S10.000	15 Winter	2	0%					
S11.000	15 Winter	2	0%					
S10.001	15 Winter	2	0%					
S12.000	15 Winter	2	0%					
S12.001	15 Winter	2	0%					

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S12.002	15 Winter	2	0%					
S10.002	15 Winter	2	0%					
S10.003	15 Winter	2	0%					
S1.018	15 Winter	2	0%					
S1.019	15 Winter	2	0%	2/15 Summer				
S1.020	15 Winter	2	0%	2/15 Summer				
S1.021	15 Winter	2	0%					
S13.000	15 Winter	2	0%					
S13.001	15 Winter	2	0%					
S13.002	15 Winter	2	0%					
S14.000	15 Winter	2	0%					
S14.001	15 Winter	2	0%					
S14.002	15 Winter	2	0%					
S13.003	15 Winter	2	0%					
S13.004	15 Winter	2	0%					
S15.000	15 Winter	2	0%					
S13.005	15 Winter	2	0%					
S1.022	15 Winter	2	0%					
S1.023	15 Winter	2	0%	2/15 Winter				
S1.024	960 Winter	2	0%	2/60 Winter				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS2.124	83.660	-0.065	0.000	0.78	0.0	27.8	OK
S2.000	SS2.125	83.390	-0.135	0.000	0.33	0.0	11.8	OK
S1.001	SS2.123	83.304	-0.071	0.000	0.80	0.0	43.4	OK
S3.000	SS2.126	82.920	-0.155	0.000	0.20	0.0	7.8	OK
S1.002	SS2.122	82.727	-0.083	0.000	0.84	0.0	76.8	OK
S1.003	SS2.121	82.224	-0.126	0.000	0.63	0.0	78.5	OK
S1.004	SS2.120	81.936	-0.164	0.000	0.42	0.0	83.8	OK
S4.000	SS2.128	81.901	-0.174	0.000	0.11	0.0	7.1	OK
S4.001	SS2.127	81.231	-0.095	0.000	0.24	0.0	8.7	OK
S1.005	SS2.119	81.214	-0.135	0.000	0.73	0.0	95.0	OK
S1.006	SS2.118	81.071	-0.230	0.000	0.47	0.0	107.8	OK
S5.000	SS2.132	83.300	-0.125	0.000	0.40	0.0	19.8	OK
S5.001	SS2.131	82.806	-0.119	0.000	0.45	0.0	20.0	OK
S5.002	SS2.130	82.705	-0.120	0.000	0.43	0.0	31.0	OK
S5.003	SS2.129	81.285	-0.115	0.000	0.66	0.0	56.1	OK
S1.007	SS2.117	80.899	-0.102	0.000	0.95	0.0	160.9	OK
S1.008	SS2.116	80.749	-0.188	0.000	0.64	0.0	161.4	OK
S1.009	SS2.115	80.531	-0.205	0.000	0.57	0.0	166.6	OK
S6.000	SS2.135	80.901	-0.124	0.000	0.40	0.0	15.4	OK
S6.001	SS2.134	80.691	-0.084	0.000	0.59	0.0	15.8	OK
S6.002	SS2.133	80.682	-0.072	0.000	0.79	0.0	30.7	OK
S1.010	SS2.114	80.083	-0.169	0.000	0.71	0.0	198.6	OK
S1.011	SS2.113	79.661	-0.269	0.000	0.34	0.0	211.1	OK
S7.000	SS2.137	79.310	-0.165	0.000	0.16	0.0	15.6	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S8.000	SS2.136	77.838	-0.137	0.000	0.25	0.0	7.4	OK
S7.001	SS2.135	77.823	-0.184	0.000	0.31	0.0	40.4	OK
S1.012	SS2.112	77.084	-0.016	0.000	0.94	0.0	236.2	OK
S1.013	SS2.111A	76.906	0.006	0.000	1.09	0.0	237.0	SURCHARGED
S1.014	SS2.111	73.824	-0.178	0.000	0.76	0.0	468.4	OK
S9.000	SS2.138	77.576	-0.149	0.000	0.24	0.0	24.4	OK
S1.015	SS2.110	73.056	0.108	0.000	1.23	0.0	485.8	SURCHARGED
S1.016	SS2.109	72.549	-0.210	0.000	0.75	0.0	499.2	OK
S1.017	SS2.108	71.930	-0.120	0.000	1.00	0.0	500.3	OK
S10.000	SS2.143	77.055	-0.170	0.000	0.14	0.0	14.3	OK
S11.000	SS2.142	76.034	-0.091	0.000	0.62	0.0	31.4	OK
S10.001	SS2.141	75.100	-0.127	0.000	0.39	0.0	54.9	OK
S12.000	SS2.146	71.567	-0.158	0.000	0.19	0.0	6.8	OK
S12.001	SS2.145	71.483	-0.128	0.000	0.23	0.0	7.1	OK
S12.002	SS2.144	71.474	-0.089	0.000	0.38	0.0	14.0	OK
S10.002	SS2.140	71.444	-0.043	0.000	1.00	0.0	79.8	OK
S10.003	SS2.139	71.163	-0.146	0.000	0.63	0.0	83.6	OK
S1.018	SS2.107	71.105	-0.286	0.000	0.54	0.0	575.6	OK
S1.019	SS2.106	69.094	0.395	0.000	1.50	0.0	572.9	SURCHARGED
S1.020	SS2.105	68.764	0.211	0.000	1.65	0.0	573.5	SURCHARGED
S1.021	SS2.104	68.173	-0.292	0.000	0.52	0.0	601.4	OK
S13.000	SS2.152	71.081	-0.144	0.000	0.27	0.0	30.1	OK
S13.001	SS2.151	68.000	-0.125	0.000	0.40	0.0	30.9	OK
S13.002	SS2.150	67.781	-0.044	0.000	0.99	0.0	31.3	OK
S14.000	SS2.155	68.601	-0.124	0.000	0.40	0.0	19.0	OK
S14.001	SS2.154	68.125	-0.100	0.000	0.60	0.0	24.7	OK
S14.002	SS2.153	68.051	-0.074	0.000	0.77	0.0	35.1	OK
S13.003	SS2.149	67.715	-0.060	0.000	0.87	0.0	93.0	OK
S13.004	SS2.148	64.751	-0.124	0.000	0.74	0.0	99.9	OK
S15.000	SS2.156	67.826	-0.149	0.000	0.24	0.0	27.4	OK
S13.005	SS2.147	64.364	-0.095	0.000	0.87	0.0	117.1	OK
S1.022	SS2.103	63.985	-0.317	0.000	0.45	0.0	711.8	OK
S1.023	SS2.102	59.187	0.012	0.000	1.09	0.0	710.7	SURCHARGED
S1.024	SS2.101	58.816	0.282	0.000	0.08	0.0	34.3	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.174	4-8	0.375	8-12	0.021

Total Area Contributing (ha) = 0.570

Total Pipe Volume (m³) = 25.046

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	56.660	2.000	28.3	0.075	5.00	0.0	0.600	o	225
S1.001	37.400	1.000	37.4	0.075	0.00	0.0	0.600	o	225
S1.002	77.280	0.258	300.0	0.050	0.00	0.0	0.600	o	300
S2.000	84.575	0.750	112.8	0.120	5.00	0.0	0.600	o	225
S2.001	41.415	2.500	16.6	0.100	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.38	66.000	0.075	0.0	0.0	0.0	2.47	98.1	10.2
S1.001	50.00	5.67	64.000	0.150	0.0	0.0	0.0	2.15	85.3	20.3
S1.002	50.00	7.10	63.000	0.200	0.0	0.0	0.0	0.90	63.8	27.1
S2.000	50.00	6.15	67.250	0.120	0.0	0.0	0.0	1.23	48.9	16.2
S2.001	50.00	6.36	66.500	0.220	0.0	0.0	0.0	3.23	128.5	29.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.003	90.650	0.302	300.0	0.050	0.00	0.0	0.600	o	300
S3.000	64.500	2.250	28.7	0.100	5.00	0.0	0.600	o	225
S1.004	9.645	0.032	301.4	0.000	0.00	0.0	0.600	o	375
S1.005	3.000	0.010	300.0	0.000	0.00	0.0	0.600	o	375
S1.006	6.575	1.000	6.6	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.003	50.00	8.77	62.742	0.470	0.0	0.0	0.0	0.90	63.8	63.6
S3.000	50.00	5.44	67.750	0.100	0.0	0.0	0.0	2.45	97.5	13.5
S1.004	50.00	8.93	62.440	0.570	0.0	0.0	0.0	1.04	114.7	77.2
S1.005	50.00	8.98	62.408	0.570	0.0	0.0	0.0	1.04	115.0	77.2
S1.006	50.00	5.02	62.398	0.000	5.7	0.0	0.0	6.17	436.1	5.7

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS2.208	67.500	1.500	1050	S1.000	66.000	225				
SS2.207	65.500	1.500	1050	S1.001	64.000	225	S1.000	64.000	225	
SS2.206	64.500	1.500	1050	S1.002	63.000	300	S1.001	63.000	225	
SS2.210	68.750	1.500	1050	S2.000	67.250	225				
SS2.209	68.000	1.500	1050	S2.001	66.500	225	S2.000	66.500	225	
SS2.205	65.500	2.758	1200	S1.003	62.742	300	S1.002	62.742	300	
							S2.001	64.000	225	1183
SS2.204	69.250	1.500	1050	S3.000	67.750	225				
SS2.203	67.000	4.560	1350	S1.004	62.440	375	S1.003	62.440	300	
							S3.000	65.500	225	2910
SS2.202	65.500	3.092	1350	S1.005	62.408	375	S1.004	62.408	375	
SS2.201	64.000	1.602	1350	S1.006	62.398	300	S1.005	62.398	375	
SS2.200	62.760	1.362	0		OUTFALL		S1.006	61.398	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS2.208	67.500	66.000	1.275	1050
S1.001	o	225	SS2.207	65.500	64.000	1.275	1050
S1.002	o	300	SS2.206	64.500	63.000	1.200	1050
S2.000	o	225	SS2.210	68.750	67.250	1.275	1050
S2.001	o	225	SS2.209	68.000	66.500	1.275	1050
S1.003	o	300	SS2.205	65.500	62.742	2.458	1200
S3.000	o	225	SS2.204	69.250	67.750	1.275	1050
S1.004	o	375	SS2.203	67.000	62.440	4.185	1350
S1.005	o	375	SS2.202	65.500	62.408	2.717	1350
S1.006	o	300	SS2.201	64.000	62.398	1.302	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	56.660	28.3	SS2.207	65.500	64.000	1.275	1050
S1.001	37.400	37.4	SS2.206	64.500	63.000	1.275	1050
S1.002	77.280	300.0	SS2.205	65.500	62.742	2.458	1200
S2.000	84.575	112.8	SS2.209	68.000	66.500	1.275	1050
S2.001	41.415	16.6	SS2.205	65.500	64.000	1.275	1200
S1.003	90.650	300.0	SS2.203	67.000	62.440	4.260	1350
S3.000	64.500	28.7	SS2.203	67.000	65.500	1.275	1350
S1.004	9.645	301.4	SS2.202	65.500	62.408	2.717	1350
S1.005	3.000	300.0	SS2.201	64.000	62.398	1.227	1350
S1.006	6.575	6.6	SS2.200	62.760	61.398	1.062	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SS2.200	62.760	61.398	61.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS2.201, DS/PN: S1.006, Volume (m³): 2.5

Design Head (m)	0.500	Diameter (mm)	113
Design Flow (l/s)	5.7	Invert Level (m)	62.398
Hydro-Brake® Type	Md5 SW Only		

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	3.5	1.200	8.4	3.000	13.3	7.000	20.3
0.200	5.3	1.400	9.1	3.500	14.4	7.500	21.0
0.300	5.3	1.600	9.7	4.000	15.4	8.000	21.7
0.400	5.4	1.800	10.3	4.500	16.3	8.500	22.4
0.500	5.6	2.000	10.9	5.000	17.2	9.000	23.1
0.600	6.0	2.200	11.4	5.500	18.0	9.500	23.7
0.800	6.9	2.400	11.9	6.000	18.8		
1.000	7.7	2.600	12.4	6.500	19.6		

Storage Structures for Storm

Tank or Pond Manhole: SS2.201, DS/PN: S1.006

Invert Level (m) 62.398

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	696.0	0.500	696.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	2	0%					
S1.001	15 Winter	2	0%					
S1.002	15 Winter	2	0%					
S2.000	15 Winter	2	0%					
S2.001	15 Winter	2	0%					
S1.003	15 Winter	2	0%					
S3.000	15 Winter	2	0%					
S1.004	15 Winter	2	0%					
S1.005	15 Winter	2	0%					
S1.006	480 Winter	2	0%					

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS2.208	66.052	-0.173	0.000	0.12	0.0	11.1	OK
S1.001	SS2.207	64.078	-0.147	0.000	0.26	0.0	20.6	OK
S1.002	SS2.206	63.140	-0.160	0.000	0.41	0.0	25.0	OK
S2.000	SS2.210	67.346	-0.129	0.000	0.36	0.0	17.0	OK
S2.001	SS2.209	66.575	-0.150	0.000	0.24	0.0	29.4	OK
S1.003	SS2.205	62.972	-0.070	0.000	0.88	0.0	54.0	OK
S3.000	SS2.204	67.810	-0.165	0.000	0.16	0.0	14.8	OK
S1.004	SS2.203	62.684	-0.132	0.000	0.75	0.0	62.4	OK
S1.005	SS2.202	62.652	-0.131	0.000	0.75	0.0	62.5	OK
S1.006	SS2.201	62.552	-0.146	0.000	0.02	0.0	4.9	OK

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.179	4-8	0.171

Total Area Contributing (ha) = 0.350

Total Pipe Volume (m³) = 13.658

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	65.550	0.525	124.9	0.100	5.00	0.0	0.600	o	225
S2.000	20.950	0.125	167.6	0.050	5.00	0.0	0.600	o	225
S1.001	29.075	0.174	167.1	0.075	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.93	62.150	0.100	0.0	0.0	0.0	1.17	46.5	13.5
S2.000	50.00	5.35	61.750	0.050	0.0	0.0	0.0	1.01	40.0	6.8
S1.001	50.00	6.42	61.625	0.225	0.0	0.0	0.0	1.01	40.1	30.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	39.745	1.300	30.6	0.075	5.00	0.0	0.600	o	225
S1.002	19.050	0.451	42.2	0.000	0.00	0.0	0.600	o	225
S1.003	39.820	0.199	200.0	0.000	0.00	0.0	0.600	o	300
S4.000	24.345	1.000	24.3	0.050	5.00	0.0	0.600	o	225
S1.004	15.620	1.302	12.0	0.000	0.00	0.0	0.600	o	300
S1.005	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300
S1.006	37.350	5.883	6.3	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.28	62.800	0.075	0.0	0.0	0.0	2.37	94.4	10.2
S1.002	50.00	6.57	61.451	0.300	0.0	0.0	0.0	2.02	80.3	40.6
S1.003	50.00	7.17	61.000	0.300	0.0	0.0	0.0	1.11	78.3	40.6
S4.000	50.00	5.15	62.500	0.050	0.0	0.0	0.0	2.66	105.9	6.8
S1.004	50.00	7.23	59.402	0.350	0.0	0.0	0.0	4.56	322.6	47.4
S1.005	50.00	7.28	58.100	0.350	0.0	0.0	0.0	1.57	111.1	47.4
S1.006	50.00	5.12	58.050	0.000	3.5	0.0	0.0	5.23	207.8	3.5

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS3.110	63.650	1.500	1050	S1.000	62.150	225				
SS3.109	63.250	1.500	1050	S2.000	61.750	225				
SS3.108	63.800	2.175	1200	S1.001	61.625	225	S1.000	61.625	225	
							S2.000	61.625	225	
SS3.107	64.300	1.500	1050	S3.000	62.800	225				
SS3.106	63.000	1.549	1050	S1.002	61.451	225	S1.001	61.451	225	
							S3.000	61.500	225	49
SS3.105	62.500	1.500	1050	S1.003	61.000	300	S1.002	61.000	225	
SS3.104	64.000	1.500	1050	S4.000	62.500	225				
SS3.103	63.000	3.598	1200	S1.004	59.402	300	S1.003	60.801	300	1399
							S4.000	61.500	225	2023
SS3.102	59.500	1.400	1050	S1.005	58.100	300	S1.004	58.100	300	
SS3.101	59.000	0.950	1050	S1.006	58.050	225	S1.005	58.050	300	
SS3.100	54.500	2.333	0		OUTFALL		S1.006	52.167	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS3.110	63.650	62.150	1.275	1050
S2.000	o	225	SS3.109	63.250	61.750	1.275	1050
S1.001	o	225	SS3.108	63.800	61.625	1.950	1200
S3.000	o	225	SS3.107	64.300	62.800	1.275	1050
S1.002	o	225	SS3.106	63.000	61.451	1.324	1050
S1.003	o	300	SS3.105	62.500	61.000	1.200	1050
S4.000	o	225	SS3.104	64.000	62.500	1.275	1050
S1.004	o	300	SS3.103	63.000	59.402	3.298	1200
S1.005	o	300	SS3.102	59.500	58.100	1.100	1050
S1.006	o	225	SS3.101	59.000	58.050	0.725	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	65.550	124.9	SS3.108	63.800	61.625	1.950	1200
S2.000	20.950	167.6	SS3.108	63.800	61.625	1.950	1200
S1.001	29.075	167.1	SS3.106	63.000	61.451	1.324	1050
S3.000	39.745	30.6	SS3.106	63.000	61.500	1.275	1050
S1.002	19.050	42.2	SS3.105	62.500	61.000	1.275	1050
S1.003	39.820	200.0	SS3.103	63.000	60.801	1.899	1200
S4.000	24.345	24.3	SS3.103	63.000	61.500	1.275	1200
S1.004	15.620	12.0	SS3.102	59.500	58.100	1.100	1050
S1.005	5.000	100.0	SS3.101	59.000	58.050	0.650	1050
S1.006	37.350	6.3	SS3.100	54.500	52.167	2.108	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SS3.100	54.500	52.167	52.167	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS3.101, DS/PN: S1.006, Volume (m³): 1.1

Design Head (m) 0.600 Hydro-Brake® Type Md4 Invert Level (m) 58.050
Design Flow (l/s) 3.5 Diameter (mm) 77

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	5.1	3.000	8.0	7.000	12.2
0.200	3.1	1.400	5.5	3.500	8.6	7.500	12.7
0.300	2.7	1.600	5.8	4.000	9.2	8.000	13.1
0.400	2.9	1.800	6.2	4.500	9.8	8.500	13.5
0.500	3.3	2.000	6.5	5.000	10.3	9.000	13.9
0.600	3.6	2.200	6.9	5.500	10.8	9.500	14.2
0.800	4.1	2.400	7.2	6.000	11.3		
1.000	4.6	2.600	7.4	6.500	11.8		

Storage Structures for Storm

Tank or Pond Manhole: SS3.101, DS/PN: S1.006

Invert Level (m) 58.050

Depth (m)	Area (m^2)	Depth (m)	Area (m^2)
0.000	195.0	0.600	195.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 2
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	2	0%					
S2.000	15 Winter	2	0%					
S1.001	15 Winter	2	0%					
S3.000	15 Winter	2	0%					
S1.002	15 Winter	2	0%					
S1.003	15 Winter	2	0%					
S4.000	15 Winter	2	0%					
S1.004	15 Winter	2	0%					
S1.005	480 Winter	2	0%					
S1.006	480 Winter	2	0%	2/120 Winter				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS3.110	62.240	-0.135	0.000	0.32	0.0	14.4	OK
S2.000	SS3.109	61.821	-0.154	0.000	0.20	0.0	7.3	OK
S1.001	SS3.108	61.781	-0.069	0.000	0.81	0.0	30.4	OK
S3.000	SS3.107	62.853	-0.172	0.000	0.12	0.0	11.2	OK
S1.002	SS3.106	61.573	-0.103	0.000	0.56	0.0	40.6	OK
S1.003	SS3.105	61.161	-0.139	0.000	0.56	0.0	40.7	OK
S4.000	SS3.104	62.542	-0.183	0.000	0.08	0.0	7.5	OK
S1.004	SS3.103	59.486	-0.216	0.000	0.17	0.0	46.8	OK
S1.005	SS3.102	58.342	-0.058	0.000	0.15	0.0	9.1	OK
S1.006	SS3.101	58.341	0.066	0.000	0.02	0.0	3.3	SURCHARGED

Appendix E – 1 in 100 Year Design Sheets

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	2.181	4-8	4.090	8-12	0.490

Total Area Contributing (ha) = 6.762

Total Pipe Volume (m^3) = 249.959

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	69.590	0.350	198.8	0.200	5.00	0.0	0.600	o	225
S2.000	26.185	0.150	174.6	0.080	5.00	0.0	0.600	o	225
S1.001	13.900	0.200	69.5	0.035	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	6.26	83.500	0.200	0.0	0.0	0.0	0.92	36.7	27.1
S2.000	50.00	5.44	83.300	0.080	0.0	0.0	0.0	0.99	39.2	10.8
S1.001	50.00	6.40	83.150	0.315	0.0	0.0	0.0	1.57	62.5	42.7

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	56.765	0.340	167.0	0.054	5.00	0.0	0.600	o	225
S1.002	62.105	0.460	135.0	0.229	0.00	0.0	0.600	o	300
S1.003	8.034	0.250	32.1	0.020	0.00	0.0	0.600	o	300
S1.004	19.490	0.826	23.6	0.049	0.00	0.0	0.600	o	300
S4.000	46.320	0.750	61.8	0.048	5.00	0.0	0.600	o	225
S4.001	21.120	0.126	167.6	0.019	0.00	0.0	0.600	o	225
S1.005	20.480	0.123	166.5	0.025	0.00	0.0	0.600	o	375
S1.006	50.120	0.300	167.1	0.130	0.00	0.0	0.600	o	450
S5.000	49.250	0.500	98.5	0.135	5.00	0.0	0.600	o	225
S5.001	6.315	0.100	63.2	0.001	0.00	0.0	0.600	o	225
S5.002	74.945	1.500	50.0	0.095	0.00	0.0	0.600	o	225
S5.003	86.440	0.549	157.4	0.226	0.00	0.0	0.600	o	300
S1.007	10.750	0.064	168.0	0.005	0.00	0.0	0.600	o	450
S1.008	7.405	0.201	36.8	0.005	0.00	0.0	0.600	o	450
S1.009	48.415	0.484	100.0	0.079	0.00	0.0	0.600	o	450

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.94	82.850	0.054	0.0	0.0	0.0	1.01	40.1	7.3
S1.002	50.00	7.17	82.510	0.598	0.0	0.0	0.0	1.35	95.5	81.0
S1.003	50.00	7.22	82.050	0.618	0.0	0.0	0.0	2.78	196.7	83.7
S1.004	50.00	7.32	81.800	0.667	0.0	0.0	0.0	3.25	229.8	90.3
S4.000	50.00	5.46	81.850	0.048	0.0	0.0	0.0	1.67	66.3	6.5
S4.001	50.00	5.81	81.100	0.067	0.0	0.0	0.0	1.01	40.0	9.1
S1.005	50.00	7.56	80.974	0.759	0.0	0.0	0.0	1.40	154.8	102.8
S1.006	50.00	8.09	80.851	0.889	0.0	0.0	0.0	1.57	249.7	120.4
S5.000	50.00	5.62	83.200	0.135	0.0	0.0	0.0	1.32	52.4	18.3
S5.001	50.00	5.69	82.700	0.136	0.0	0.0	0.0	1.65	65.5	18.4
S5.002	50.00	6.36	82.600	0.231	0.0	0.0	0.0	1.85	73.8	31.3
S5.003	50.00	7.51	81.100	0.457	0.0	0.0	0.0	1.25	88.4	61.9
S1.007	50.00	8.21	80.551	1.351	0.0	0.0	0.0	1.57	249.0	182.9
S1.008	50.00	8.24	80.487	1.356	0.0	0.0	0.0	3.36	534.1	183.6
S1.009	50.00	8.64	80.286	1.435	0.0	0.0	0.0	2.03	323.3	194.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S6.000	41.695	0.250	166.8	0.105	5.00	0.0	0.600	o	225
S6.001	3.440	0.021	163.8	0.005	0.00	0.0	0.600	o	225
S6.002	63.845	0.382	167.1	0.121	0.00	0.0	0.600	o	225
S1.010	32.155	0.322	99.9	0.072	0.00	0.0	0.600	o	450
S1.011	65.870	2.830	23.3	0.163	0.00	0.0	0.600	o	450
S7.000	38.995	1.543	25.3	0.104	5.00	0.0	0.600	o	225
S8.000	7.155	0.043	166.4	0.050	5.00	0.0	0.600	o	225
S7.001	71.700	1.057	67.8	0.141	0.00	0.0	0.600	o	300
S1.012	5.450	0.200	27.3	0.001	0.00	0.0	0.600	o	450
S1.013	5.450	0.150	36.3	0.001	0.00	0.0	0.600	o	450
S1.014	52.685	1.054	50.0	2.179	0.00	0.0	0.600	o	525
S9.000	68.925	2.700	25.5	0.165	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S6.000	50.00	5.69	80.800	0.105	0.0	0.0	0.0	1.01	40.1	14.2
S6.001	50.00	5.74	80.550	0.110	0.0	0.0	0.0	1.02	40.5	14.9
S6.002	50.00	6.80	80.529	0.231	0.0	0.0	0.0	1.01	40.1	31.3
S1.010	50.00	8.90	79.802	1.738	0.0	0.0	0.0	2.03	323.6	235.3
S1.011	50.00	9.16	79.480	1.901	0.0	0.0	0.0	4.23	672.4	257.4
S7.000	50.00	5.25	79.250	0.104	0.0	0.0	0.0	2.61	103.9	14.1
S8.000	50.00	5.12	77.750	0.050	0.0	0.0	0.0	1.01	40.2	6.8
S7.001	50.00	5.87	77.707	0.295	0.0	0.0	0.0	1.91	135.1	39.9
S1.012	50.00	9.19	76.650	2.197	0.0	0.0	0.0	3.91	621.3	297.5
S1.013	50.00	9.21	76.450	2.198	0.0	0.0	0.0	3.38	537.8	297.6
S1.014	50.00	9.49	73.477	4.377	0.0	0.0	0.0	3.17	687.0	592.7
S9.000	50.00	5.44	77.500	0.165	0.0	0.0	0.0	2.60	103.4	22.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.015	13.200	0.264	50.0	0.005	0.00	0.0	0.600	o	525
S1.016	59.880	0.709	84.5	0.169	0.00	0.0	0.600	o	600
S1.017	7.300	0.250	29.2	0.000	0.00	0.0	0.600	o	600
S10.000	38.590	1.750	22.1	0.095	5.00	0.0	0.600	o	225
S11.000	89.845	0.898	100.1	0.222	5.00	0.0	0.600	o	225
S10.001	40.825	3.252	12.6	0.078	0.00	0.0	0.600	o	225
S12.000	18.955	0.114	166.3	0.046	5.00	0.0	0.600	o	225
S12.001	8.030	0.048	167.3	0.005	0.00	0.0	0.600	o	225
S12.002	25.270	0.151	167.4	0.056	0.00	0.0	0.600	o	225
S10.002	42.189	0.253	166.8	0.107	0.00	0.0	0.600	o	300
S10.003	23.800	0.143	166.4	0.050	0.00	0.0	0.600	o	375
S1.018	96.615	2.692	35.9	0.005	0.00	0.0	0.600	o	600
S1.019	5.855	0.146	40.1	0.005	0.00	0.0	0.600	o	600
S1.020	3.500	0.088	39.8	0.000	0.00	0.0	0.600	o	600

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.015	50.00	9.56	72.423	4.547	0.0	0.0	0.0	3.17	686.9	615.7
S1.016	50.00	9.94	72.159	4.716	0.0	0.0	0.0	2.65	749.6	638.6
S1.017	50.00	9.96	71.450	4.716	0.0	0.0	0.0	4.52	1277.4	638.6
S10.000	50.00	5.23	77.000	0.095	0.0	0.0	0.0	2.80	111.3	12.9
S11.000	50.00	6.15	75.900	0.222	0.0	0.0	0.0	1.31	52.0	30.1
S10.001	50.00	6.33	75.002	0.395	0.0	0.0	0.0	3.71	147.6	53.5
S12.000	50.00	5.31	71.500	0.046	0.0	0.0	0.0	1.01	40.2	6.2
S12.001	50.00	5.45	71.386	0.051	0.0	0.0	0.0	1.01	40.1	6.9
S12.002	50.00	5.86	71.338	0.107	0.0	0.0	0.0	1.01	40.1	14.5
S10.002	50.00	6.91	71.187	0.609	0.0	0.0	0.0	1.21	85.9	82.5
S10.003	50.00	7.19	70.934	0.659	0.0	0.0	0.0	1.40	154.8	89.2
S1.018	50.00	10.36	70.791	5.380	0.0	0.0	0.0	4.07	1151.9	728.5
S1.019	50.00	10.38	68.099	5.385	0.0	0.0	0.0	3.85	1089.5	729.2
S1.020	50.00	10.40	67.953	5.385	0.0	0.0	0.0	3.87	1094.0	729.2

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.021	96.945	3.166	30.6	0.395	0.00	0.0	0.600	o	600
S13.000	63.950	3.100	20.6	0.204	5.00	0.0	0.600	o	225
S13.001	6.513	0.300	21.7	0.005	0.00	0.0	0.600	o	225
S13.002	6.230	0.050	124.6	0.001	0.00	0.0	0.600	o	225
S14.000	54.675	0.500	109.4	0.130	5.00	0.0	0.600	o	225
S14.001	11.285	0.100	112.9	0.045	0.00	0.0	0.600	o	225
S14.002	41.595	0.350	118.8	0.089	0.00	0.0	0.600	o	225
S13.003	68.520	3.050	22.5	0.230	0.00	0.0	0.600	o	225
S13.004	83.280	0.416	200.2	0.093	0.00	0.0	0.600	o	375
S15.000	66.295	3.250	20.4	0.185	5.00	0.0	0.600	o	225
S13.005	76.350	0.382	199.9	0.000	0.00	0.0	0.600	o	375
S1.022	85.715	5.202	16.5	0.000	0.00	0.0	0.600	o	600
S1.023	26.630	0.266	100.1	0.000	0.00	0.0	0.600	o	675
S1.024	25.090	4.234	5.9	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.021	50.00	10.77	67.865	5.780	0.0	0.0	0.0	4.41	1247.3	782.7
S13.000	50.00	5.37	71.000	0.204	0.0	0.0	0.0	2.89	115.1	27.6
S13.001	50.00	5.41	67.900	0.209	0.0	0.0	0.0	2.82	112.2	28.3
S13.002	50.00	5.50	67.600	0.210	0.0	0.0	0.0	1.17	46.5	28.4
S14.000	50.00	5.73	68.500	0.130	0.0	0.0	0.0	1.25	49.7	17.6
S14.001	50.00	5.88	68.000	0.175	0.0	0.0	0.0	1.23	48.9	23.7
S14.002	50.00	6.46	67.900	0.264	0.0	0.0	0.0	1.20	47.6	35.7
S13.003	50.00	6.87	67.550	0.704	0.0	0.0	0.0	2.77	110.2	95.3
S13.004	50.00	7.96	64.500	0.797	0.0	0.0	0.0	1.28	141.0	107.9
S15.000	50.00	5.38	67.750	0.185	0.0	0.0	0.0	2.91	115.7	25.1
S13.005	50.00	8.96	64.084	0.982	0.0	0.0	0.0	1.28	141.1	133.0
S1.022	50.00	11.00	63.702	6.762	0.0	0.0	0.0	6.02	1701.7	915.7
S1.023	50.00	11.17	58.500	6.762	0.0	0.0	0.0	2.62	937.4	915.7
S1.024	50.00	5.06	58.234	0.000	35.3	0.0	0.0	6.50	459.4	35.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS2.124	85.000	1.500	1050	S1.000	83.500	225				
SS2.125	84.800	1.500	1050	S2.000	83.300	225				
SS2.123	84.650	1.500	1050	S1.001	83.150	225	S1.000	83.150	225	
							S2.000	83.150	225	
SS2.126	84.350	1.500	1050	S3.000	82.850	225				
SS2.122	84.400	1.890	1200	S1.002	82.510	300	S1.001	82.950	225	365
							S3.000	82.510	225	
SS2.121	83.550	1.500	1050	S1.003	82.050	300	S1.002	82.050	300	
SS2.120	83.300	1.500	1050	S1.004	81.800	300	S1.003	81.800	300	
SS2.128	83.350	1.500	1050	S4.000	81.850	225				
SS2.127	82.600	1.500	1050	S4.001	81.100	225	S4.000	81.100	225	
SS2.119	82.750	1.776	1350	S1.005	80.974	375	S1.004	80.974	300	
							S4.001	80.974	225	
SS2.118	82.500	1.649	1350	S1.006	80.851	450	S1.005	80.851	375	
SS2.132	84.700	1.500	1050	S5.000	83.200	225				
SS2.131	84.200	1.500	1050	S5.001	82.700	225	S5.000	82.700	225	
SS2.130	84.100	1.500	1050	S5.002	82.600	225	S5.001	82.600	225	
SS2.129	82.600	1.500	1050	S5.003	81.100	300	S5.002	81.100	225	
SS2.117	82.200	1.649	1350	S1.007	80.551	450	S1.006	80.551	450	
							S5.003	80.551	300	
SS2.116	82.000	1.513	1350	S1.008	80.487	450	S1.007	80.487	450	
SS2.115	81.800	1.514	1350	S1.009	80.286	450	S1.008	80.286	450	
SS2.135	82.300	1.500	1050	S6.000	80.800	225				
SS2.134	82.100	1.550	1050	S6.001	80.550	225	S6.000	80.550	225	
SS2.133	82.050	1.521	1050	S6.002	80.529	225	S6.001	80.529	225	
SS2.114	81.750	1.948	1350	S1.010	79.802	450	S1.009	79.802	450	
							S6.002	80.147	225	120
SS2.113	81.350	1.870	1350	S1.011	79.480	450	S1.010	79.480	450	
SS2.137	80.750	1.500	1050	S7.000	79.250	225				
SS2.136	79.250	1.500	1050	S8.000	77.750	225				
SS2.135	79.500	1.793	1050	S7.001	77.707	300	S7.000	77.707	225	
							S8.000	77.707	225	
SS2.112	78.300	1.650	1350	S1.012	76.650	450	S1.011	76.650	450	
							S7.001	76.650	300	
SS2.111A	78.150	1.700	1350	S1.013	76.450	450	S1.012	76.450	450	
SS2.111	78.000	4.523	1500	S1.014	73.477	525	S1.013	76.300	450	2748
SS2.138	79.000	1.500	1050	S9.000	77.500	225				
SS2.110	76.300	3.877	1500	S1.015	72.423	525	S1.014	72.423	525	
							S9.000	74.800	225	2077
SS2.109	75.750	3.591	1500	S1.016	72.159	600	S1.015	72.159	525	
SS2.108	73.250	1.800	1500	S1.017	71.450	600	S1.016	71.450	600	
SS2.143	78.500	1.500	1050	S10.000	77.000	225				
SS2.142	77.400	1.500	1050	S11.000	75.900	225				
SS2.141	76.750	1.748	1200	S10.001	75.002	225	S10.000	75.250	225	248
							S11.000	75.002	225	
SS2.146	73.000	1.500	1050	S12.000	71.500	225				

<u>Manhole Schedules for Storm</u>

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS2.145	73.450	2.064	1200	S12.001	71.386	225	S12.000	71.386	225	
SS2.144	73.400	2.062	1200	S12.002	71.338	225	S12.001	71.338	225	
SS2.140	73.300	2.113	1200	S10.002	71.187	300	S10.001	71.750	225	488
							S12.002	71.187	225	
SS2.139	73.050	2.116	1350	S10.003	70.934	375	S10.002	70.934	300	
SS2.107	73.000	2.209	1500	S1.018	70.791	600	S1.017	71.200	600	409
							S10.003	70.791	375	
SS2.106	69.900	1.801	1500	S1.019	68.099	600	S1.018	68.099	600	
SS2.105	69.850	1.897	1500	S1.020	67.953	600	S1.019	67.953	600	
SS2.104	69.400	1.535	1500	S1.021	67.865	600	S1.020	67.865	600	
SS2.152	72.500	1.500	1050	S13.000	71.000	225				
SS2.151	69.400	1.500	1050	S13.001	67.900	225	S13.000	67.900	225	
SS2.150	69.100	1.500	1050	S13.002	67.600	225	S13.001	67.600	225	
SS2.155	70.000	1.500	1050	S14.000	68.500	225				
SS2.154	69.500	1.500	1050	S14.001	68.000	225	S14.000	68.000	225	
SS2.153	69.400	1.500	1050	S14.002	67.900	225	S14.001	67.900	225	
SS2.149	69.050	1.500	1050	S13.003	67.550	225	S13.002	67.550	225	
							S14.002	67.550	225	
SS2.148	66.000	1.500	1350	S13.004	64.500	375	S13.003	64.500	225	
SS2.156	69.250	1.500	1050	S15.000	67.750	225				
SS2.147	66.000	1.916	1350	S13.005	64.084	375	S13.004	64.084	375	
							S15.000	64.500	225	266
SS2.103	66.500	2.798	1500	S1.022	63.702	600	S1.021	64.699	600	997
							S13.005	63.702	375	
SS2.102	60.000	1.500	1500	S1.023	58.500	675	S1.022	58.500	600	
SS2.101	59.500	1.266	1500	S1.024	58.234	300	S1.023	58.234	675	
SS2.100	55.000	1.000	0		OUTFALL		S1.024	54.000	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS2.124	85.000	83.500	1.275	1050
S2.000	o	225	SS2.125	84.800	83.300	1.275	1050
S1.001	o	225	SS2.123	84.650	83.150	1.275	1050
S3.000	o	225	SS2.126	84.350	82.850	1.275	1050
S1.002	o	300	SS2.122	84.400	82.510	1.590	1200
S1.003	o	300	SS2.121	83.550	82.050	1.200	1050
S1.004	o	300	SS2.120	83.300	81.800	1.200	1050
S4.000	o	225	SS2.128	83.350	81.850	1.275	1050
S4.001	o	225	SS2.127	82.600	81.100	1.275	1050
S1.005	o	375	SS2.119	82.750	80.974	1.401	1350
S1.006	o	450	SS2.118	82.500	80.851	1.199	1350
S5.000	o	225	SS2.132	84.700	83.200	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	69.590	198.8	SS2.123	84.650	83.150	1.275	1050
S2.000	26.185	174.6	SS2.123	84.650	83.150	1.275	1050
S1.001	13.900	69.5	SS2.122	84.400	82.950	1.225	1200
S3.000	56.765	167.0	SS2.122	84.400	82.510	1.665	1200
S1.002	62.105	135.0	SS2.121	83.550	82.050	1.200	1050
S1.003	8.034	32.1	SS2.120	83.300	81.800	1.200	1050
S1.004	19.490	23.6	SS2.119	82.750	80.974	1.476	1350
S4.000	46.320	61.8	SS2.127	82.600	81.100	1.275	1050
S4.001	21.120	167.6	SS2.119	82.750	80.974	1.551	1350
S1.005	20.480	166.5	SS2.118	82.500	80.851	1.274	1350
S1.006	50.120	167.1	SS2.117	82.200	80.551	1.199	1350
S5.000	49.250	98.5	SS2.131	84.200	82.700	1.275	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.001	o	225	SS2.131	84.200	82.700	1.275	1050
S5.002	o	225	SS2.130	84.100	82.600	1.275	1050
S5.003	o	300	SS2.129	82.600	81.100	1.200	1050
S1.007	o	450	SS2.117	82.200	80.551	1.199	1350
S1.008	o	450	SS2.116	82.000	80.487	1.063	1350
S1.009	o	450	SS2.115	81.800	80.286	1.064	1350
S6.000	o	225	SS2.135	82.300	80.800	1.275	1050
S6.001	o	225	SS2.134	82.100	80.550	1.325	1050
S6.002	o	225	SS2.133	82.050	80.529	1.296	1050
S1.010	o	450	SS2.114	81.750	79.802	1.498	1350
S1.011	o	450	SS2.113	81.350	79.480	1.420	1350
S7.000	o	225	SS2.137	80.750	79.250	1.275	1050
S8.000	o	225	SS2.136	79.250	77.750	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S5.001	6.315	63.2	SS2.130	84.100	82.600	1.275	1050
S5.002	74.945	50.0	SS2.129	82.600	81.100	1.275	1050
S5.003	86.440	157.4	SS2.117	82.200	80.551	1.349	1350
S1.007	10.750	168.0	SS2.116	82.000	80.487	1.063	1350
S1.008	7.405	36.8	SS2.115	81.800	80.286	1.064	1350
S1.009	48.415	100.0	SS2.114	81.750	79.802	1.498	1350
S6.000	41.695	166.8	SS2.134	82.100	80.550	1.325	1050
S6.001	3.440	163.8	SS2.133	82.050	80.529	1.296	1050
S6.002	63.845	167.1	SS2.114	81.750	80.147	1.378	1350
S1.010	32.155	99.9	SS2.113	81.350	79.480	1.420	1350
S1.011	65.870	23.3	SS2.112	78.300	76.650	1.200	1350
S7.000	38.995	25.3	SS2.135	79.500	77.707	1.568	1050
S8.000	7.155	166.4	SS2.135	79.500	77.707	1.568	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S7.001	o	300	SS2.135	79.500	77.707	1.493	1050
S1.012	o	450	SS2.112	78.300	76.650	1.200	1350
S1.013	o	450	SS2.111A	78.150	76.450	1.250	1350
S1.014	o	525	SS2.111	78.000	73.477	3.998	1500
S9.000	o	225	SS2.138	79.000	77.500	1.275	1050
S1.015	o	525	SS2.110	76.300	72.423	3.352	1500
S1.016	o	600	SS2.109	75.750	72.159	2.991	1500
S1.017	o	600	SS2.108	73.250	71.450	1.200	1500
S10.000	o	225	SS2.143	78.500	77.000	1.275	1050
S11.000	o	225	SS2.142	77.400	75.900	1.275	1050
S10.001	o	225	SS2.141	76.750	75.002	1.523	1200
S12.000	o	225	SS2.146	73.000	71.500	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S7.001	71.700	67.8	SS2.112	78.300	76.650	1.350	1350
S1.012	5.450	27.3	SS2.111A	78.150	76.450	1.250	1350
S1.013	5.450	36.3	SS2.111	78.000	76.300	1.250	1500
S1.014	52.685	50.0	SS2.110	76.300	72.423	3.352	1500
S9.000	68.925	25.5	SS2.110	76.300	74.800	1.275	1500
S1.015	13.200	50.0	SS2.109	75.750	72.159	3.066	1500
S1.016	59.880	84.5	SS2.108	73.250	71.450	1.200	1500
S1.017	7.300	29.2	SS2.107	73.000	71.200	1.200	1500
S10.000	38.590	22.1	SS2.141	76.750	75.250	1.275	1200
S11.000	89.845	100.1	SS2.141	76.750	75.002	1.523	1200
S10.001	40.825	12.6	SS2.140	73.300	71.750	1.325	1200
S12.000	18.955	166.3	SS2.145	73.450	71.386	1.839	1200

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S12.001	o	225	SS2.145	73.450	71.386	1.839	1200
S12.002	o	225	SS2.144	73.400	71.338	1.837	1200
S10.002	o	300	SS2.140	73.300	71.187	1.813	1200
S10.003	o	375	SS2.139	73.050	70.934	1.741	1350
S1.018	o	600	SS2.107	73.000	70.791	1.609	1500
S1.019	o	600	SS2.106	69.900	68.099	1.201	1500
S1.020	o	600	SS2.105	69.850	67.953	1.297	1500
S1.021	o	600	SS2.104	69.400	67.865	0.935	1500
S13.000	o	225	SS2.152	72.500	71.000	1.275	1050
S13.001	o	225	SS2.151	69.400	67.900	1.275	1050
S13.002	o	225	SS2.150	69.100	67.600	1.275	1050
S14.000	o	225	SS2.155	70.000	68.500	1.275	1050
S14.001	o	225	SS2.154	69.500	68.000	1.275	1050
S14.002	o	225	SS2.153	69.400	67.900	1.275	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S12.001	8.030	167.3	SS2.144	73.400	71.338	1.837	1200
S12.002	25.270	167.4	SS2.140	73.300	71.187	1.888	1200
S10.002	42.189	166.8	SS2.139	73.050	70.934	1.816	1350
S10.003	23.800	166.4	SS2.107	73.000	70.791	1.834	1500
S1.018	96.615	35.9	SS2.106	69.900	68.099	1.201	1500
S1.019	5.855	40.1	SS2.105	69.850	67.953	1.297	1500
S1.020	3.500	39.8	SS2.104	69.400	67.865	0.935	1500
S1.021	96.945	30.6	SS2.103	66.500	64.699	1.201	1500
S13.000	63.950	20.6	SS2.151	69.400	67.900	1.275	1050
S13.001	6.513	21.7	SS2.150	69.100	67.600	1.275	1050
S13.002	6.230	124.6	SS2.149	69.050	67.550	1.275	1050
S14.000	54.675	109.4	SS2.154	69.500	68.000	1.275	1050
S14.001	11.285	112.9	SS2.153	69.400	67.900	1.275	1050
S14.002	41.595	118.8	SS2.149	69.050	67.550	1.275	1050

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S13.003	o	225	SS2.149	69.050	67.550	1.275	1050
S13.004	o	375	SS2.148	66.000	64.500	1.125	1350
S15.000	o	225	SS2.156	69.250	67.750	1.275	1050
S13.005	o	375	SS2.147	66.000	64.084	1.541	1350
S1.022	o	600	SS2.103	66.500	63.702	2.198	1500
S1.023	o	675	SS2.102	60.000	58.500	0.825	1500
S1.024	o	300	SS2.101	59.500	58.234	0.966	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S13.003	68.520	22.5	SS2.148	66.000	64.500	1.275	1350
S13.004	83.280	200.2	SS2.147	66.000	64.084	1.541	1350
S15.000	66.295	20.4	SS2.147	66.000	64.500	1.275	1350
S13.005	76.350	199.9	SS2.103	66.500	63.702	2.423	1500
S1.022	85.715	16.5	SS2.102	60.000	58.500	0.900	1500
S1.023	26.630	100.1	SS2.101	59.500	58.234	0.591	1500
S1.024	25.090	5.9	SS2.100	55.000	54.000	0.700	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.024	SS2.100	55.000	54.000	54.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS2.101, DS/PN: S1.024, Volume (m³): 11.2

Design Head (m)	1.000	Diameter (mm)	237
Design Flow (l/s)	35.3	Invert Level (m)	58.234
Hydro-Brake® Type	Md5 SW Only		

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	8.5	1.200	37.7	3.000	58.6	7.000	89.4
0.200	20.9	1.400	40.3	3.500	63.2	7.500	92.6
0.300	29.8	1.600	42.9	4.000	67.6	8.000	95.6
0.400	33.4	1.800	45.4	4.500	71.7	8.500	98.6
0.500	34.3	2.000	47.8	5.000	75.6	9.000	101.4
0.600	34.1	2.200	50.1	5.500	79.3	9.500	104.2
0.800	34.0	2.400	52.4	6.000	82.8		
1.000	35.4	2.600	54.5	6.500	86.2		

Storage Structures for Storm

Tank or Pond Manhole: SS2.101, DS/PN: S1.024

Invert Level (m) 58.234

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	2655.0	1.000	2655.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%	100/15 Summer				
S2.000	15 Winter	100	0%	100/15 Summer				
S1.001	15 Winter	100	0%	100/15 Summer				
S3.000	15 Winter	100	0%	100/15 Summer				
S1.002	15 Winter	100	0%	100/15 Summer				
S1.003	15 Winter	100	0%	100/15 Summer				
S1.004	15 Winter	100	0%	100/15 Summer				
S4.000	15 Winter	100	0%					
S4.001	15 Winter	100	0%	100/15 Summer				
S1.005	15 Winter	100	0%	100/15 Summer				
S1.006	15 Winter	100	0%	100/15 Summer				
S5.000	15 Winter	100	0%	100/15 Summer				
S5.001	15 Winter	100	0%	100/15 Summer				
S5.002	15 Winter	100	0%	100/15 Summer				
S5.003	15 Winter	100	0%	100/15 Summer				
S1.007	15 Winter	100	0%	100/15 Summer				
S1.008	15 Winter	100	0%	100/15 Summer				
S1.009	15 Winter	100	0%	100/15 Summer				
S6.000	15 Winter	100	0%	100/15 Summer				
S6.001	15 Winter	100	0%	100/15 Summer				
S6.002	15 Winter	100	0%	100/15 Summer				
S1.010	15 Winter	100	0%	100/15 Summer				
S1.011	30 Winter	100	0%					
S7.000	15 Winter	100	0%					
S8.000	15 Winter	100	0%	100/15 Summer				
S7.001	15 Winter	100	0%	100/15 Summer				
S1.012	30 Winter	100	0%	100/15 Summer	100/15 Winter			3
S1.013	30 Winter	100	0%	100/15 Summer				
S1.014	30 Winter	100	0%	100/15 Summer				
S9.000	15 Winter	100	0%					
S1.015	30 Winter	100	0%	100/15 Summer				
S1.016	30 Winter	100	0%	100/15 Summer				
S1.017	30 Winter	100	0%	100/15 Summer	100/15 Winter			2
S10.000	15 Winter	100	0%					
S11.000	15 Winter	100	0%	100/15 Summer				
S10.001	15 Winter	100	0%					
S12.000	30 Winter	100	0%	100/15 Summer	100/15 Winter			3
S12.001	15 Winter	100	0%	100/15 Summer				

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S12.002	15 Winter	100	0%	100/15 Summer				
S10.002	15 Winter	100	0%	100/15 Summer				
S10.003	15 Winter	100	0%	100/15 Summer				
S1.018	15 Winter	100	0%	100/15 Summer				
S1.019	30 Winter	100	0%	100/15 Summer	100/15 Summer			6
S1.020	30 Winter	100	0%	100/15 Summer				
S1.021	30 Winter	100	0%					
S13.000	15 Winter	100	0%					
S13.001	15 Winter	100	0%	100/15 Summer	100/15 Winter			1
S13.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			5
S14.000	15 Winter	100	0%	100/15 Summer				
S14.001	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S14.002	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S13.003	15 Winter	100	0%	100/15 Summer	100/15 Summer			4
S13.004	15 Winter	100	0%	100/15 Summer				
S15.000	15 Winter	100	0%					
S13.005	15 Winter	100	0%	100/15 Summer				
S1.022	30 Winter	100	0%					
S1.023	30 Winter	100	0%	100/15 Summer				
S1.024	1440 Winter	100	0%	100/15 Summer	100/480 Winter			3

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS2.124	84.860	1.135	0.000	1.44	0.0	51.2	FLOOD RISK
S2.000	SS2.125	84.152	0.627	0.000	0.63	0.0	23.0	SURCHARGED
S1.001	SS2.123	84.102	0.727	0.000	1.47	0.0	79.9	SURCHARGED
S3.000	SS2.126	83.726	0.651	0.000	0.38	0.0	14.6	SURCHARGED
S1.002	SS2.122	83.681	0.871	0.000	1.61	0.0	146.0	SURCHARGED
S1.003	SS2.121	82.595	0.245	0.000	1.11	0.0	139.3	SURCHARGED
S1.004	SS2.120	82.294	0.194	0.000	0.73	0.0	145.9	SURCHARGED
S4.000	SS2.128	81.930	-0.145	0.000	0.27	0.0	16.9	OK
S4.001	SS2.127	81.890	0.564	0.000	0.45	0.0	16.5	SURCHARGED
S1.005	SS2.119	81.863	0.514	0.000	1.26	0.0	163.8	SURCHARGED
S1.006	SS2.118	81.678	0.377	0.000	0.86	0.0	194.1	SURCHARGED
S5.000	SS2.132	83.678	0.253	0.000	0.86	0.0	43.1	SURCHARGED
S5.001	SS2.131	83.415	0.490	0.000	0.94	0.0	41.8	SURCHARGED
S5.002	SS2.130	83.345	0.520	0.000	0.81	0.0	57.8	SURCHARGED
S5.003	SS2.129	82.366	0.966	0.000	1.33	0.0	113.7	FLOOD RISK
S1.007	SS2.117	81.491	0.490	0.000	1.73	0.0	292.5	SURCHARGED
S1.008	SS2.116	81.234	0.297	0.000	1.15	0.0	290.0	SURCHARGED
S1.009	SS2.115	80.974	0.238	0.000	1.03	0.0	302.7	SURCHARGED
S6.000	SS2.135	81.647	0.622	0.000	0.80	0.0	30.7	SURCHARGED
S6.001	SS2.134	81.478	0.703	0.000	1.24	0.0	33.3	SURCHARGED
S6.002	SS2.133	81.446	0.692	0.000	1.61	0.0	62.6	SURCHARGED
S1.010	SS2.114	80.466	0.214	0.000	1.31	0.0	368.4	SURCHARGED
S1.011	SS2.113	79.742	-0.188	0.000	0.63	0.0	394.7	OK
S7.000	SS2.137	79.347	-0.128	0.000	0.38	0.0	37.5	OK

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S8.000	SS2.136	78.619	0.644	0.000	0.48	0.0	14.3	SURCHARGED
S7.001	SS2.135	78.607	0.600	0.000	0.70	0.0	90.7	SURCHARGED
S1.012	SS2.112	78.330	1.230	0.000	1.99	0.0	502.0	FLOOD RISK
S1.013	SS2.111A	78.053	1.153	0.000	2.30	0.0	502.3	FLOOD RISK
S1.014	SS2.111	77.792	3.790	0.000	1.37	0.0	842.0	FLOOD RISK
S9.000	SS2.138	77.626	-0.099	0.000	0.58	0.0	58.4	OK
S1.015	SS2.110	75.840	2.892	0.000	2.22	0.0	875.6	SURCHARGED
S1.016	SS2.109	74.540	1.781	0.000	1.36	0.0	907.6	SURCHARGED
S1.017	SS2.108	73.250	1.200	0.000	1.81	0.0	904.4	FLOOD RISK
S10.000	SS2.143	77.089	-0.136	0.000	0.32	0.0	34.3	OK
S11.000	SS2.142	76.833	0.708	0.000	1.30	0.0	65.7	SURCHARGED
S10.001	SS2.141	75.172	-0.055	0.000	0.86	0.0	120.2	OK
S12.000	SS2.146	73.004	1.279	0.000	0.90	0.0	32.6	FLOOD RISK
S12.001	SS2.145	73.113	1.502	0.000	1.14	0.0	35.2	SURCHARGED
S12.002	SS2.144	73.173	1.610	0.000	1.15	0.0	42.6	FLOOD RISK
S10.002	SS2.140	73.196	1.709	0.000	1.94	0.0	155.3	FLOOD RISK
S10.003	SS2.139	72.577	1.268	0.000	1.14	0.0	151.8	SURCHARGED
S1.018	SS2.107	72.439	1.048	0.000	0.96	0.0	1032.5	SURCHARGED
S1.019	SS2.106	69.969	1.270	0.000	2.29	0.0	877.5	FLOOD RISK
S1.020	SS2.105	69.202	0.649	0.000	2.53	0.0	877.5	SURCHARGED
S1.021	SS2.104	68.285	-0.180	0.000	0.83	0.0	957.6	OK
S13.000	SS2.152	71.135	-0.090	0.000	0.65	0.0	72.4	OK
S13.001	SS2.151	69.400	1.275	0.007	0.97	0.0	74.8	FLOOD RISK
S13.002	SS2.150	69.108	1.283	0.000	2.12	0.0	66.8	FLOOD RISK
S14.000	SS2.155	69.836	1.111	0.000	0.75	0.0	35.7	FLOOD RISK
S14.001	SS2.154	69.500	1.275	0.476	0.99	0.0	41.0	FLOOD RISK
S14.002	SS2.153	69.403	1.278	0.000	1.12	0.0	50.9	FLOOD RISK
S13.003	SS2.149	69.054	1.279	0.000	1.14	0.0	122.1	FLOOD RISK
S13.004	SS2.148	65.348	0.473	0.000	1.05	0.0	140.5	SURCHARGED
S15.000	SS2.156	67.876	-0.099	0.000	0.59	0.0	65.9	OK
S13.005	SS2.147	64.884	0.425	0.000	1.41	0.0	189.0	SURCHARGED
S1.022	SS2.103	64.084	-0.218	0.000	0.73	0.0	1140.3	OK
S1.023	SS2.102	59.678	0.503	0.000	1.74	0.0	1137.0	SURCHARGED
S1.024	SS2.101	59.604	1.070	0.000	0.10	0.0	39.9	FLOOD RISK

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.174	4-8	0.375	8-12	0.021

Total Area Contributing (ha) = 0.570

Total Pipe Volume (m³) = 25.046

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	56.660	2.000	28.3	0.075	5.00	0.0	0.600	o	225
S1.001	37.400	1.000	37.4	0.075	0.00	0.0	0.600	o	225
S1.002	77.280	0.258	300.0	0.050	0.00	0.0	0.600	o	300
S2.000	84.575	0.750	112.8	0.120	5.00	0.0	0.600	o	225
S2.001	41.415	2.500	16.6	0.100	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.38	66.000	0.075	0.0	0.0	0.0	2.47	98.1	10.2
S1.001	50.00	5.67	64.000	0.150	0.0	0.0	0.0	2.15	85.3	20.3
S1.002	50.00	7.10	63.000	0.200	0.0	0.0	0.0	0.90	63.8	27.1
S2.000	50.00	6.15	67.250	0.120	0.0	0.0	0.0	1.23	48.9	16.2
S2.001	50.00	6.36	66.500	0.220	0.0	0.0	0.0	3.23	128.5	29.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.003	90.650	0.302	300.0	0.050	0.00	0.0	0.600	o	300
S3.000	64.500	2.250	28.7	0.100	5.00	0.0	0.600	o	225
S1.004	9.645	0.032	301.4	0.000	0.00	0.0	0.600	o	375
S1.005	3.000	0.010	300.0	0.000	0.00	0.0	0.600	o	375
S1.006	6.575	1.000	6.6	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.003	50.00	8.77	62.742	0.470	0.0	0.0	0.0	0.90	63.8	63.6
S3.000	50.00	5.44	67.750	0.100	0.0	0.0	0.0	2.45	97.5	13.5
S1.004	50.00	8.93	62.440	0.570	0.0	0.0	0.0	1.04	114.7	77.2
S1.005	50.00	8.98	62.408	0.570	0.0	0.0	0.0	1.04	115.0	77.2
S1.006	50.00	5.02	62.398	0.000	5.7	0.0	0.0	6.17	436.1	5.7

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SS2.208	67.500	1.500	1050	S1.000	66.000	225				
SS2.207	65.500	1.500	1050	S1.001	64.000	225	S1.000	64.000	225	
SS2.206	64.500	1.500	1050	S1.002	63.000	300	S1.001	63.000	225	
SS2.210	68.750	1.500	1050	S2.000	67.250	225				
SS2.209	68.000	1.500	1050	S2.001	66.500	225	S2.000	66.500	225	
SS2.205	65.500	2.758	1200	S1.003	62.742	300	S1.002	62.742	300	
							S2.001	64.000	225	1183
SS2.204	69.250	1.500	1050	S3.000	67.750	225				
SS2.203	67.000	4.560	1350	S1.004	62.440	375	S1.003	62.440	300	
							S3.000	65.500	225	2910
SS2.202	65.500	3.092	1350	S1.005	62.408	375	S1.004	62.408	375	
SS2.201	64.000	1.602	1350	S1.006	62.398	300	S1.005	62.398	375	
SS2.200	62.760	1.362	0		OUTFALL		S1.006	61.398	300	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS2.208	67.500	66.000	1.275	1050
S1.001	o	225	SS2.207	65.500	64.000	1.275	1050
S1.002	o	300	SS2.206	64.500	63.000	1.200	1050
S2.000	o	225	SS2.210	68.750	67.250	1.275	1050
S2.001	o	225	SS2.209	68.000	66.500	1.275	1050
S1.003	o	300	SS2.205	65.500	62.742	2.458	1200
S3.000	o	225	SS2.204	69.250	67.750	1.275	1050
S1.004	o	375	SS2.203	67.000	62.440	4.185	1350
S1.005	o	375	SS2.202	65.500	62.408	2.717	1350
S1.006	o	300	SS2.201	64.000	62.398	1.302	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	56.660	28.3	SS2.207	65.500	64.000	1.275	1050
S1.001	37.400	37.4	SS2.206	64.500	63.000	1.275	1050
S1.002	77.280	300.0	SS2.205	65.500	62.742	2.458	1200
S2.000	84.575	112.8	SS2.209	68.000	66.500	1.275	1050
S2.001	41.415	16.6	SS2.205	65.500	64.000	1.275	1200
S1.003	90.650	300.0	SS2.203	67.000	62.440	4.260	1350
S3.000	64.500	28.7	SS2.203	67.000	65.500	1.275	1350
S1.004	9.645	301.4	SS2.202	65.500	62.408	2.717	1350
S1.005	3.000	300.0	SS2.201	64.000	62.398	1.227	1350
S1.006	6.575	6.6	SS2.200	62.760	61.398	1.062	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SS2.200	62.760	61.398	61.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS2.201, DS/PN: S1.006, Volume (m³): 2.5

Design Head (m) 0.500 Diameter (mm) 113
Design Flow (l/s) 5.7 Invert Level (m) 62.398
Hydro-Brake® Type Md5 SW Only

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.5	1.200	8.4	3.000	13.3	7.000	20.3
0.200	5.3	1.400	9.1	3.500	14.4	7.500	21.0
0.300	5.3	1.600	9.7	4.000	15.4	8.000	21.7
0.400	5.4	1.800	10.3	4.500	16.3	8.500	22.4
0.500	5.6	2.000	10.9	5.000	17.2	9.000	23.1
0.600	6.0	2.200	11.4	5.500	18.0	9.500	23.7
0.800	6.9	2.400	11.9	6.000	18.8		
1.000	7.7	2.600	12.4	6.500	19.6		

Storage Structures for Storm

Tank or Pond Manhole: SS2.201, DS/PN: S1.006

Invert Level (m) 62.398

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	696.0	0.500	696.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%					
S1.001	15 Winter	100	0%	100/15 Summer				
S1.002	15 Winter	100	0%	100/15 Summer				
S2.000	15 Winter	100	0%					
S2.001	15 Winter	100	0%					
S1.003	15 Winter	100	0%	100/15 Summer				
S3.000	15 Winter	100	0%					
S1.004	15 Winter	100	0%	100/15 Summer				
S1.005	15 Winter	100	0%	100/15 Summer				
S1.006	960 Winter	100	0%	100/240 Winter				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS2.208	66.082	-0.143	0.000	0.28	0.0	26.6	OK
S1.001	SS2.207	64.741	0.516	0.000	0.61	0.0	49.2	SURCHARGED
S1.002	SS2.206	64.474	1.174	0.000	0.88	0.0	54.2	FLOOD RISK
S2.000	SS2.210	67.419	-0.056	0.000	0.85	0.0	40.8	OK
S2.001	SS2.209	66.632	-0.093	0.000	0.62	0.0	75.3	OK
S1.003	SS2.205	64.290	1.247	0.000	1.92	0.0	118.7	SURCHARGED
S3.000	SS2.204	67.847	-0.128	0.000	0.38	0.0	35.4	OK
S1.004	SS2.203	63.032	0.217	0.000	1.74	0.0	145.3	SURCHARGED
S1.005	SS2.202	62.893	0.110	0.000	1.75	0.0	145.7	SURCHARGED
S1.006	SS2.201	62.755	0.057	0.000	0.02	0.0	5.4	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	100	Add Flow / Climate Change (%)	0
M5-60 (mm)	18.800	Minimum Backdrop Height (m)	0.200
Ratio R	0.250	Maximum Backdrop Height (m)	1.500
Maximum Rainfall (mm/hr)	50	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.179	4-8	0.171

Total Area Contributing (ha) = 0.350

Total Pipe Volume (m³) = 13.658

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	65.550	0.525	124.9	0.100	5.00	0.0	0.600	o	225
S2.000	20.950	0.125	167.6	0.050	5.00	0.0	0.600	o	225
S1.001	29.075	0.174	167.1	0.075	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	5.93	62.150	0.100	0.0	0.0	0.0	1.17	46.5	13.5
S2.000	50.00	5.35	61.750	0.050	0.0	0.0	0.0	1.01	40.0	6.8
S1.001	50.00	6.42	61.625	0.225	0.0	0.0	0.0	1.01	40.1	30.5

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	T.E. (mins)	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
S3.000	39.745	1.300	30.6	0.075	5.00	0.0	0.600	o	225
S1.002	19.050	0.451	42.2	0.000	0.00	0.0	0.600	o	225
S1.003	39.820	0.199	200.0	0.000	0.00	0.0	0.600	o	300
S4.000	24.345	1.000	24.3	0.050	5.00	0.0	0.600	o	225
S1.004	15.620	1.302	12.0	0.000	0.00	0.0	0.600	o	300
S1.005	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300
S1.006	37.350	5.883	6.3	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S3.000	50.00	5.28	62.800	0.075	0.0	0.0	0.0	2.37	94.4	10.2
S1.002	50.00	6.57	61.451	0.300	0.0	0.0	0.0	2.02	80.3	40.6
S1.003	50.00	7.17	61.000	0.300	0.0	0.0	0.0	1.11	78.3	40.6
S4.000	50.00	5.15	62.500	0.050	0.0	0.0	0.0	2.66	105.9	6.8
S1.004	50.00	7.23	59.402	0.350	0.0	0.0	0.0	4.56	322.6	47.4
S1.005	50.00	7.28	58.100	0.350	0.0	0.0	0.0	1.57	111.1	47.4
S1.006	50.00	5.12	58.050	0.000	3.5	0.0	0.0	5.23	207.8	3.5

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SS3.110	63.650	1.500	1050	S1.000	62.150	225				
SS3.109	63.250	1.500	1050	S2.000	61.750	225				
SS3.108	63.800	2.175	1200	S1.001	61.625	225	S1.000	61.625	225	
							S2.000	61.625	225	
SS3.107	64.300	1.500	1050	S3.000	62.800	225				
SS3.106	63.000	1.549	1050	S1.002	61.451	225	S1.001	61.451	225	
							S3.000	61.500	225	49
SS3.105	62.500	1.500	1050	S1.003	61.000	300	S1.002	61.000	225	
SS3.104	64.000	1.500	1050	S4.000	62.500	225				
SS3.103	63.000	3.598	1200	S1.004	59.402	300	S1.003	60.801	300	1399
							S4.000	61.500	225	2023
SS3.102	59.500	1.400	1050	S1.005	58.100	300	S1.004	58.100	300	
SS3.101	59.000	0.950	1050	S1.006	58.050	225	S1.005	58.050	300	
SS3.100	54.500	2.333	0		OUTFALL		S1.006	52.167	225	

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	o	225	SS3.110	63.650	62.150	1.275	1050
S2.000	o	225	SS3.109	63.250	61.750	1.275	1050
S1.001	o	225	SS3.108	63.800	61.625	1.950	1200
S3.000	o	225	SS3.107	64.300	62.800	1.275	1050
S1.002	o	225	SS3.106	63.000	61.451	1.324	1050
S1.003	o	300	SS3.105	62.500	61.000	1.200	1050
S4.000	o	225	SS3.104	64.000	62.500	1.275	1050
S1.004	o	300	SS3.103	63.000	59.402	3.298	1200
S1.005	o	300	SS3.102	59.500	58.100	1.100	1050
S1.006	o	225	SS3.101	59.000	58.050	0.725	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
S1.000	65.550	124.9	SS3.108	63.800	61.625	1.950	1200
S2.000	20.950	167.6	SS3.108	63.800	61.625	1.950	1200
S1.001	29.075	167.1	SS3.106	63.000	61.451	1.324	1050
S3.000	39.745	30.6	SS3.106	63.000	61.500	1.275	1050
S1.002	19.050	42.2	SS3.105	62.500	61.000	1.275	1050
S1.003	39.820	200.0	SS3.103	63.000	60.801	1.899	1200
S4.000	24.345	24.3	SS3.103	63.000	61.500	1.275	1200
S1.004	15.620	12.0	SS3.102	59.500	58.100	1.100	1050
S1.005	5.000	100.0	SS3.101	59.000	58.050	0.650	1050
S1.006	37.350	6.3	SS3.100	54.500	52.167	2.108	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.006	SS3.100	54.500	52.167	52.167	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.250		

Online Controls for Storm

Hydro-Brake® Manhole: SS3.101, DS/PN: S1.006, Volume (m^3): 1.1

Design Head (m) 0.600 Hydro-Brake® Type Md4 Invert Level (m) 58.050
Design Flow (l/s) 3.5 Diameter (mm) 77

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.3	1.200	5.1	3.000	8.0	7.000	12.2
0.200	3.1	1.400	5.5	3.500	8.6	7.500	12.7
0.300	2.7	1.600	5.8	4.000	9.2	8.000	13.1
0.400	2.9	1.800	6.2	4.500	9.8	8.500	13.5
0.500	3.3	2.000	6.5	5.000	10.3	9.000	13.9
0.600	3.6	2.200	6.9	5.500	10.8	9.500	14.2
0.800	4.1	2.400	7.2	6.000	11.3		
1.000	4.6	2.600	7.4	6.500	11.8		

Storage Structures for Storm

Tank or Pond Manhole: SS3.101, DS/PN: S1.006

Invert Level (m) 58.050

Depth (m)	Area (m^2)	Depth (m)	Area (m^2)
0.000	195.0	0.600	195.0

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 100
Climate Change (%) 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
S1.000	15 Winter	100	0%	100/15 Summer				
S2.000	15 Winter	100	0%	100/15 Summer				
S1.001	15 Winter	100	0%	100/15 Summer				
S3.000	15 Winter	100	0%					
S1.002	15 Winter	100	0%	100/15 Summer				
S1.003	15 Winter	100	0%	100/15 Summer				
S4.000	15 Winter	100	0%					
S1.004	15 Winter	100	0%					
S1.005	480 Winter	100	0%	100/15 Summer				
S1.006	480 Winter	100	0%	100/15 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
S1.000	SS3.110	62.557	0.182	0.000	0.68	0.0	30.6	SURCHARGED
S2.000	SS3.109	62.385	0.410	0.000	0.39	0.0	14.0	SURCHARGED
S1.001	SS3.108	62.355	0.505	0.000	1.59	0.0	59.4	SURCHARGED
S3.000	SS3.107	62.885	-0.140	0.000	0.30	0.0	26.8	OK
S1.002	SS3.106	61.903	0.227	0.000	1.12	0.0	81.3	SURCHARGED
S1.003	SS3.105	61.336	0.036	0.000	1.12	0.0	81.3	SURCHARGED
S4.000	SS3.104	62.565	-0.160	0.000	0.19	0.0	18.0	OK
S1.004	SS3.103	59.524	-0.178	0.000	0.34	0.0	92.9	OK
S1.005	SS3.102	58.772	0.372	0.000	0.30	0.0	18.7	SURCHARGED
S1.006	SS3.101	58.770	0.495	0.000	0.02	0.0	3.9	FLOOD RISK

Appendix F – SuDS Design Sheets

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — $A = \mathbf{4.0}$ m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — $r = \mathbf{0.360}$

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate} = \mathbf{0}$ %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — $d = \mathbf{300}$ mm

Width of pit — $w = \mathbf{1000}$ mm

Length of pit — $l = \mathbf{1000}$ mm

Percentage free volume — $V_{free} = \mathbf{30}$ %

Soil infiltration rate — $f = \mathbf{157.\times10^{-6}}$ m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d = \mathbf{600000}$ mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5	0.36;	6.8;	1.90;	12.9;	0.05;	0.03;	0.02
10	0.51;	9.6;	1.96;	18.8;	0.08;	0.06;	0.02
15	0.62;	11.7;	1.97;	23.0;	0.09;	0.08;	0.01
30	0.79;	14.9;	1.98;	29.4;	0.12;	0.17;	0.00
60	1.00;	18.8;	1.94;	36.5;	0.15;	0.34;	0.00
120	1.22;	22.9;	1.91;	43.7;	0.17;	0.68;	0.00
240	1.48;	27.8;	1.87;	52.0;	0.21;	1.36;	0.00
360	1.67;	31.4;	1.84;	57.7;	0.23;	2.03;	0.00
600	1.90;	35.7;	1.80;	64.4;	0.26;	3.39;	0.00
1440	2.42;	45.5;	1.74;	79.3;	0.32;	8.14;	0.00

Required storage volume — $S_{req} = \mathbf{0.02}$ m^3

Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free} = \mathbf{0.09}$ m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f) = 1$min 47s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — A = **23.7** m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — r = **0.360**

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — d = **300** mm

Width of pit — w = **5800** mm

Length of pit — l = **5100** mm

Percentage free volume — V_{free} = **30** %

Soil infiltration rate — f = **24.9×10^{-6}** m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d$ = **3270000** mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.36;	6.8;	1.90;	12.9;	0.30;	0.02;	0.28
10	0.51;	9.6;	1.96;	18.8;	0.45;	0.05;	0.40
15	0.62;	11.7;	1.97;	23.0;	0.55;	0.07;	0.47
30	0.79;	14.9;	1.98;	29.4;	0.70;	0.15;	0.55
60	1.00;	18.8;	1.94;	36.5;	0.87;	0.29;	0.57
120	1.22;	22.9;	1.91;	43.7;	1.04;	0.59;	0.45
240	1.48;	27.8;	1.87;	52.0;	1.23;	1.17;	0.06
360	1.67;	31.4;	1.84;	57.7;	1.37;	1.76;	0.00
600	1.90;	35.7;	1.80;	64.4;	1.53;	2.93;	0.00
1440	2.42;	45.5;	1.74;	79.3;	1.88;	7.03;	0.00

Required storage volume — S_{req} = **0.57** m^3

Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free}$ = **2.66** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 58min 21s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — A = **30.0** m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — r = **0.360**

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — d = **1000** mm

Width of pit — w = **1000** mm

Length of pit — l = **1000** mm

Percentage free volume — V_{free} = **95** %

Soil infiltration rate — f = **157.×10⁻⁶** m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d$ = **2000000** mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.36;	6.8;	1.90;	12.9;	0.39;	0.09;	0.29
10	0.51;	9.6;	1.96;	18.8;	0.56;	0.19;	0.38
15	0.62;	11.7;	1.97;	23.0;	0.69;	0.28;	0.41
30	0.79;	14.9;	1.98;	29.4;	0.88;	0.57;	0.32
60	1.00;	18.8;	1.94;	36.5;	1.10;	1.13;	0.00
120	1.22;	22.9;	1.91;	43.7;	1.31;	2.26;	0.00
240	1.48;	27.8;	1.87;	52.0;	1.56;	4.52;	0.00
360	1.67;	31.4;	1.84;	57.7;	1.73;	6.78;	0.00
600	1.90;	35.7;	1.80;	64.4;	1.93;	11.30;	0.00
1440	2.42;	45.5;	1.74;	79.3;	2.38;	27.13;	0.00

Required storage volume — S_{req} = **0.41** m^3

Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free}$ = **0.95** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 10min 53s

PASS - Soakaway discharge time less than or equal to 24 hours

Appendix G – Foul Sewer Design Sheets

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	446.00	Maximum Backdrop Height (m)	1.500
Persons per House	1.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.000	73.270	1.221	60.0	0.000	14	0.0	1.500	o	150
F2.000	25.825	1.021	25.3	0.000	9	0.0	1.500	o	150
F1.001	17.075	0.114	149.8	0.000	0	0.0	1.500	o	225
F3.000	42.945	0.716	60.0	0.000	3	0.0	1.500	o	150
F1.002	62.450	0.416	150.0	0.000	16	0.0	1.500	o	225
F1.003	5.170	0.034	150.0	0.000	0	0.0	1.500	o	225
F1.004	18.830	0.465	40.5	0.000	5	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	83.150	0.000	0.0	14	0.0	16	0.45	1.13	20.0	0.4
F2.000	82.950	0.000	0.0	9	0.0	10	0.52	1.75	30.9	0.3
F1.001	81.929	0.000	0.0	23	0.0	22	0.36	0.94	37.3	0.7
F3.000	83.000	0.000	0.0	3	0.0	8	0.27	1.13	20.0	0.1
F1.002	81.815	0.000	0.0	42	0.0	29	0.43	0.94	37.2	1.3
F1.003	81.399	0.000	0.0	42	0.0	29	0.43	0.94	37.2	1.3
F1.004	81.364	0.000	0.0	47	0.0	22	0.71	1.81	71.8	1.5

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F4.000	46.605	0.777	60.0	0.000	2	0.0	1.500	o	150
F4.001	23.315	0.623	37.4	0.000	0	0.0	1.500	o	150
F1.005	19.030	0.250	76.1	0.000	0	0.0	1.500	o	225
F1.006	53.125	0.300	177.1	0.000	0	0.0	1.500	o	225
F5.000	49.610	0.827	60.0	0.000	7	0.0	1.500	o	150
F5.001	6.505	0.108	60.0	0.000	1	0.0	1.500	o	150
F5.002	74.525	1.165	64.0	0.000	0	0.0	1.500	o	150
F5.003	85.135	1.703	50.0	0.000	0	0.0	1.500	o	225
F1.007	8.575	0.057	150.0	0.000	0	0.0	1.500	o	225
F1.008	8.295	0.055	150.0	0.000	0	0.0	1.500	o	225
F1.009	48.930	0.327	149.6	0.000	0	0.0	1.500	o	225
F6.000	38.370	0.640	60.0	0.000	6	0.0	1.500	o	150
F6.001	4.485	0.075	59.8	0.000	1	0.0	1.500	o	150
F6.002	66.765	1.128	59.2	0.000	3	0.0	1.500	o	150
F1.010	29.910	0.150	199.4	0.000	4	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F4.000	82.300	0.000	0.0	2	0.0	6	0.24	1.13	20.0	0.1
F4.001	81.523	0.000	0.0	2	0.0	6	0.28	1.44	25.4	0.1
F1.005	80.899	0.000	0.0	49	0.0	27	0.58	1.32	52.3	1.5
F1.006	80.649	0.000	0.0	49	0.0	33	0.43	0.86	34.2	1.5
F5.000	82.850	0.000	0.0	7	0.0	11	0.36	1.13	20.0	0.2
F5.001	82.023	0.000	0.0	8	0.0	12	0.37	1.13	20.0	0.2
F5.002	81.915	0.000	0.0	8	0.0	12	0.37	1.10	19.4	0.2
F5.003	80.750	0.000	0.0	8	0.0	10	0.37	1.63	64.6	0.2
F1.007	79.047	0.000	0.0	57	0.0	34	0.48	0.94	37.2	1.8
F1.008	78.989	0.000	0.0	57	0.0	34	0.48	0.94	37.2	1.8
F1.009	78.934	0.000	0.0	57	0.0	34	0.48	0.94	37.3	1.8
F6.000	80.450	0.000	0.0	6	0.0	11	0.34	1.13	20.0	0.2
F6.001	79.810	0.000	0.0	7	0.0	11	0.36	1.13	20.0	0.2
F6.002	79.735	0.000	0.0	10	0.0	13	0.40	1.14	20.1	0.3
F1.010	78.607	0.000	0.0	71	0.0	40	0.46	0.81	32.3	2.2

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F1.011	61.485	2.008	30.6	0.000	8	0.0	1.500	o	225
F1.012	5.905	0.150	39.4	0.000	0	0.0	1.500	o	225
F1.013	7.825	0.150	52.2	0.000	0	0.0	1.500	o	225
F1.014	49.375	0.329	150.1	0.000	0	0.0	1.500	o	225
F7.000	68.495	2.900	23.6	0.000	8	0.0	1.500	o	150
F1.015	13.385	0.089	150.4	0.000	0	0.0	1.500	o	225
F1.016	60.704	1.642	37.0	0.000	0	0.0	1.500	o	225
F1.017	72.220	3.250	22.2	0.000	0	0.0	1.500	o	225
F1.018	7.845	0.150	52.3	0.000	0	0.0	1.500	o	225
F1.019	36.705	0.500	73.4	0.000	0	0.0	1.500	o	225
F1.020	61.130	0.850	71.9	0.000	8	0.0	1.500	o	225
F1.021	38.358	0.950	40.4	0.000	0	0.0	1.500	o	225
F1.022	28.170	1.050	26.8	0.000	0	0.0	1.500	o	225
F8.000	38.155	1.750	21.8	0.000	6	0.0	1.500	o	150
F9.000	87.145	1.452	60.0	0.000	12	0.0	1.500	o	150

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.011	78.457	0.000	0.0	79	0.0	27	0.92	2.08	82.6	2.4
F1.012	76.449	0.000	0.0	79	0.0	28	0.84	1.83	72.9	2.4
F1.013	76.299	0.000	0.0	79	0.0	30	0.76	1.59	63.3	2.4
F1.014	73.460	0.000	0.0	79	0.0	39	0.53	0.94	37.2	2.4
F7.000	77.350	0.000	0.0	8	0.0	10	0.51	1.81	31.9	0.2
F1.015	73.131	0.000	0.0	87	0.0	41	0.54	0.94	37.2	2.7
F1.016	73.042	0.000	0.0	87	0.0	29	0.89	1.89	75.2	2.7
F1.017	71.400	0.000	0.0	87	0.0	26	1.06	2.44	97.1	2.7
F1.018	68.150	0.000	0.0	87	0.0	32	0.78	1.59	63.2	2.7
F1.019	68.000	0.000	0.0	87	0.0	35	0.70	1.34	53.3	2.7
F1.020	67.500	0.000	0.0	95	0.0	36	0.72	1.35	53.9	2.9
F1.021	66.650	0.000	0.0	95	0.0	31	0.88	1.81	71.9	2.9
F1.022	65.700	0.000	0.0	95	0.0	28	1.02	2.22	88.3	2.9
F8.000	76.650	0.000	0.0	6	0.0	8	0.48	1.88	33.3	0.2
F9.000	75.550	0.000	0.0	12	0.0	14	0.42	1.13	20.0	0.4

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F8.001	43.415	1.809	24.0	0.000	3	0.0	1.500	o	225
F10.000	43.325	0.722	60.0	0.000	7	0.0	1.500	o	150
F8.002	25.755	0.129	199.7	0.000	0	0.0	1.500	o	225
F8.003	5.810	0.029	200.3	0.000	0	0.0	1.500	o	225
F8.004	28.475	0.654	43.5	0.000	0	0.0	1.500	o	225
F8.005	67.060	2.794	24.0	0.000	0	0.0	1.500	o	225
F8.006	5.336	0.222	24.0	0.000	0	0.0	1.500	o	225
F8.007	4.515	0.023	196.3	0.000	0	0.0	1.500	o	225
F11.000	54.485	0.908	60.0	0.000	10	0.0	1.500	o	150
F11.001	10.625	0.071	149.6	0.000	5	0.0	1.500	o	150
F11.002	39.705	0.265	149.8	0.000	8	0.0	1.500	o	225
F8.008	68.055	2.856	23.8	0.000	22	0.0	1.500	o	225
F8.009	83.800	0.419	200.0	0.000	16	0.0	1.500	o	225
F12.000	88.345	3.250	27.2	0.000	16	0.0	1.500	o	150

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F8.001	72.787	0.000	0.0	21	0.0	14	0.66	2.35	93.4	0.7
F10.000	71.700	0.000	0.0	7	0.0	11	0.36	1.13	20.0	0.2
F8.002	70.978	0.000	0.0	28	0.0	26	0.35	0.81	32.2	0.9
F8.003	70.849	0.000	0.0	28	0.0	26	0.35	0.81	32.2	0.9
F8.004	70.820	0.000	0.0	28	0.0	18	0.59	1.74	69.3	0.9
F8.005	70.166	0.000	0.0	28	0.0	16	0.72	2.35	93.4	0.9
F8.006	67.372	0.000	0.0	28	0.0	16	0.72	2.35	93.3	0.9
F8.007	67.150	0.000	0.0	28	0.0	25	0.35	0.82	32.5	0.9
F11.000	68.100	0.000	0.0	10	0.0	13	0.40	1.13	20.0	0.3
F11.001	67.192	0.000	0.0	15	0.0	20	0.33	0.72	12.6	0.5
F11.002	67.121	0.000	0.0	23	0.0	22	0.36	0.94	37.2	0.7
F8.008	66.856	0.000	0.0	73	0.0	24	0.97	2.36	93.7	2.3
F8.009	64.000	0.000	0.0	89	0.0	45	0.49	0.81	32.2	2.8
F12.000	67.400	0.000	0.0	16	0.0	14	0.61	1.68	29.8	0.5

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F8.010	68.915	0.345	200.0	0.000	0	0.0	1.500	o	225
F13.000	35.265	1.350	26.1	0.000	10	0.0	1.500	o	150
F8.011	68.915	0.345	200.0	0.000	0	0.0	1.500	o	225
F1.023	72.305	0.362	200.0	0.000	0	0.0	1.500	o	225
F14.000	50.730	0.800	63.4	0.000	10	0.0	1.500	o	150
F15.000	44.620	1.550	28.8	0.000	0	0.0	1.500	o	150
F15.001	6.065	0.400	15.2	0.000	0	0.0	1.500	o	150
F14.001	13.437	0.200	67.2	0.000	0	0.0	1.500	o	150
F14.002	28.165	0.952	29.6	0.000	16	0.0	1.500	o	225
F1.024	73.250	0.366	200.0	0.000	0	0.0	1.500	o	225
F16.000	41.465	1.250	33.2	0.000	12	0.0	1.500	o	150

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F8.010	63.581	0.000	0.0	105	0.0	48	0.52	0.81	32.2	3.3
F13.000	66.500	0.000	0.0	10	0.0	11	0.53	1.72	30.4	0.3
F8.011	63.236	0.000	0.0	115	0.0	51	0.53	0.81	32.2	3.6
F1.023	62.892	0.000	0.0	210	0.0	69	0.63	0.81	32.2	6.5
F14.000	64.750	0.000	0.0	10	0.0	14	0.39	1.10	19.5	0.3
F15.000	65.750	0.000	0.0	0	0.0	0	0.00	1.64	28.9	0.0
F15.001	64.200	0.000	0.0	0	0.0	0	0.00	2.26	39.9	0.0
F14.001	63.800	0.000	0.0	10	0.0	14	0.39	1.07	18.9	0.3
F14.002	63.600	0.000	0.0	26	0.0	16	0.66	2.11	84.1	0.8
F1.024	62.530	0.000	0.0	236	0.0	73	0.66	0.81	32.2	7.3
F16.000	63.250	0.000	0.0	12	0.0	13	0.52	1.52	26.9	0.4

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	DWF (l/s)	k (mm)	HYD SECT	DIA (mm)
F17.000	17.145	0.286	59.9	0.000	0	0.0	1.500	o	150
F17.001	13.950	0.093	150.0	0.000	0	0.0	1.500	o	150
F1.025	5.640	0.235	24.0	0.000	0	0.0	1.500	o	225
F1.026	37.015	1.542	24.0	0.000	0	0.0	1.500	o	225
F1.027	5.301	0.221	24.0	0.000	0	0.0	1.500	o	225
F1.028	9.405	0.392	24.0	0.000	0	0.0	1.500	o	225

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ DWF (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F17.000	61.400	0.000	0.0	0	0.0	0	0.00	1.13	20.0	0.0
F17.001	61.114	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
F1.025	61.021	0.000	0.0	248	0.0	44	1.42	2.35	93.4	7.7
F1.026	59.042	0.000	0.0	248	0.0	44	1.42	2.35	93.4	7.7
F1.027	54.721	0.000	0.0	248	0.0	44	1.42	2.35	93.4	7.7
F1.028	52.562	0.000	0.0	248	0.0	44	1.42	2.35	93.4	7.7

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
FF2.129	85.000	1.850	1200	F1.000	83.150	150				
FF2.130	84.800	1.850	1200	F2.000	82.950	150				
FF2.128	84.650	2.721	1200	F1.001	81.929	225	F1.000	81.929	150	
							F2.000	81.929	150	
FF2.131	84.350	1.350	1050	F3.000	83.000	150				
FF2.127	84.400	2.585	1200	F1.002	81.815	225	F1.001	81.815	225	
							F3.000	82.284	150	394
FF2.126	83.550	2.151	1200	F1.003	81.399	225	F1.002	81.399	225	
FF2.125	83.450	2.086	1200	F1.004	81.364	225	F1.003	81.364	225	
FF2.133	83.350	1.050	1050	F4.000	82.300	150				
FF2.132	82.600	1.077	1050	F4.001	81.523	150	F4.000	81.523	150	
FF2.124	82.750	1.851	1200	F1.005	80.899	225	F1.004	80.899	225	
							F4.001	80.900	150	
FF2.123	82.500	1.851	1200	F1.006	80.649	225	F1.005	80.649	225	
FF2.137	84.700	1.850	1200	F5.000	82.850	150				
FF2.136	84.200	2.177	1200	F5.001	82.023	150	F5.000	82.023	150	
FF2.135	84.100	2.185	1200	F5.002	81.915	150	F5.001	81.915	150	
FF2.134	82.600	1.850	1200	F5.003	80.750	225	F5.002	80.750	150	
FF2.122	82.200	3.153	1200	F1.007	79.047	225	F1.006	80.349	225	1303
							F5.003	79.047	225	
FF2.121	82.000	3.011	1200	F1.008	78.989	225	F1.007	78.989	225	
FF2.120	81.700	2.766	1200	F1.009	78.934	225	F1.008	78.934	225	
FF2.140	82.300	1.850	1200	F6.000	80.450	150				
FF2.139	82.100	2.290	1200	F6.001	79.810	150	F6.000	79.810	150	
FF2.138	82.050	2.315	1200	F6.002	79.735	150	F6.001	79.735	150	
FF2.119	81.750	3.143	1200	F1.010	78.607	225	F1.009	78.607	225	
							F6.002	78.607	150	
FF2.118	81.350	2.893	1200	F1.011	78.457	225	F1.010	78.457	225	
FF2.117	78.300	1.851	1200	F1.012	76.449	225	F1.011	76.449	225	
FF2.116	78.150	1.851	1200	F1.013	76.299	225	F1.012	76.299	225	
FF2.115	78.000	4.540	1200	F1.014	73.460	225	F1.013	76.149	225	2689
FF2.141	79.200	1.850	1200	F7.000	77.350	150				
FF2.114	76.300	3.169	1200	F1.015	73.131	225	F1.014	73.131	225	
							F7.000	74.450	150	1244
FF2.113	75.750	2.708	1200	F1.016	73.042	225	F1.015	73.042	225	
FF2.111	73.250	1.850	1200	F1.017	71.400	225	F1.016	71.400	225	
FF2.110	70.000	1.850	1200	F1.018	68.150	225	F1.017	68.150	225	
FF2.109	69.850	1.850	1200	F1.019	68.000	225	F1.018	68.000	225	
FF2.108	69.350	1.850	1200	F1.020	67.500	225	F1.019	67.500	225	
FF2.107	68.500	1.850	1200	F1.021	66.650	225	F1.020	66.650	225	
FF2.106	67.550	1.850	1200	F1.022	65.700	225	F1.021	65.700	225	
FF2.154	78.500	1.850	1200	F8.000	76.650	150				
FF2.155	77.400	1.850	1200	F9.000	75.550	150				
FF2.153	76.750	3.963	1200	F8.001	72.787	225	F8.000	74.900	150	2038
							F9.000	74.098	150	1236
FF2.152	73.050	1.350	1050	F10.000	71.700	150				

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Diam.,L*W (mm)	PN (Pipe Out)	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN (Pipes In)	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
FF2.151	73.275	2.297	1200	F8.002	70.978	225	F8.001	70.978	225	
							F10.000	70.978	150	
FF2.150	73.400	2.551	1200	F8.003	70.849	225	F8.002	70.849	225	
FF2.149	73.450	2.630	1200	F8.004	70.820	225	F8.003	70.820	225	
FF2.148	72.500	2.334	1200	F8.005	70.166	225	F8.004	70.166	225	
FF2.147	69.300	1.928	1200	F8.006	67.372	225	F8.005	67.372	225	
FF2.146	69.000	1.850	1200	F8.007	67.150	225	F8.006	67.150	225	
FF2.158	69.950	1.850	1200	F11.000	68.100	150				
FF2.157	69.500	2.308	1200	F11.001	67.192	150	F11.000	67.192	150	
FF2.156	69.400	2.279	1200	F11.002	67.121	225	F11.001	67.121	150	
FF2.145	69.050	2.194	1200	F8.008	66.856	225	F8.007	67.127	225	271
							F11.002	66.856	225	
FF2.144	65.500	1.500	1050	F8.009	64.000	225	F8.008	64.000	225	
FF2.159	69.250	1.850	1200	F12.000	67.400	150				
FF2.143	66.000	2.419	1200	F8.010	63.581	225	F8.009	63.581	225	
							F12.000	64.150	150	494
FF2.160	68.350	1.850	1200	F13.000	66.500	150				
FF2.142	67.000	3.764	1200	F8.011	63.236	225	F8.010	63.236	225	
							F13.000	65.150	150	1839
FF2.105	66.500	3.608	1200	F1.023	62.892	225	F1.022	64.650	225	1758
							F8.011	62.892	225	
FF2.163	66.100	1.350	1050	F14.000	64.750	150				
FF2.165	67.250	1.500	1050	F15.000	65.750	150				
FF2.164	65.700	1.500	1050	F15.001	64.200	150	F15.000	64.200	150	
FF2.162	65.300	1.500	1050	F14.001	63.800	150	F14.000	63.950	150	150
							F15.001	63.800	150	
FF2.161	65.450	1.850	1200	F14.002	63.600	225	F14.001	63.600	150	
FF2.104	64.500	1.970	1200	F1.024	62.530	225	F1.023	62.530	225	
							F14.002	62.648	225	118
FF2.167	64.600	1.350	1050	F16.000	63.250	150				
FF2.168	63.250	1.850	1200	F17.000	61.400	150				
FF2.166	63.500	2.386	1200	F17.001	61.114	150	F17.000	61.114	150	
FF2.103	63.000	1.979	1200	F1.025	61.021	225	F1.024	62.164	225	1143
							F16.000	62.000	150	904
							F17.001	61.021	150	
FF2.102	62.500	3.458	1200	F1.026	59.042	225	F1.025	60.786	225	1744
FF2.101	59.000	4.279	1200	F1.027	54.721	225	F1.026	57.500	225	2779
FF2.100	56.000	3.438	1200	F1.028	52.562	225	F1.027	54.500	225	1938
FExis FS.001	55.370	3.200	0		OUTFALL		F1.028	52.170	225	

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	o	150	FF2.129	85.000	83.150	1.700	1200
F2.000	o	150	FF2.130	84.800	82.950	1.700	1200
F1.001	o	225	FF2.128	84.650	81.929	2.496	1200
F3.000	o	150	FF2.131	84.350	83.000	1.200	1050
F1.002	o	225	FF2.127	84.400	81.815	2.360	1200
F1.003	o	225	FF2.126	83.550	81.399	1.926	1200
F1.004	o	225	FF2.125	83.450	81.364	1.861	1200
F4.000	o	150	FF2.133	83.350	82.300	0.900	1050
F4.001	o	150	FF2.132	82.600	81.523	0.927	1050
F1.005	o	225	FF2.124	82.750	80.899	1.626	1200
F1.006	o	225	FF2.123	82.500	80.649	1.626	1200
F5.000	o	150	FF2.137	84.700	82.850	1.700	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.000	73.270	60.0	FF2.128	84.650	81.929	2.571	1200
F2.000	25.825	25.3	FF2.128	84.650	81.929	2.571	1200
F1.001	17.075	149.8	FF2.127	84.400	81.815	2.360	1200
F3.000	42.945	60.0	FF2.127	84.400	82.284	1.966	1200
F1.002	62.450	150.0	FF2.126	83.550	81.399	1.926	1200
F1.003	5.170	150.0	FF2.125	83.450	81.364	1.861	1200
F1.004	18.830	40.5	FF2.124	82.750	80.899	1.626	1200
F4.000	46.605	60.0	FF2.132	82.600	81.523	0.927	1050
F4.001	23.315	37.4	FF2.124	82.750	80.900	1.700	1200
F1.005	19.030	76.1	FF2.123	82.500	80.649	1.626	1200
F1.006	53.125	177.1	FF2.122	82.200	80.349	1.626	1200
F5.000	49.610	60.0	FF2.136	84.200	82.023	2.027	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F5.001	o	150	FF2.136	84.200	82.023	2.027	1200
F5.002	o	150	FF2.135	84.100	81.915	2.035	1200
F5.003	o	225	FF2.134	82.600	80.750	1.625	1200
F1.007	o	225	FF2.122	82.200	79.047	2.928	1200
F1.008	o	225	FF2.121	82.000	78.989	2.786	1200
F1.009	o	225	FF2.120	81.700	78.934	2.541	1200
F6.000	o	150	FF2.140	82.300	80.450	1.700	1200
F6.001	o	150	FF2.139	82.100	79.810	2.140	1200
F6.002	o	150	FF2.138	82.050	79.735	2.165	1200
F1.010	o	225	FF2.119	81.750	78.607	2.918	1200
F1.011	o	225	FF2.118	81.350	78.457	2.668	1200
F1.012	o	225	FF2.117	78.300	76.449	1.626	1200
F1.013	o	225	FF2.116	78.150	76.299	1.626	1200
F1.014	o	225	FF2.115	78.000	73.460	4.315	1200
F7.000	o	150	FF2.141	79.200	77.350	1.700	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F5.001	6.505	60.0	FF2.135	84.100	81.915	2.035	1200
F5.002	74.525	64.0	FF2.134	82.600	80.750	1.700	1200
F5.003	85.135	50.0	FF2.122	82.200	79.047	2.928	1200
F1.007	8.575	150.0	FF2.121	82.000	78.989	2.786	1200
F1.008	8.295	150.0	FF2.120	81.700	78.934	2.541	1200
F1.009	48.930	149.6	FF2.119	81.750	78.607	2.918	1200
F6.000	38.370	60.0	FF2.139	82.100	79.810	2.140	1200
F6.001	4.485	59.8	FF2.138	82.050	79.735	2.165	1200
F6.002	66.765	59.2	FF2.119	81.750	78.607	2.993	1200
F1.010	29.910	199.4	FF2.118	81.350	78.457	2.668	1200
F1.011	61.485	30.6	FF2.117	78.300	76.449	1.626	1200
F1.012	5.905	39.4	FF2.116	78.150	76.299	1.626	1200
F1.013	7.825	52.2	FF2.115	78.000	76.149	1.626	1200
F1.014	49.375	150.1	FF2.114	76.300	73.131	2.944	1200
F7.000	68.495	23.6	FF2.114	76.300	74.450	1.700	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.015	o	225	FF2.114	76.300	73.131	2.944	1200
F1.016	o	225	FF2.113	75.750	73.042	2.483	1200
F1.017	o	225	FF2.111	73.250	71.400	1.625	1200
F1.018	o	225	FF2.110	70.000	68.150	1.625	1200
F1.019	o	225	FF2.109	69.850	68.000	1.625	1200
F1.020	o	225	FF2.108	69.350	67.500	1.625	1200
F1.021	o	225	FF2.107	68.500	66.650	1.625	1200
F1.022	o	225	FF2.106	67.550	65.700	1.625	1200
F8.000	o	150	FF2.154	78.500	76.650	1.700	1200
F9.000	o	150	FF2.155	77.400	75.550	1.700	1200
F8.001	o	225	FF2.153	76.750	72.787	3.738	1200
F10.000	o	150	FF2.152	73.050	71.700	1.200	1050
F8.002	o	225	FF2.151	73.275	70.978	2.072	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.015	13.385	150.4	FF2.113	75.750	73.042	2.483	1200
F1.016	60.704	37.0	FF2.111	73.250	71.400	1.625	1200
F1.017	72.220	22.2	FF2.110	70.000	68.150	1.625	1200
F1.018	7.845	52.3	FF2.109	69.850	68.000	1.625	1200
F1.019	36.705	73.4	FF2.108	69.350	67.500	1.625	1200
F1.020	61.130	71.9	FF2.107	68.500	66.650	1.625	1200
F1.021	38.358	40.4	FF2.106	67.550	65.700	1.625	1200
F1.022	28.170	26.8	FF2.105	66.500	64.650	1.625	1200
F8.000	38.155	21.8	FF2.153	76.750	74.900	1.700	1200
F9.000	87.145	60.0	FF2.153	76.750	74.098	2.502	1200
F8.001	43.415	24.0	FF2.151	73.275	70.978	2.072	1200
F10.000	43.325	60.0	FF2.151	73.275	70.978	2.147	1200
F8.002	25.755	199.7	FF2.150	73.400	70.849	2.326	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F8.003	o	225	FF2.150	73.400	70.849	2.326	1200
F8.004	o	225	FF2.149	73.450	70.820	2.405	1200
F8.005	o	225	FF2.148	72.500	70.166	2.109	1200
F8.006	o	225	FF2.147	69.300	67.372	1.703	1200
F8.007	o	225	FF2.146	69.000	67.150	1.625	1200
F11.000	o	150	FF2.158	69.950	68.100	1.700	1200
F11.001	o	150	FF2.157	69.500	67.192	2.158	1200
F11.002	o	225	FF2.156	69.400	67.121	2.054	1200
F8.008	o	225	FF2.145	69.050	66.856	1.969	1200
F8.009	o	225	FF2.144	65.500	64.000	1.275	1050
F12.000	o	150	FF2.159	69.250	67.400	1.700	1200
F8.010	o	225	FF2.143	66.000	63.581	2.194	1200
F13.000	o	150	FF2.160	68.350	66.500	1.700	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F8.003	5.810	200.3	FF2.149	73.450	70.820	2.405	1200
F8.004	28.475	43.5	FF2.148	72.500	70.166	2.109	1200
F8.005	67.060	24.0	FF2.147	69.300	67.372	1.703	1200
F8.006	5.336	24.0	FF2.146	69.000	67.150	1.625	1200
F8.007	4.515	196.3	FF2.145	69.050	67.127	1.698	1200
F11.000	54.485	60.0	FF2.157	69.500	67.192	2.158	1200
F11.001	10.625	149.6	FF2.156	69.400	67.121	2.129	1200
F11.002	39.705	149.8	FF2.145	69.050	66.856	1.969	1200
F8.008	68.055	23.8	FF2.144	65.500	64.000	1.275	1050
F8.009	83.800	200.0	FF2.143	66.000	63.581	2.194	1200
F12.000	88.345	27.2	FF2.143	66.000	64.150	1.700	1200
F8.010	68.915	200.0	FF2.142	67.000	63.236	3.539	1200
F13.000	35.265	26.1	FF2.142	67.000	65.150	1.700	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F8.011	o	225	FF2.142	67.000	63.236	3.539	1200
F1.023	o	225	FF2.105	66.500	62.892	3.383	1200
F14.000	o	150	FF2.163	66.100	64.750	1.200	1050
F15.000	o	150	FF2.165	67.250	65.750	1.350	1050
F15.001	o	150	FF2.164	65.700	64.200	1.350	1050
F14.001	o	150	FF2.162	65.300	63.800	1.350	1050
F14.002	o	225	FF2.161	65.450	63.600	1.625	1200
F1.024	o	225	FF2.104	64.500	62.530	1.745	1200
F16.000	o	150	FF2.167	64.600	63.250	1.200	1050
F17.000	o	150	FF2.168	63.250	61.400	1.700	1200
F17.001	o	150	FF2.166	63.500	61.114	2.236	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F8.011	68.915	200.0	FF2.105	66.500	62.892	3.383	1200
F1.023	72.305	200.0	FF2.104	64.500	62.530	1.745	1200
F14.000	50.730	63.4	FF2.162	65.300	63.950	1.200	1050
F15.000	44.620	28.8	FF2.164	65.700	64.200	1.350	1050
F15.001	6.065	15.2	FF2.162	65.300	63.800	1.350	1050
F14.001	13.437	67.2	FF2.161	65.450	63.600	1.700	1200
F14.002	28.165	29.6	FF2.104	64.500	62.648	1.627	1200
F1.024	73.250	200.0	FF2.103	63.000	62.164	0.611	1200
F16.000	41.465	33.2	FF2.103	63.000	62.000	0.850	1200
F17.000	17.145	59.9	FF2.166	63.500	61.114	2.236	1200
F17.001	13.950	150.0	FF2.103	63.000	61.021	1.829	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.025	o	225	FF2.103	63.000	61.021	1.754	1200
F1.026	o	225	FF2.102	62.500	59.042	3.233	1200
F1.027	o	225	FF2.101	59.000	54.721	4.054	1200
F1.028	o	225	FF2.100	56.000	52.562	3.213	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH DIAM., L*W (mm)
F1.025	5.640	24.0	FF2.102	62.500	60.786	1.489	1200
F1.026	37.015	24.0	FF2.101	59.000	57.500	1.275	1200
F1.027	5.301	24.0	FF2.100	56.000	54.500	1.275	1200
F1.028	9.405	24.0	FExis FS.001	55.370	52.170	2.975	0

Free Flowing Outfall Details for Foul - Main

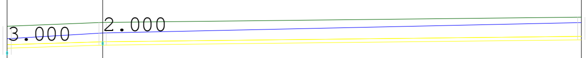
Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.028	FExis FS.001	55.370	52.170	52.170	0	0

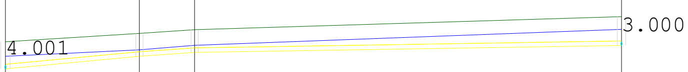
Simulation Criteria for Foul - Main

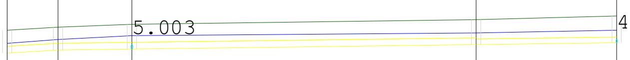
Volumetric Runoff Coeff	0.750	Foul Sewage per hectare (l/s)	0.000
PIMP (% impervious)	100	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Run Time (mins)	60
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

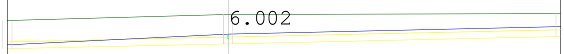
Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

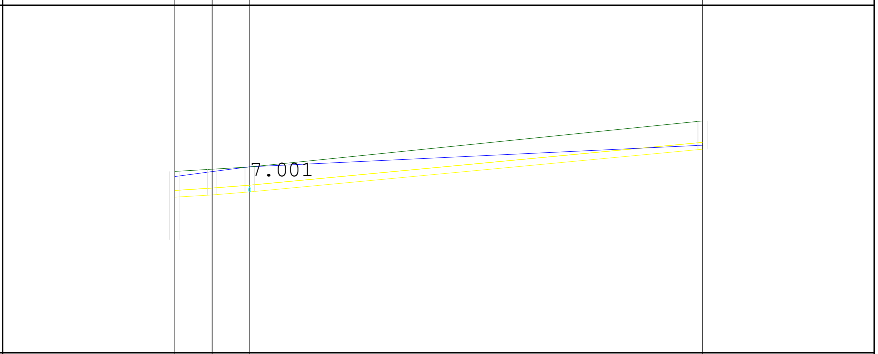
Appendix H – Storm Water Longitudinal Sections

MH Name	SS2.122	SS2.123	SS2.124	
Hor Scale 1100 Ver Scale 500 Datum (m)72.000				
PN		S1.001	S1.000	
Dia (mm)		225	225	
Slope (1:X)		69.5	198.8	
Cover Level (m)	84.400	84.650	85.000	
Invert Level (m)		82.950 83.150	83.150 83.500	
Length (m)		13.900	69.590	

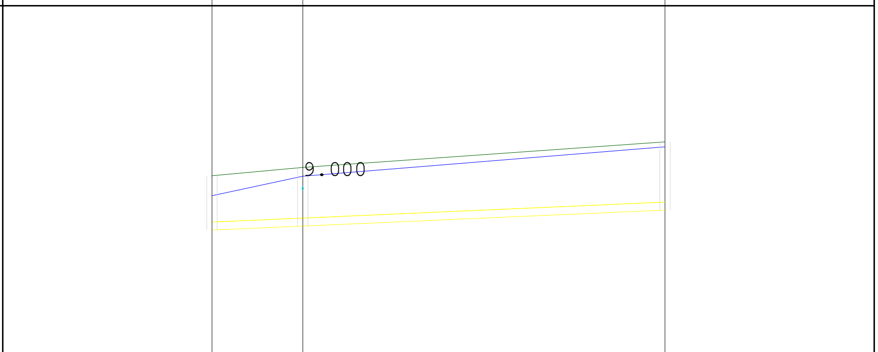
MH Name	SS2.119	SS2.120		SS2.122	
Hor Scale 1100 Ver Scale 500 Datum (m)71.000					
PN		S1.004		S1.002	
Dia (mm)		300		300	
Slope (1:X)		23.6		135.0	
Cover Level (m)	82.750	83.300	83.550	84.400	
Invert Level (m)		80.974 81.800	81.800 82.050	82.050 82.510	
Length (m)		19.490		62.105	

MH Name	SS2.115			SS2.118	SS2.119	
Hor Scale 1100 Ver Scale 500 Datum (m)70.000						
PN				S1.006	S1.005	
Dia (mm)				450	375	
Slope (1:X)				167.1	166.5	
Cover Level (m)	81.800	82.000	82.200	82.500	82.750	
Invert Level (m)		80.487	80.487 80.551	80.551 80.851	80.851 80.974	
Length (m)				50.120	20.480	

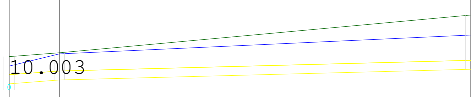
MH Name	SS2.113	SS2.114	SS2.115	
Hor Scale 1100 Ver Scale 500 Datum (m)69.000				
PN		S1.010	S1.009	
Dia (mm)		450	450	
Slope (1:X)		99.9	100.0	
Cover Level (m)	81.350	81.750	81.800	
Invert Level (m)		79.480 79.802	79.802 80.286	
Length (m)		32.155	48.415	



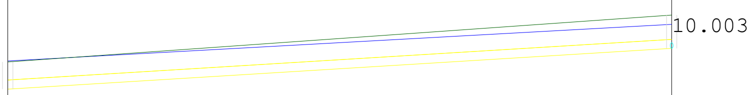
MH Name	SS2.111			SS2.113	
Hor Scale 1100 Ver Scale 500 Datum (m)66.000					
PN				S1.011	
Dia (mm)				450	
Slope (1:X)				23.3	
Cover Level (m)	78.000	78.150	78.300	81.350	
Invert Level (m)		76.450	76.650	76.650 79.480	
Length (m)				65.870	



MH Name	SS2.109		SS2.111	
Hor Scale 1100 Ver Scale 500 Datum (m)64.000				
PN			S1.014	
Dia (mm)			525	
Slope (1:X)			50.0	
Cover Level (m)	75.750	76.300	78.000	
Invert Level (m)		72.159 72.423	72.423 73.477	
Length (m)			52.685	

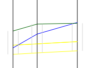


MH Name	SS2.107		SS2.109	
Hor Scale 1100 Ver Scale 500 Datum (m)62.000				
PN			S1.016	
Dia (mm)			600	
Slope (1:X)			84.5	
Cover Level (m)	73.000	73.250	75.750	
Invert Level (m)		71.450	71.450 72.159	
Length (m)			59.880	

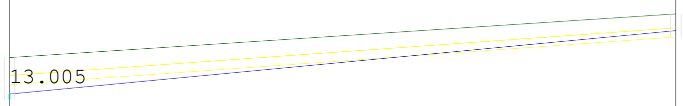


MH Name	SS2.106	SS2.107	
Hor Scale 1100 Ver Scale 500 Datum (m)59.000			
PN		S1.018	
Dia (mm)		600	
Slope (1:X)		35.9	
Cover Level (m)	69.900	73.000	
Invert Level (m)		68.099 70.791	
Length (m)		96.615	

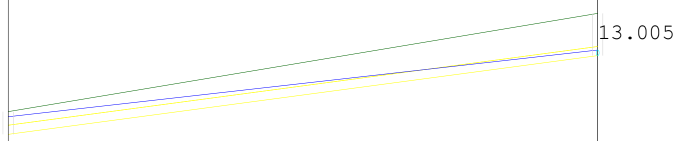
MH Name	SS2.104		
Hor Scale 1100 Ver Scale 500 Datum (m)57.000			
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	69.400	69.900	
Invert Level (m)		68.099	
Length (m)			



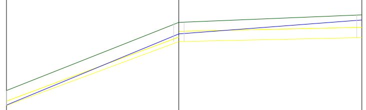
MH Name	SS2.103		SS2.104
Hor Scale 1100 Ver Scale 500 Datum (m)55.000			
PN		S1.021	
Dia (mm)		600	
Slope (1:X)		30.6	
Cover Level (m)	66.500		69.400
Invert Level (m)	64.699		67.865
Length (m)		96.945	



MH Name	SS2.102		SS2.103
Hor Scale 1100 Ver Scale 500 Datum (m)51.000			
PN		S1.022	
Dia (mm)		600	
Slope (1:X)		16.5	
Cover Level (m)	60.000		66.500
Invert Level (m)	58.500		63.702
Length (m)		85.715	

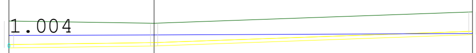


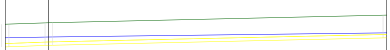
MH Name	SS2.100		SS2.101		SS2.102
Hor Scale 1100 Ver Scale 500 Datum (m)45.000					
PN		S1.024		S1.023	
Dia (mm)		300		675	
Slope (1:X)		5.9		100.1	
Cover Level (m)	55.000		59.500		60.000
Invert Level (m)	54.000		58.234 / 58.234		58.500
Length (m)		25.090		26.630	

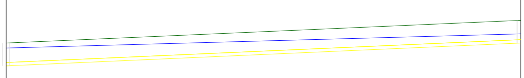


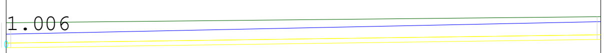
MH Name	SS2.123	SS2.125	
Hor Scale 1100 Ver Scale 500 Datum (m)72.000		1.000	
PN		S2.000	
Dia (mm)		225	
Slope (1:X)		174.6	
Cover Level (m)	84.650	84.800	
Invert Level (m)		83.150 83.300	
Length (m)		26.185	

MH Name	SS2.122	SS2.126	
Hor Scale 1100 Ver Scale 500 Datum (m)72.000		1.001	
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		167.0	
Cover Level (m)	84.400	84.350	
Invert Level (m)		82.510 82.850	
Length (m)		56.765	

MH Name	SS2.119	SS2.127	SS2.128	
Hor Scale 1100 Ver Scale 500 Datum (m)71.000		 1.004		
PN		S4.001	S4.000	
Dia (mm)		225	225	
Slope (1:X)		167.6	61.8	
Cover Level (m)	82.750	82.600	83.350	
Invert Level (m)		80.974 81.100	81.100 81.850	
Length (m)		21.120	46.320	

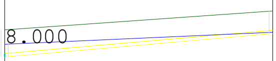
MH Name	SS2.130		SS2.132	
Hor Scale 1100 Ver Scale 500 Datum (m)72.000				
PN			S5.000	
Dia (mm)			225	
Slope (1:X)			98.5	
Cover Level (m)	84.100	84.200	84.700	
Invert Level (m)		82.700	82.700 83.200	
Length (m)			49.250	

MH Name	SS2.129		SS2.130
Hor Scale 1100 Ver Scale 500 Datum (m)71.000			
PN		S5.002	
Dia (mm)		225	
Slope (1:X)		50.0	
Cover Level (m)	82.600		84.100
Invert Level (m)	81.100		82.600
Length (m)		74.945	

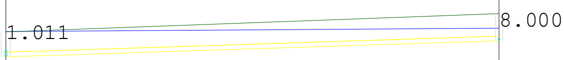
MH Name	SS2.117		SS2.129
Hor Scale 1100 Ver Scale 500 Datum (m)70.000			
PN		S5.003	
Dia (mm)		300	
Slope (1:X)		157.4	
Cover Level (m)	82.200		82.600
Invert Level (m)	80.551		81.100
Length (m)		86.440	

MH Name	SS2.133	SS2.135
Hor Scale 1100 Ver Scale 500 Datum (m) 70.000		
PN	S6.000	
Dia (mm)	225	
Slope (1:X)	166.8	
Cover Level (m)	82.050	82.300
Invert Level (m)	80.550	80.800
Length (m)	41.695	

MH Name	SS2.114	SS2.133
Hor Scale 1100 Ver Scale 500 Datum (m) 69.000	1.009	
PN	S6.002	
Dia (mm)	225	
Slope (1:X)	167.1	
Cover Level (m)	81.750	82.050
Invert Level (m)	80.147	80.529
Length (m)	63.845	



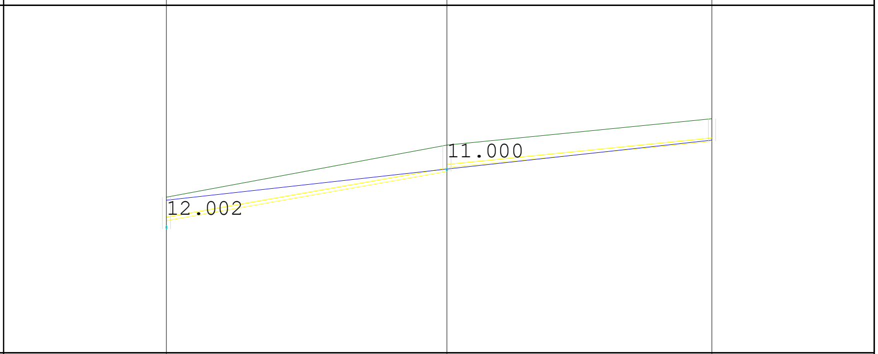
MH Name	SS2.135	SS2.137
Hor Scale 1100 Ver Scale 500 Datum (m) 68.000		
PN	S7.000	
Dia (mm)	225	
Slope (1:X)	25.3	
Cover Level (m)	79.500	80.750
Invert Level (m)	77.707	79.250
Length (m)	38.995	



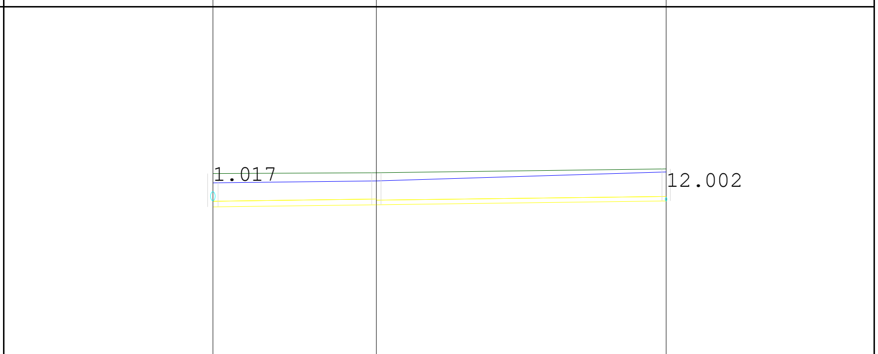
MH Name	SS2.112	SS2.135
Hor Scale 1100 Ver Scale 500 Datum (m) 67.000		
PN	S7.001	
Dia (mm)	300	
Slope (1:X)	67.8	
Cover Level (m)	78.300	79.500
Invert Level (m)	76.650	77.707
Length (m)	71.700	

MH Name	SS2.135		
Hor Scale 1100 Ver Scale 500 Datum (m) 67.000		7.000	
PN			
Dia (mm)			
Slope (1:X)			
Cover Level (m)	79.500	79.250	
Invert Level (m)		77.750	
Length (m)			

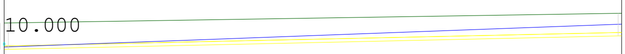
MH Name	SS2.110	SS2.138	
Hor Scale 1100 Ver Scale 500 Datum (m) 64.000		1.014	
PN		S9.000	
Dia (mm)		225	
Slope (1:X)		25.5	
Cover Level (m)	76.300	79.000	
Invert Level (m)	74.800	77.500	
Length (m)		68.925	



MH Name	SS2.140	SS2.141	SS2.143	
Hor Scale 1100 Ver Scale 500 Datum (m) 63.000				
PN		S10.001	S10.000	
Dia (mm)		225	225	
Slope (1:X)		12.6	22.1	
Cover Level (m)	73.300	76.750	78.500	
Invert Level (m)		71.750 / 75.002	75.250 / 77.000	
Length (m)		40.825	38.590	

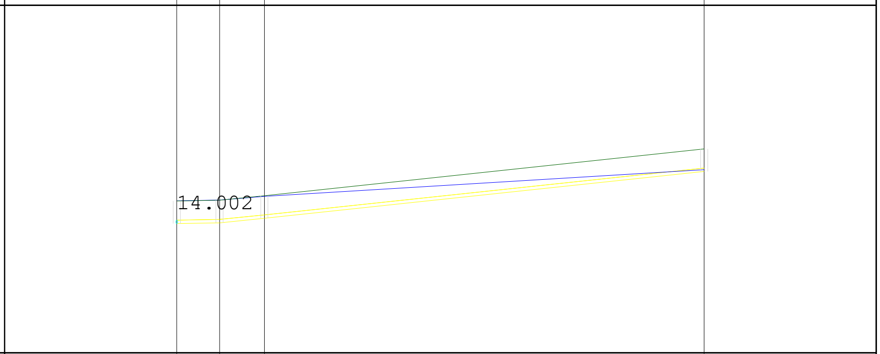


MH Name	SS2.107	SS2.139	SS2.140	
Hor Scale 1100 Ver Scale 500 Datum (m) 61.000				
PN		S10.003	S10.002	
Dia (mm)		375	300	
Slope (1:X)		166.4	166.8	
Cover Level (m)	73.000	73.050	73.300	
Invert Level (m)		70.791 / 70.934	70.934 / 71.187	
Length (m)		23.800	42.189	

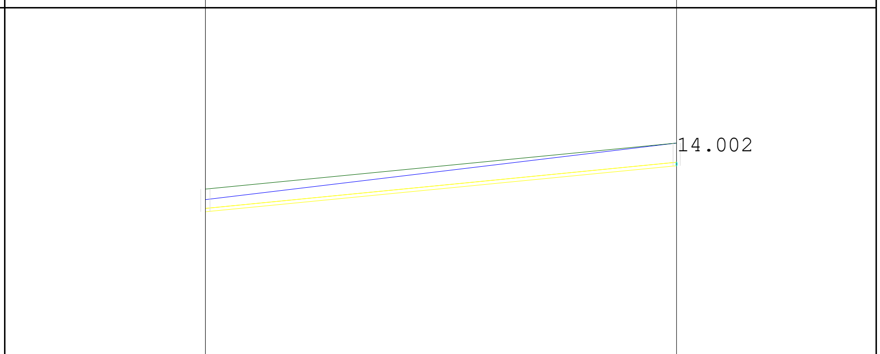
MH Name	SS2.141		SS2.142
Hor Scale 1100 Ver Scale 500 Datum (m) 65.000			
PN		S11.000	
Dia (mm)		225	
Slope (1:X)		100.1	
Cover Level (m)	76.750		77.400
Invert Level (m)	75.002		75.900
Length (m)		89.845	

MH Name	SS2.140		SS2.144				SS2.146
Hor Scale 1100 Ver Scale 500 Datum (m) 61.000							
PN		S12.002				S12.000	
Dia (mm)		225				225	
Slope (1:X)		167.4				166.3	
Cover Level (m)	73.300		73.400		73.450		73.000
Invert Level (m)	71.187		71.338 71.338		71.386 71.386		71.500
Length (m)		25.270				18.955	

MH Name	SS2.149			SS2.152	
Hor Scale 1100 Ver Scale 500 Datum (m)59.000					
PN				S13.000	
Dia (mm)				225	
Slope (1:X)				20.6	
Cover Level (m)	69.050	69.100	69.400	72.500	
Invert Level (m)		67.600	67.900	67.900 71.000	
Length (m)				63.950	



MH Name	SS2.148	SS2.149	
Hor Scale 1100 Ver Scale 500 Datum (m)55.000			
PN		S13.003	
Dia (mm)		225	
Slope (1:X)		22.5	
Cover Level (m)	66.000	69.050	
Invert Level (m)		64.500 67.550	
Length (m)		68.520	



Hor Scale 1100

Ver Scale 500

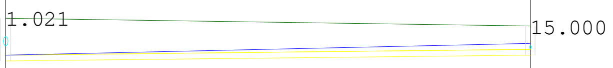
Datum (m) 54.000

MH Name	SS2.147		SS2.148
PN		S13.004	
Dia (mm)		375	
Slope (1:X)		200.2	
Cover Level (m)	66.000		66.000
Invert Level (m)	64.084		64.500
Length (m)		83.280	

Hor Scale 1100

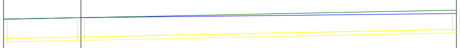
Ver Scale 500

Datum (m) 54.000

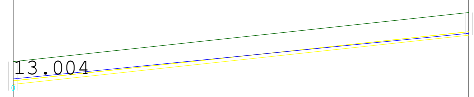


MH Name	SS2.103		SS2.147
PN		S13.005	
Dia (mm)		375	
Slope (1:X)		199.9	
Cover Level (m)	66.500		66.000
Invert Level (m)	63.702		64.084
Length (m)		76.350	

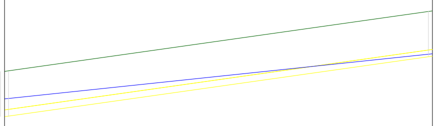
Denis O'Sullivan & Associates		Page 17
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Castlepark, Mallow Co. Cork	
Date 26/09/2024 File SW Model.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

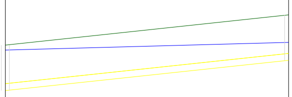
MH Name	SS2.153		SS2.155	
Hor Scale 1100 Ver Scale 500 Datum (m) 57.000				
PN			S14.000	
Dia (mm)			225	
Slope (1:X)			109.4	
Cover Level (m)	69.400	69.500	70.000	
Invert Level (m)		67.900 68.000	68.000 68.500	
Length (m)			54.675	

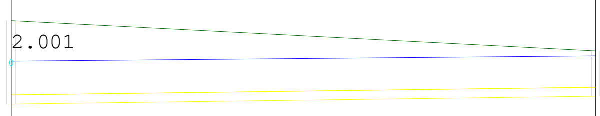
MH Name	SS2.149	SS2.153	
Hor Scale 1100 Ver Scale 500 Datum (m) 57.000			
PN		S14.002	
Dia (mm)		225	
Slope (1:X)		118.8	
Cover Level (m)	69.050	69.400	
Invert Level (m)		67.550 67.900	
Length (m)		41.595	

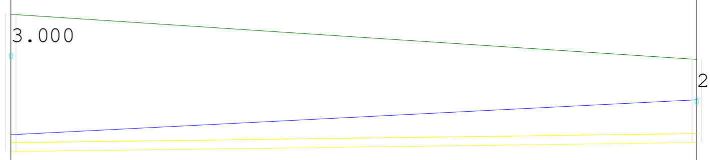


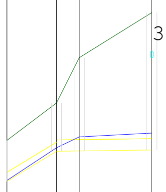
MH Name	SS2.147		SS2.156	
Hor Scale 1100 Ver Scale 500 Datum (m)55.000				
PN		S15.000		
Dia (mm)		225		
Slope (1:X)		20.4		
Cover Level (m)	66.000		69.250	
Invert Level (m)	64.500		67.750	
Length (m)		66.295		

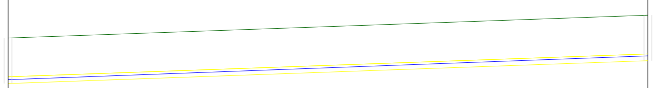
MH Name	SS2.207		SS2.208
Hor Scale 1000 Ver Scale 250 Datum (m) 60.000			
PN		S1.000	
Dia (mm)		225	
Slope (1:X)		28.3	
Cover Level (m)	65.500		67.500
Invert Level (m)	64.000		66.000
Length (m)		56.660	

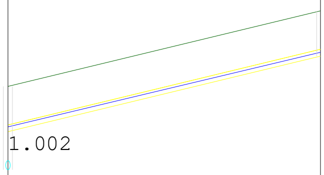
MH Name	SS2.206		SS2.207
Hor Scale 1000 Ver Scale 250 Datum (m) 58.000			
PN		S1.001	
Dia (mm)		225	
Slope (1:X)		37.4	
Cover Level (m)	64.500		65.500
Invert Level (m)	63.000		64.000
Length (m)		37.400	

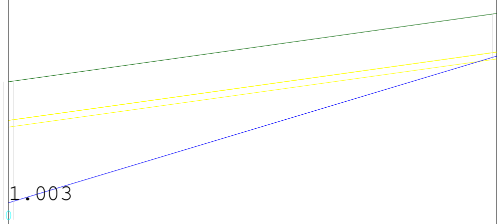
MH Name	SS2.205		SS2.206	
Hor Scale 1000 Ver Scale 250 Datum (m)58.000				
PN		S1.002		
Dia (mm)		300		
Slope (1:X)		300.0		
Cover Level (m)	65.500		64.500	
Invert Level (m)		62.742	63.000	
Length (m)		77.280		

MH Name	SS2.203		SS2.205	
Hor Scale 1000 Ver Scale 250 Datum (m)59.000				
PN		S1.003		
Dia (mm)		300		
Slope (1:X)		300.0		
Cover Level (m)	67.000		65.500	
Invert Level (m)		62.440	62.742	
Length (m)		90.650		

MH Name	SS2.200				
Hor Scale 1000 Ver Scale 250 Datum (m)58.000					
PN					
Dia (mm)					
Slope (1:X)					
Cover Level (m)	62.760	64.000		67.000	
Invert Level (m)		62.398		62.408 62.440	
Length (m)					

MH Name	SS2.209		SS2.210	
Hor Scale 1000 Ver Scale 250 Datum (m)62.000				
PN		S2.000		
Dia (mm)		225		
Slope (1:X)		112.8		
Cover Level (m)	68.000		68.750	
Invert Level (m)		66.500	67.250	
Length (m)		84.575		

MH Name	SS2.205		SS2.209
Hor Scale 1000 Ver Scale 250 Datum (m) 60.000			
PN		S2.001	
Dia (mm)		225	
Slope (1:X)		16.6	
Cover Level (m)	65.500		68.000
Invert Level (m)	64.000		66.500
Length (m)		41.415	

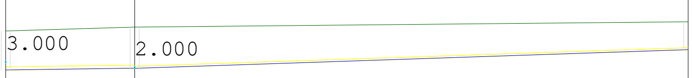
MH Name	SS2.203		SS2.204
Hor Scale 1000 Ver Scale 250 Datum (m) 60.000			
PN		S3.000	
Dia (mm)		225	
Slope (1:X)		28.7	
Cover Level (m)	67.000		69.250
Invert Level (m)	65.500		67.750
Length (m)		64.500	

Appendix J – Foul Sewer Longitudinal Sections

Hor Scale 1000

Ver Scale 500

Datum (m) 72.000

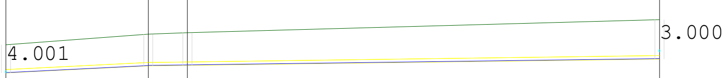


MH Name	FF2.127	FF2.128		FF2.129
PN		F1.001	F1.000	
Dia (mm)		225	150	
Slope (1:X)		149.8	60.0	
Cover Level (m)	84.400	84.650		85.000
Invert Level (m)	81.815	81.929	81.929	83.150
Length (m)		17.075	73.270	

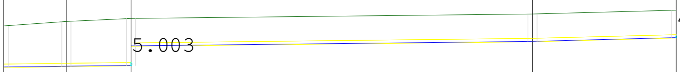
Hor Scale 1000

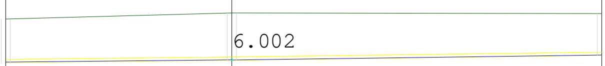
Ver Scale 500

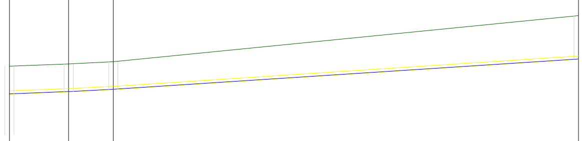
Datum (m) 71.000

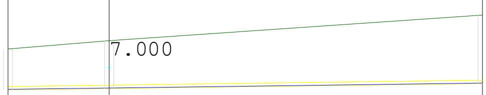


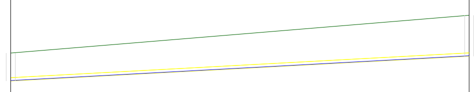
MH Name	FF2.124		FF2.125			FF2.127
PN		F1.004			F1.002	
Dia (mm)		225			225	
Slope (1:X)		40.5			150.0	
Cover Level (m)	82.750		83.450	83.550		84.400
Invert Level (m)	80.899		81.364	81.399	81.399	81.815
Length (m)		18.830			62.450	

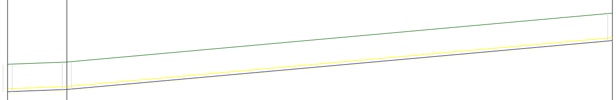
MH Name	FF2.120			FF2.123	FF2.124	
Hor Scale 1000 Ver Scale 500 Datum (m)69.000						
PN				F1.006	F1.005	
Dia (mm)				225	225	
Slope (1:X)				177.1	76.1	
Cover Level (m)	81.700	82.000	82.200	82.500	82.750	
Invert Level (m)		78.934 / 78.989	78.989 / 79.047	80.349 / 80.649	80.649 / 80.899	
Length (m)				53.125	19.030	

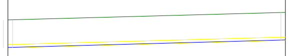
MH Name	FF2.118	FF2.119	FF2.120	
Hor Scale 1000 Ver Scale 500 Datum (m)69.000				
PN		F1.010	F1.009	
Dia (mm)		225	225	
Slope (1:X)		199.4	149.6	
Cover Level (m)	81.350	81.750	81.700	
Invert Level (m)		78.457 / 78.607	78.607 / 78.934	
Length (m)		29.910	48.930	

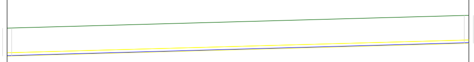
MH Name	FF2.115			FF2.118	
Hor Scale 1000 Ver Scale 500 Datum (m)66.000					
PN				F1.011	
Dia (mm)				225	
Slope (1:X)				30.6	
Cover Level (m)	78.000	78.150	78.300	81.350	
Invert Level (m)		76.149 76.299	76.449	76.449 78.457	
Length (m)				61.485	

MH Name	FF2.113	FF2.114	FF2.115	
Hor Scale 1000 Ver Scale 500 Datum (m)64.000				
PN		F1.015	F1.014	
Dia (mm)		225	225	
Slope (1:X)		150.4	150.1	
Cover Level (m)	75.750	76.300	78.000	
Invert Level (m)		73.042 73.131	73.131 73.460	
Length (m)		13.385	49.375	

MH Name	FF2.111	FF2.113	
Hor Scale 1000 Ver Scale 500 Datum (m)62.000			
PN		F1.016	
Dia (mm)		225	
Slope (1:X)		37.0	
Cover Level (m)	73.250	75.750	
Invert Level (m)		71.400 73.042	
Length (m)		60.704	

MH Name	FF2.109		FF2.111	
Hor Scale 1000 Ver Scale 500 Datum (m)59.000				
PN			F1.017	
Dia (mm)			225	
Slope (1:X)			22.2	
Cover Level (m)	69.850	70.000	73.250	
Invert Level (m)		68.000 68.150	68.150 71.400	
Length (m)			72.220	

MH Name	FF2.108		FF2.109
Hor Scale 1000 Ver Scale 500 Datum (m)57.000			
PN		F1.019	
Dia (mm)		225	
Slope (1:X)		73.4	
Cover Level (m)	69.350		69.850
Invert Level (m)	67.500		68.000
Length (m)		36.705	

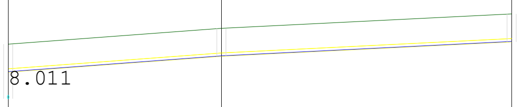
MH Name	FF2.107		FF2.108
Hor Scale 1000 Ver Scale 500 Datum (m)56.000			
PN		F1.020	
Dia (mm)		225	
Slope (1:X)		71.9	
Cover Level (m)	68.500		69.350
Invert Level (m)	66.650		67.500
Length (m)		61.130	

Denis O'Sullivan & Associates		Page 6
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Castlepark, Mallow Co. Cork	Micro Drainage
Date 26/09/2024 File FS MODEL.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

Hor Scale 1000

Ver Scale 500

Datum (m)54.000

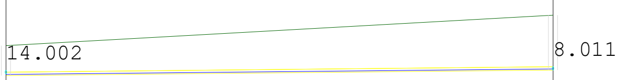


MH Name	FF2.105	FF2.106	FF2.107	
PN		F1.022	F1.021	
Dia (mm)		225	225	
Slope (1:X)		26.8	40.4	
Cover Level (m)	66.500	67.550	68.500	
Invert Level (m)		64.650 / 65.700	65.700 / 66.650	
Length (m)		28.170	38.358	

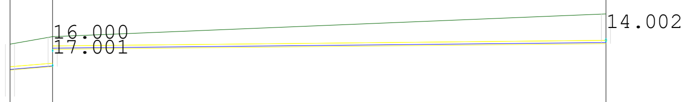
Hor Scale 1000

Ver Scale 500

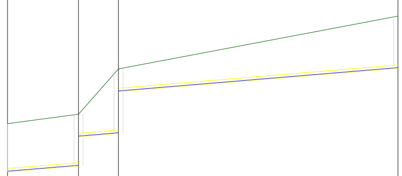
Datum (m)53.000



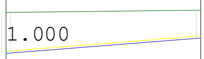
MH Name	FF2.104	FF2.105	
PN		F1.023	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	64.500	66.500	
Invert Level (m)		62.530 / 62.892	
Length (m)		72.305	

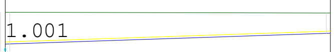


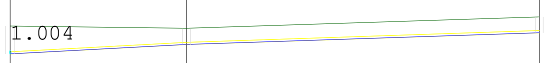
MH Name	FF2.102		FF2.104	
Hor Scale 1000 Ver Scale 500 Datum (m)50.000				
PN			F1.024	
Dia (mm)			225	
Slope (1:X)			200.0	
Cover Level (m)	62.500	63.000	64.500	
Invert Level (m)		61.021	62.164 62.530	
Length (m)			73.250	

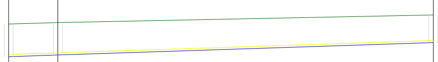


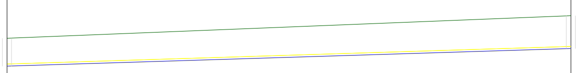
MH Name	FExis FS.001			FF2.102	
Hor Scale 1000 Ver Scale 500 Datum (m)46.000					
PN				F1.026	
Dia (mm)				225	
Slope (1:X)				24.0	
Cover Level (m)	55.370	56.000	59.000	62.500	
Invert Level (m)		52.170 52.562	54.721	57.500 59.042	
Length (m)				37.015	

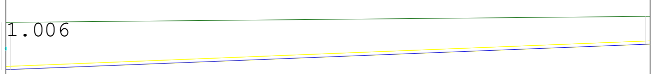
MH Name	FF2.128		FF2.130
Hor Scale 1000 Ver Scale 500 Datum (m)72.000			
PN		F2.000	
Dia (mm)		150	
Slope (1:X)		25.3	
Cover Level (m)	84.650		84.800
Invert Level (m)	81.929		82.950
Length (m)		25.825	

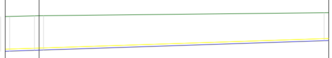
MH Name	FF2.127		FF2.131
Hor Scale 1000 Ver Scale 500 Datum (m)72.000			
PN		F3.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	84.400		84.350
Invert Level (m)	82.284		83.000
Length (m)		42.945	

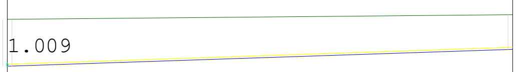
MH Name	FF2.124	FF2.132	FF2.133	
Hor Scale 1000 Ver Scale 500 Datum (m)71.000				
PN		F4.001	F4.000	
Dia (mm)		150	150	
Slope (1:X)		37.4	60.0	
Cover Level (m)	82.750	82.600	83.350	
Invert Level (m)		80.900 81.523	81.523 82.300	
Length (m)		23.315	46.605	

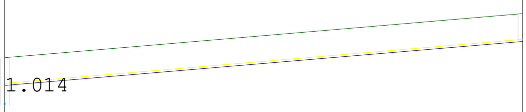
MH Name	FF2.135		FF2.137	
Hor Scale 1000 Ver Scale 500 Datum (m)72.000				
PN			F5.000	
Dia (mm)			150	
Slope (1:X)			60.0	
Cover Level (m)	84.100	84.200	84.700	
Invert Level (m)		82.023	82.023 82.850	
Length (m)			49.610	

MH Name	FF2.134		FF2.135
Hor Scale 1000 Ver Scale 500 Datum (m)71.000			
PN		F5.002	
Dia (mm)		150	
Slope (1:X)		64.0	
Cover Level (m)	82.600		84.100
Invert Level (m)	80.750		81.915
Length (m)		74.525	

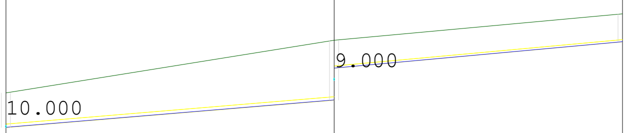
MH Name	FF2.122		FF2.134
Hor Scale 1000 Ver Scale 500 Datum (m)69.000		 1.006	
PN		F5.003	
Dia (mm)		225	
Slope (1:X)		50.0	
Cover Level (m)	82.200		82.600
Invert Level (m)	79.047		80.750
Length (m)		85.135	

MH Name	FF2.138		FF2.140	
Hor Scale 1000 Ver Scale 500 Datum (m)70.000				
PN			F6.000	
Dia (mm)			150	
Slope (1:X)			60.0	
Cover Level (m)	82.050	82.100	82.300	
Invert Level (m)		79.810	79.810 / 80.450	
Length (m)			38.370	

MH Name	FF2.119	FF2.138	
Hor Scale 1000 Ver Scale 500 Datum (m)69.000			
PN		F6.002	
Dia (mm)		150	
Slope (1:X)		59.2	
Cover Level (m)	81.750	82.050	
Invert Level (m)		78.607 / 79.735	
Length (m)		66.765	



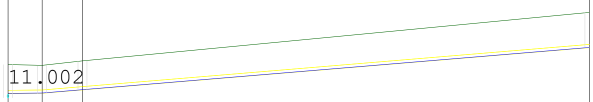
MH Name	FF2.114		FF2.141
Hor Scale 1000 Ver Scale 500 Datum (m) 65.000			
PN		F7.000	
Dia (mm)		150	
Slope (1:X)		23.6	
Cover Level (m)	76.300		79.200
Invert Level (m)	74.450		77.350
Length (m)		68.495	

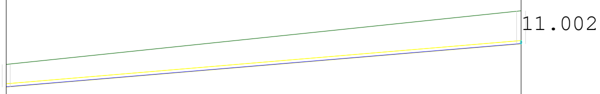


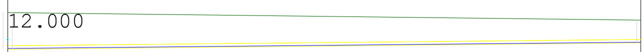
MH Name	FF2.151		FF2.153		FF2.154
Hor Scale 1000 Ver Scale 500 Datum (m) 63.000					
PN		F8.001		F8.000	
Dia (mm)		225		150	
Slope (1:X)		24.0		21.8	
Cover Level (m)	73.275		76.750		78.500
Invert Level (m)	70.978		72.787 74.900		76.650
Length (m)		43.415		38.155	

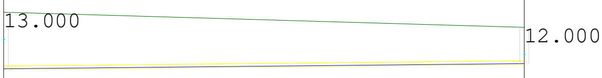
Denis O'Sullivan & Associates		Page 13
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Castlepark, Mallow Co. Cork	
Date 26/09/2024 File FS MODEL.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

MH Name	FF2.148	FF2.149		FF2.151	
Hor Scale 1000 Ver Scale 500 Datum (m) 60.000					
PN		F8.004		F8.002	
Dia (mm)		225		225	
Slope (1:X)		43.5		199.7	
Cover Level (m)	72.500	73.450	73.400	73.275	
Invert Level (m)		70.166 70.820	70.849	70.849 70.978	
Length (m)		28.475		25.755	

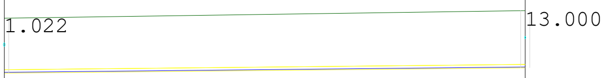
MH Name	FF2.145			FF2.148	
Hor Scale 1000 Ver Scale 500 Datum (m) 58.000					
PN				F8.005	
Dia (mm)				225	
Slope (1:X)				24.0	
Cover Level (m)	69.050	69.000	69.300	72.500	
Invert Level (m)		67.150	67.372	67.372 70.166	
Length (m)				67.060	

MH Name	FF2.144		FF2.145
Hor Scale 1000 Ver Scale 500 Datum (m)55.000			
PN		F8.008	
Dia (mm)		225	
Slope (1:X)		23.8	
Cover Level (m)	65.500		69.050
Invert Level (m)	64.000		66.856
Length (m)		68.055	

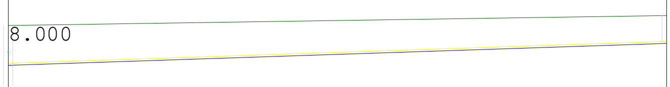
MH Name	FF2.143		FF2.144
Hor Scale 1000 Ver Scale 500 Datum (m)53.000			
PN		F8.009	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	66.000		65.500
Invert Level (m)	63.581		64.000
Length (m)		83.800	

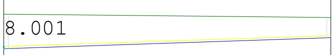


MH Name	FF2.142		FF2.143
Hor Scale 1000 Ver Scale 500 Datum (m)54.000			
PN		F8.010	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	67.000		66.000
Invert Level (m)	63.236		63.581
Length (m)		68.915	



MH Name	FF2.105		FF2.142
Hor Scale 1000 Ver Scale 500 Datum (m)53.000			
PN		F8.011	
Dia (mm)		225	
Slope (1:X)		200.0	
Cover Level (m)	66.500		67.000
Invert Level (m)	62.892		63.236
Length (m)		68.915	

MH Name	FF2.153		FF2.155
Hor Scale 1000 Ver Scale 500 Datum (m) 64.000			
PN		F9.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	76.750		77.400
Invert Level (m)	74.098		75.550
Length (m)		87.145	

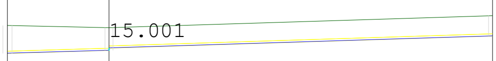
MH Name	FF2.151		FF2.152
Hor Scale 1000 Ver Scale 500 Datum (m) 61.000			
PN		F10.000	
Dia (mm)		150	
Slope (1:X)		60.0	
Cover Level (m)	73.275		73.050
Invert Level (m)	70.978		71.700
Length (m)		43.325	

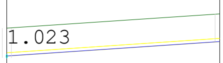
MH Name	FF2.156		FF2.158
Hor Scale 1000 Ver Scale 500 Datum (m)57.000			
PN			F11.000
Dia (mm)			150
Slope (1:X)			60.0
Cover Level (m)	69.400	69.500	69.950
Invert Level (m)	67.121	67.192 67.192	68.100
Length (m)			54.485

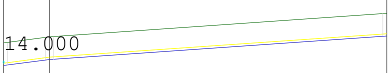
MH Name	FF2.145	FF2.156
Hor Scale 1000 Ver Scale 500 Datum (m)57.000	8.007	
PN	F11.002	
Dia (mm)	225	
Slope (1:X)	149.8	
Cover Level (m)	69.050	69.400
Invert Level (m)	66.856	67.121
Length (m)	39.705	

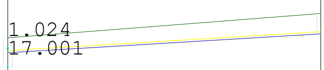
MH Name	FF2.143		FF2.159
Hor Scale 1000 Ver Scale 500 Datum (m)55.000		8.009	
PN		F12.000	
Dia (mm)		150	
Slope (1:X)		27.2	
Cover Level (m)	66.000		69.250
Invert Level (m)	64.150		67.400
Length (m)		88.345	

MH Name	FF2.142		FF2.160
Hor Scale 1000 Ver Scale 500 Datum (m)54.000		8.010	
PN		F13.000	
Dia (mm)		150	
Slope (1:X)		26.1	
Cover Level (m)	67.000		68.350
Invert Level (m)	65.150		66.500
Length (m)		35.265	

MH Name	FF2.161	FF2.162	FF2.163	
Hor Scale 1000 Ver Scale 500 Datum (m)53.000				
PN		F14.001	F14.000	
Dia (mm)		150	150	
Slope (1:X)		67.2	63.4	
Cover Level (m)	65.450	65.300	66.100	
Invert Level (m)		63.600 63.800	63.950 64.750	
Length (m)		13.437	50.730	

MH Name	FF2.104	FF2.161	
Hor Scale 1000 Ver Scale 500 Datum (m)52.000			
PN		F14.002	
Dia (mm)		225	
Slope (1:X)		29.6	
Cover Level (m)	64.500	65.450	
Invert Level (m)		62.648 63.600	
Length (m)		28.165	

MH Name	FF2.162		FF2.165	
Hor Scale 1000 Ver Scale 500 Datum (m)54.000				
PN			F15.000	
Dia (mm)			150	
Slope (1:X)			28.8	
Cover Level (m)	65.300	65.700	67.250	
Invert Level (m)		64.200	64.200 / 65.750	
Length (m)			44.620	

MH Name	FF2.103	FF2.167	
Hor Scale 1000 Ver Scale 500 Datum (m)51.000			
PN		F16.000	
Dia (mm)		150	
Slope (1:X)		33.2	
Cover Level (m)	63.000	64.600	
Invert Level (m)		62.000 / 63.250	
Length (m)		41.465	

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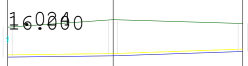
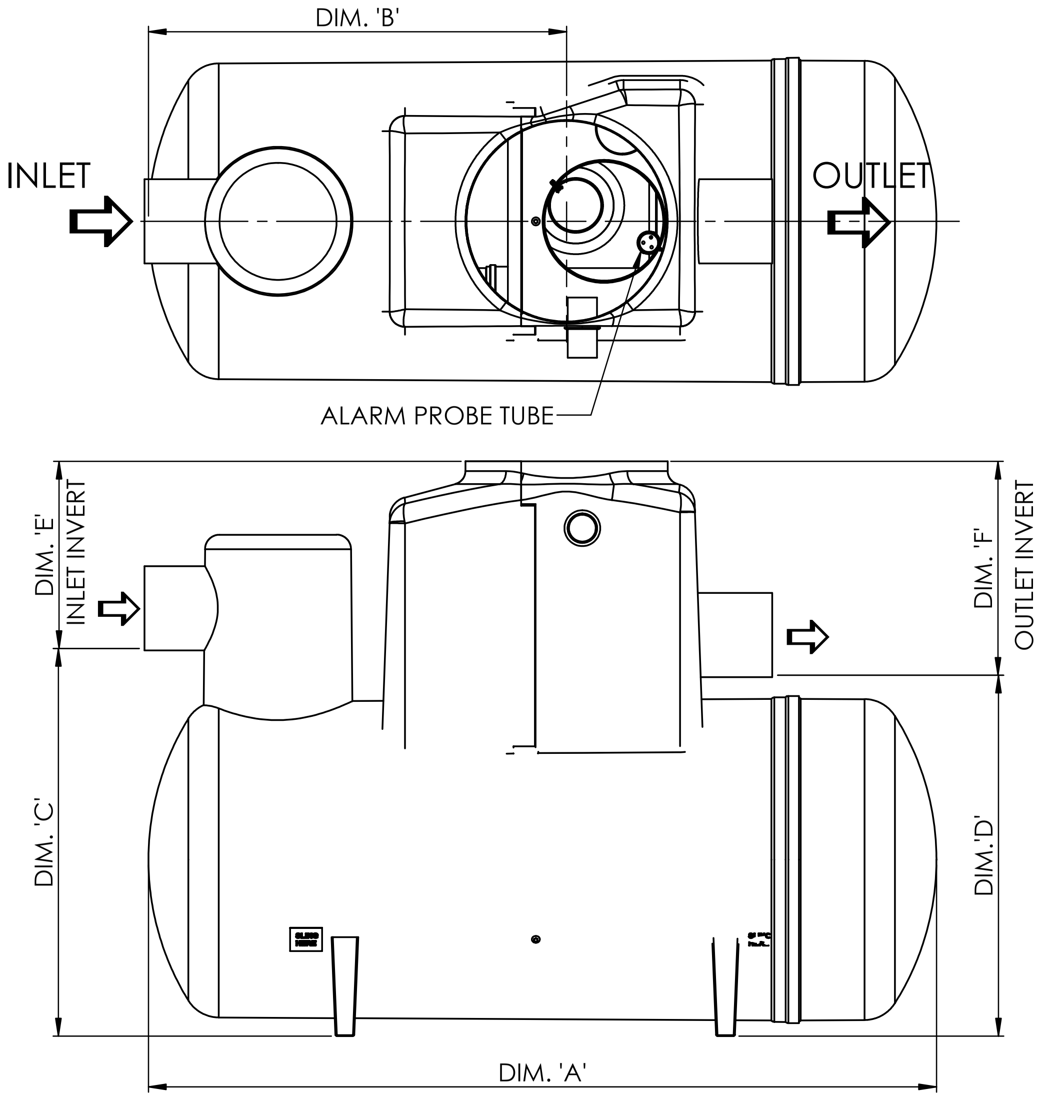
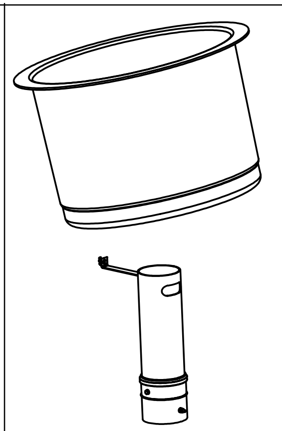
Unit 5, Joyce House Barrack Square Ballincollig, Co. Cork	Residential Development Castlepark, Mallow Co. Cork	
Date 26/09/2024 File FS MODEL.MDX	Designed By S.O.'Grady Checked By	
Micro Drainage	Network W.12.4	

MH Name	FF2.103	FF2.166	FF2.168	
Hor Scale 1000 Ver Scale 500 Datum (m)51.000				
PN		F17.001	F17.000	
Dia (mm)		150	150	
Slope (1:X)		150.0	59.9	
Cover Level (m)	63.000	63.500	63.250	
Invert Level (m)		61.021 61.114	61.114 61.400	
Length (m)		13.950	17.145	

Appendix K – Petrol Interceptor Details

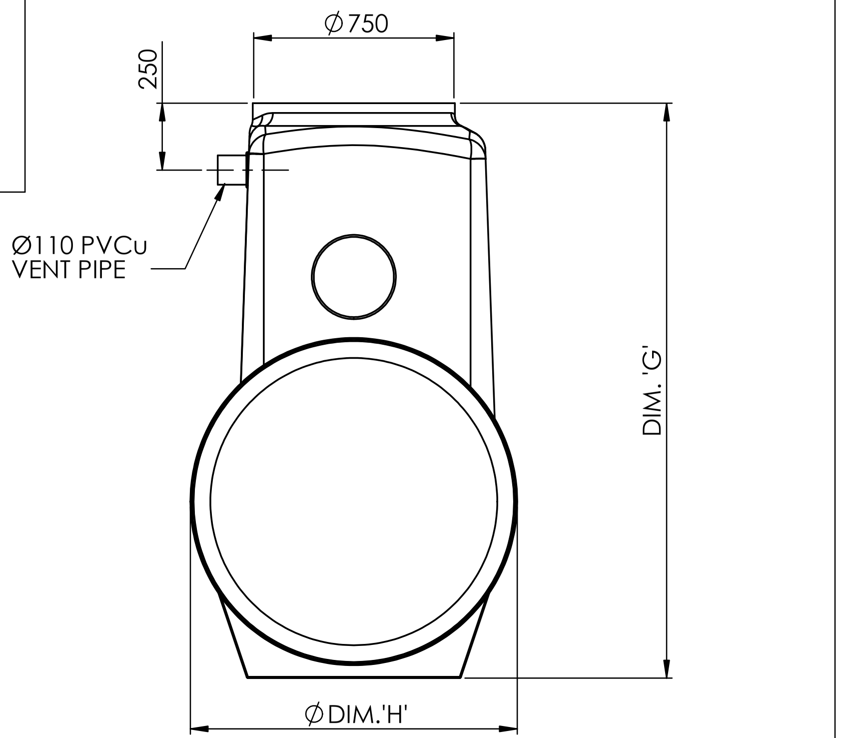




EXTENSION PARTS (IF REQUIRED) INCLUDED IN PRODUCT CODE

NOTES

1. UNITS ARE SUPPLIED WITH THE STANDARD (MINIMUM) PIPEWORK SIZE, AND ORIENTATION SHOWN ON THE DRAWING. THE STANDARD EN858-1 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZE CONNECTIONS MAY NOT BE FULLY COMPLIANT WITH THE STANDARD. PLEASE CONSULT OUR SALES DEPARTMENT FOR DETAILS OF AVAILABLE OPTIONS, BUT PLEASE NOTE WE DO NOT ALTER INTERNAL PIPEWORK.
2. ALL UNITS SUPPLIED ARE CLASS 1 AND INCLUDE A COALESCER.
3. EXTENSION PARTS FOR DEEPER INVERTS CAN BE PROVIDED FOR ON SITE ASSEMBLY.
4. ALL UNITS REQUIRE APPROPRIATE CONCRETE BASE, COVER AND FRAME TO SUIT APPLIED LOADINGS.
5. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY.
6. A Ø76mm TUBE IS SUPPLIED TO HOUSE AN OIL ALARM PROBE.



UNIT	NOMINAL FLOW (l/sec.)	DIM.'A'	DIM.'B'	DIM.'C'	DIM.'D'	DIM.'E'	DIM.'F'	DIM.'G'	DIM.'H'	STD. PIPE Ø	APPROX. EMPTY WEIGHT (kg)	FALL ACROSS UNIT
NSBE010	10.0	2070	1095	1450	1350	700	800	2150	1220	315	160	100
NSBE015	15.0	2950	1560	1450	1350	700	800	2150	1220	315	200	100
NSBE020	20.0	3893	2016	1450	1350	700	800	2150	1220	375	220	100
NSBE025	25.0	3575	1900	1680	1580	700	800	2380	1420	375	300	100
NSBE030	30.0	4265	2263	1680	1580	700	800	2380	1420	450	325	100

Please check with Kingspan Environmental that this drawing is the latest issue

Issue	Date	Drawn by	Approved by	Description
05	24.06.13	T.Kelly		CC1131 - Case Feet Changed
04	13.02.13	T.Kelly		CC981 Phase 2 - NSBE025 & 030 Added

Material : Various
Finish :
Weight :
Tolerance :
Thickness : n/a
Surface Area :

Drawing : DS1155

Page 1 of 2

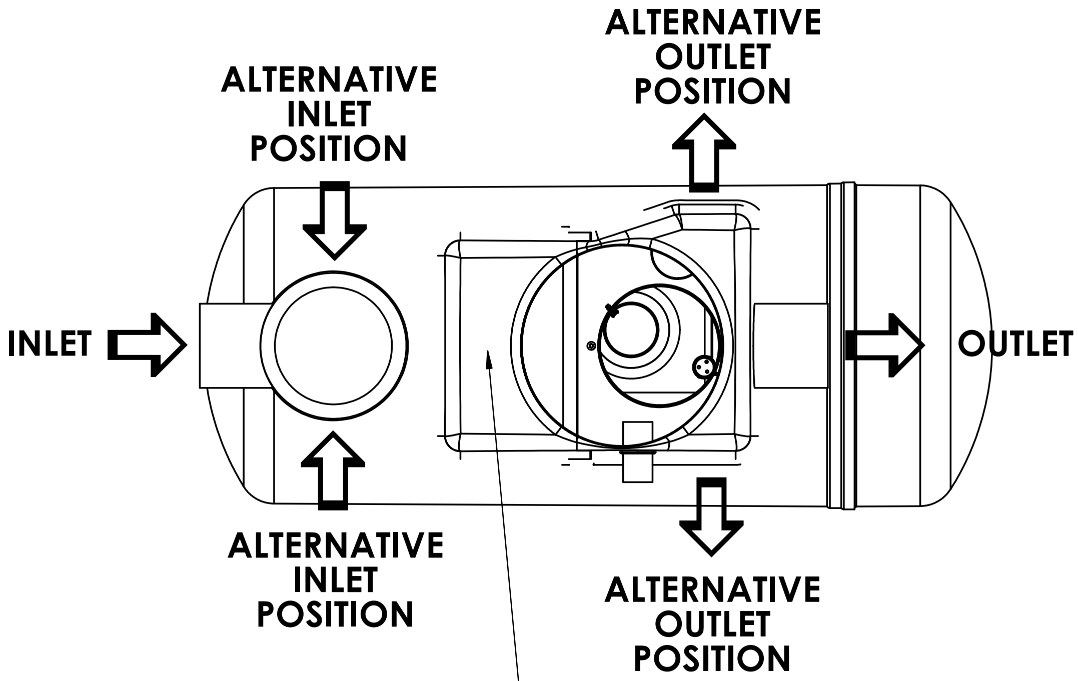
NSBE010 - NSBE030 Bypass Separators

All dimensions in mm

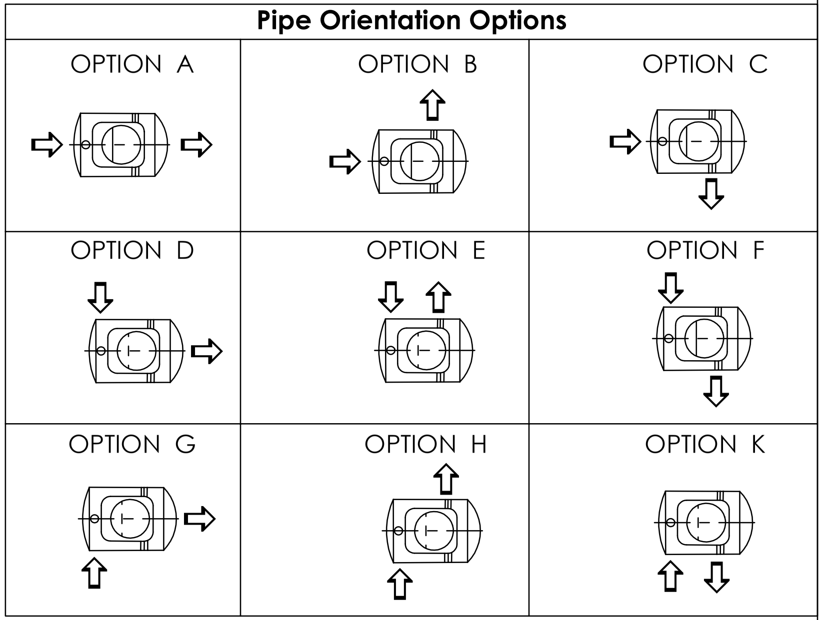
Scale: Not to scale

Kingspan Environmental

R:\Drawing Data\02 - Sales Drawings\DS\DS - 11\DS1155



Please Note:-
Due to the physically small size of the NSBE010, the inlet pipe, all orientation options, is fitted directly into this turret.



Material : Various	Tolerance (unless stated) :	**Drawing : DS1155** Page 2 of 2
Finish :	Thickness : n/a	
Weight : 229.91 Kg	Surface Area : m²	NSBE010 - 030 BYPASS SEPARATORS
Modelled By :		

All Dimensions In mm | Scale: Do Not Scale | Third Angle Projection

Kingspan Environmental

R:\Drawing Data\02 - Sales Drawings\DS\DS - 11\DS1155

Appendix L – Hydrobrake Details

Hydro-Brake® Flow Control

Modelling Guide

Unit Selection Design Guide

Overview

Hydro-Brake® Flow Controls restrict the flow in surface/storm water or foul/combined sewer systems by inducing a vortex flow pattern in the water passing through the device, having the effect of increasing back-pressure.

Their 'hydrodynamic' rather than 'physical restriction' based operation provides flow regulation whilst maintaining larger clearances than most other types of flow control, making them less susceptible to blockage. Their unique "S"-shaped head-flow characteristic also enables them to pass greater flows at lower heads, which can enable more efficient use of upstream storage facilities.

This document provides guidance relating to the selection and use of Hydro-Brake® Flow Controls for use in surface/storm water and foul/combined sewer systems.

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. If in doubt, or to enquire about new product additions, please contact HRD Technologies Ltd.

STH Range of Hydro-Brake® Flow Controls

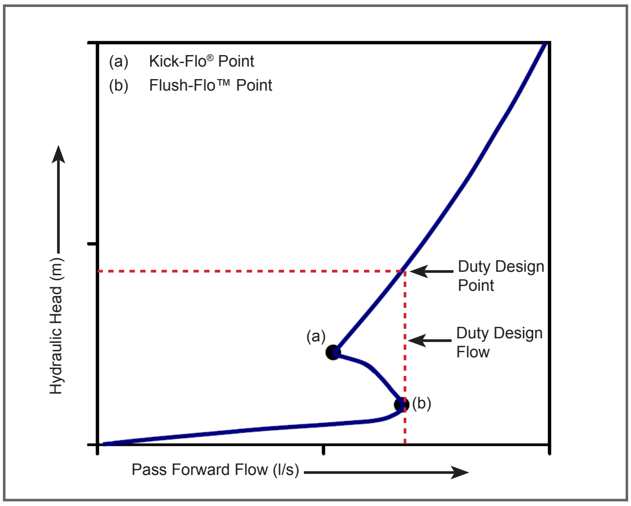
BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

See back cover for details.

Hydraulic Characteristics and Specification

Hydro-Brake® Flow Controls should be selected such that the duty/design flow is not exceeded at any point on the head-flow curve, see illustration right. If this is not achievable using the initially selected unit, it may be appropriate to select an alternative option (see selection guidance overleaf).

While the primary aim of a flow control is to provide a particular flow rate at a given upstream head (giving a design/duty point), it is important to note that secondary opportunities, such as potential for optimised storage use, derive from consideration of the full hydraulic characteristic. It is therefore important to ensure that the same flow control, or one confirmed to provide equivalent hydraulic performance, is implemented in any final installation.



Typical Hydro-Brake® Head Versus Flow Characteristics

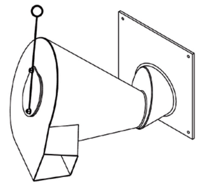
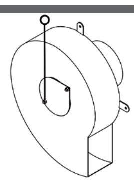
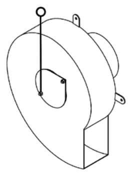
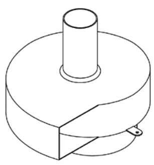
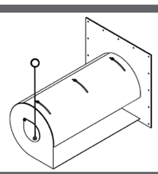
To ensure correct implementation a multiple design-point specification, defining the main hydraulic features of the selected flow control, can be provided by HRD Technologies Ltd. This should include at least the following information:

- outlet size and model of Hydro-Brake® Flow Control
- definition of the duty/design point (head and flow)
- definition of the Flush-Flo™ point (head and flow)
- definition of the Kick-Flo® point (head and flow)

To ensure that a drainage system performs as designed, it is strongly recommended that this information is reproduced on any technical specifications.

Hydro-Brake® Flow Control Models Supported in Micro Drainage

The Table below provides a summary of the Hydro-Brake® Flow Control models currently supported by the Micro Drainage programs, including details of unit styles, applications and design/installation considerations. Advice regarding unit selection is provided in subsequent sections.

Win*Des*® Reference Code	Style / Typical Shape	Application	Design / Installation Notes
Md1 Md2 Md4 Md14	**Conical** 	Foul / combined and surface / storm water.	With the exception of the Md14, conical units require benching into the intake (the Md14 has a piped intake). They generally require larger manholes than equivalent sump-type units.
Md5 Md6 Md7 Md12	**Sump-Type** 	Surface / storm water only.	Sump-type units require the provision of a sump to accommodate the flow control. As this will always be full of water, sump-type units are unsuitable for use in foul / combined systems.
Md13	**Sump-Type** BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE No 08/4599  STH Range of Hydro-Brake® Flow Controls	Surface / storm water only.	The Md13 (STH) unit will always have an outlet size in excess of 75 mm and can always be fitted to a 225 mm diameter outlet pipe or larger.
Md8 Md9 Md11	**Vertical Discharge** 	Foul / combined and surface / storm water.	Vertical discharge units require a chamber design to accommodate the vertically directed outlet. They do not have S-shaped head / discharge curves and are for special applications only - please refer to HRD Technologies Ltd for advice.
Md10	**Tubular** 	Foul / combined and surface / storm water.	Tubular units require benching into the intake. They do not have S-shaped head / discharge curves and are for special applications only - please refer to HRD Technologies Ltd for advice.

Note: For system modelling using other software packages, HRD Technologies Ltd can provide individual unit head / flow characteristics in an appropriate format.

General Advice

Selection of the most appropriate Hydro-Brake® Flow Control for a particular application depends on a number of considerations, including the type of sewer system, the hydraulic characteristic of the device, device clearances and overall physical dimensions. The Micro Drainage programs provide outputs for hydraulic characteristic and outlet size.

The table opposite provides general selection guidance taking into account the considerations of type of sewer system, device clearances and overall physical dimensions. This should be considered along with other information provided here and in conjunction with the advice contained within the software design program that is being used.

The Table should be followed from the top, using the left hand column for surface/storm water applications and the right hand column for foul/combined applications. The 'general comments' provided are relevant to both applications.

HRD Technologies Ltd offer a free design service and can assist with unit selection.

General Guidance on Unit Selection

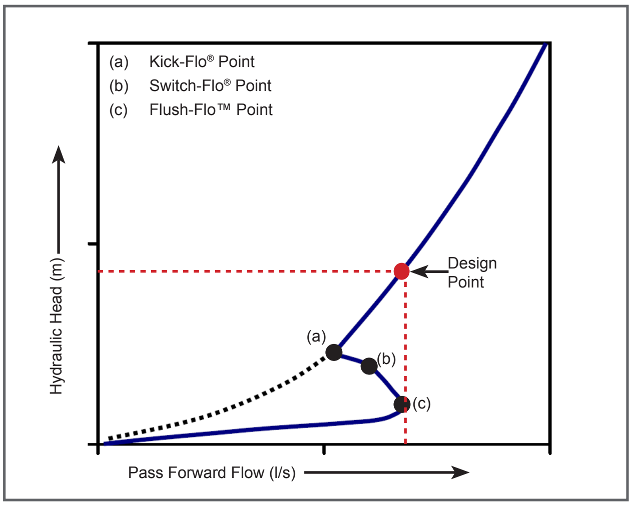
<table>
<tr><th>Surface / Storm Water Applications</th><th>Foul / Combined Applications</th></tr>
<tr><td>1) Select sump-type Md13 (STH) initially. This is a British Board of Agrément (BBA) approved product that is currently only available in certain sizes – if a size is not available for the specified duty/design point go to 2) otherwise use Md13 (STH). The Md13 (STH) has a minimum outlet size in excess of 75 mm and can always be fitted to a 225 mm diameter outlet pipe (or greater).</td><td>1) Select conical-type Md4 (CX) initially provided the required outlet >150 mm. If the required manhole/chamber size is too large go to 2) otherwise use Md4 (CX).</td></tr>
<tr><td>2) Select sump-type Md6 (SXH) initially provided the required outlet >75 mm (please seek advice if outlet <75 mm). If required outlet >200 mm go to 3) otherwise use Md6 (SXH).</td><td>2) Select conical-type Md2 (CH) provided the required outlet >150 mm. If the required manhole/chamber size is too large go to 3) otherwise use Md2 (CH).</td></tr>
<tr><td>3) Select sump-type Md5 (SH) or Md12 (SMXH) provided the required outlet >75 mm (please seek advice if outlet <75 mm). If required outlet >250 mm (Md5 - SH) or >300 mm (Md12 - SMXH) go to 4) otherwise use Md5 (SH) /Md12 (SMXH).</td><td>3) Select conical-type Md1 (C) provided the required outlet >429 mm. If the required manhole/chamber size is too large go to 4) otherwise use Md1 (C).</td></tr>
<tr><td>4) Select conical-type Md4 (CX) provided the required outlet >100 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/chamber size is too large go to 5), otherwise use Md4 (CX).</td><td>4) Vertical discharge units Md8 (SV), Md9 (SMV) and Md11 (SXV) can be considered if their outlets are >150 mm. Their physical dimensions should be considered - the Md9 (SMV) is typically used when the diameter of the Md8 (SV) and Md11 (SXV) >200 to 250 mm. If none of these units are suitable go to 5).</td></tr>
<tr><td>5) Select conical-type Md2 (CH) unit provided the required outlet >100 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/chamber size is too large go to 6), otherwise use Md2 (CH).</td><td>5) Select tubular-type Md10 (TH) provided the required outlet >333 mm. This is sometimes the only option that will meet a certain head/discharge relationship (eg. low head, low flow situations). It should only be used when there is no other alternative.</td></tr>
<tr><td>6) Select conical-type Md1 (C) provided the required outlet >285 mm. This unit does not require a sump arrangement but requires benching into the intake. If the required manhole/chamber size is too large go to 7), otherwise use Md1 (C).</td><td rowspan="4">For design assistance for any
Hydro-Brake® Flow Control
please call: **01-4013964** or
e-mail: enquiries@hrdtec.com</td></tr>
<tr><td>7) Select sump-type Md7 (SMH) provided the required outlet >75 mm. If the required outlet >300 mm then go to 8), otherwise use Md7 (SMH).</td></tr>
<tr><td>8) Vertical discharge units Md8 (SV), Md9 (SMV) and Md11 (SXV) can be considered provided the required outlet >75 mm. Their physical dimensions should be considered - the Md9 (SMV) is typically used when the diameter of the Md8 (SV) and Md11 (SXV) >200 to 250 mm. If none of these units are suitable go to 9).</td></tr>
<tr><td>9) Select tubular-type Md10 (TH) provided the required outlet >222 mm. This is sometimes the only option that will meet a certain head/discharge relationship (eg. low head, low flow situations). It should only be used when there is no other alternative.</td></tr>
<tr><td colspan="2">**General Comments:** The minimum sizes quoted for Hydro-Brake® Flow Controls represent sizes based on experience as offering significant reduction in risk of blockage and hence maintenance and derive from general practice in flow control selection in the UK and Ireland. Sizes below the minimum recommended can be specified though it should be recognised these might incur increased risks of blockage and associated maintenance. Sizes above the maximum recommended can also be specified though may require oversized manholes/chambers. For the larger units, refer to HRD Technologies Ltd for advice.</td></tr>
</table>

The information provided here is intended for the purposes of general guidance only - individual application requirements may differ. **If in doubt, please contact HRD Technologies Ltd.**

STH Type Hydro-Brake® Flow Control with BBA Approval

Now included in Win*Des*® W.12.6!

The new STH type Hydro-Brake® Flow Control range has a unique head / discharge performance curve which introduces a very important feature - the Switch-Flo® Point. This point illustrates the unique performance feature of the STH range which can lead to further savings in upstream storage, whilst also enabling increased inlet / outlet size to further reduce the risk of blockage.



Typical STH Head Versus Flow Characteristics

Kick-Flo® (a) - the point at which the vortex has initiated and at which the curve begins to return back to follow the orifice curve and reach the same design point or desired head / flow condition.

NEW Switch-Flo® (b) - marks the transition between the Kick-Flo® and Flush-Flo™, from vortex initiation to stabilisation. This point adds a new layer of resolution to the Hydro-Brake® curve that has implications to upstream storage savings.

Flush-Flo™ (c) - the point at which the vortex begins to initiate and have a throttling effect. This point on the Hydro-Brake® curve is usually much nearer to the maximum design flow (Design Point), than other vortex flow controls leading to more water passing through the unit during the earlier stages of a storm, thus reducing the amount of water that needs to be stored upstream.

BBA APPROVAL INSPECTION TESTING CERTIFICATION
CERTIFICATE No 08/4599

STH Range of Hydro-Brake® Flow Controls

The STH Hydro-Brake® Flow Control is the only vortex flow control available today that has been given the prestigious BBA Approval Certificate. The BBA assessment procedure entails rigorous assessment of production and manufacturing standards, and confirms that the hydraulic performance of the Hydro-Brake® Flow Control matches the data given to designers by HRD Technologies with their head / discharge curves.

A worked example showing the steps to model a Hydro-Brake® Flow Control and associated Stormcell® Storage System within Micro Drainage Win*Des*® is available on our website:

www.hrdtec.com

Take a Look at Our New Stormwater Web Resource

Engineering Nature's Way™

www.engineeringnaturesway.co.uk

Engineering Nature's Way is a brand new resource for people working with Sustainable Drainage and flood management in the UK.

The site provides an opportunity to share news, opinion, information and best practice for people working in local and central Government; developers, consulting engineers and contractors. Do you have something to share? We would be delighted to receive your contributions.

turning water around ...®

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HRD Technologies Ltd

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Appendix 12.5 DOSA Surface Water Management Plan

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT AT CASTLEPARK, MALLOW, CO. CORK

SURFACE WATER MANAGEMENT PLAN

DATE 17/10/2024

REVISION 2

JOB NO. 6621

Joyce House, Barrack Square, Ballincollig, Co. Cork
T 021 4871781 E info@dosa.ie W www.dosa.ie

DOCUMENT CONTROL

PROJECT NAME: Residential Development at Castlepark, Mallow, Co. Cork

PROJECT NUMBER: 6621

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Contents

1 *Introduction*

DOSA Consulting Engineers were engaged as Engineers for the proposed development at Castlepark, Mallow, Co. Cork. The purpose of this Drainage Impact Assessment report is to provide details of the Storm Water elements associated with the proposed development.

Following the Opinion received from Cork County Council from the Section 32B meeting, the report has been amended to address concerns raised relating to the overall SuDS strategy.

1.1 Site Location

The subject site which is currently undeveloped is located on the southeast of Mallow town. The site is a greenfield site characterised by its undulating topography and its steep slope rising from the southern & end. The Blackwater River runs along the site's southern edge, with the L-1220-0/St, Joseph's Road & Scoil Aonghusa CNS to the north, farmland and stand-alone detached farmhouse to the east and the existing Castle Park Village estate to the west.

A snapshot of the proposed site is outlined in Figure 1.1 below.

Figure 1.1 – Context Map

1.2 Scope of Assessment

This report deals with the following aspects associated with this development:

- Existing Site
- Site Investigations
- Soil Type Classification
- Storm Water Drainage Design
- Sustainable urban Drainage Systems (SuDS)
- Flood Risk Assessment and Exceedance Flows
- SuDS Maintenance

1.3 Site Topography

The topography of the site slopes southwards towards the River Blackwater. It comprises one large single plot across which the levels vary from +87.5m O.D. along the boundary with the L-1220-0/St Joseph's Road to +43m O.D. at its most elevated southern extremity.

Figure 1.3 – Site Topography

1.4 Existing Hydrological Environment

The site is within hydrometric area 18 (Blackwater (Munster)). Hydrometric area No. 18 includes the surface catchment drained by the River Blakwater and all streams entering tidal water in Youghal Bay.

The site itself is in the catchment of the Blackwater River (EPA Sub Catchment SC-090). The surface water catchment divide is shown on Figure 2.

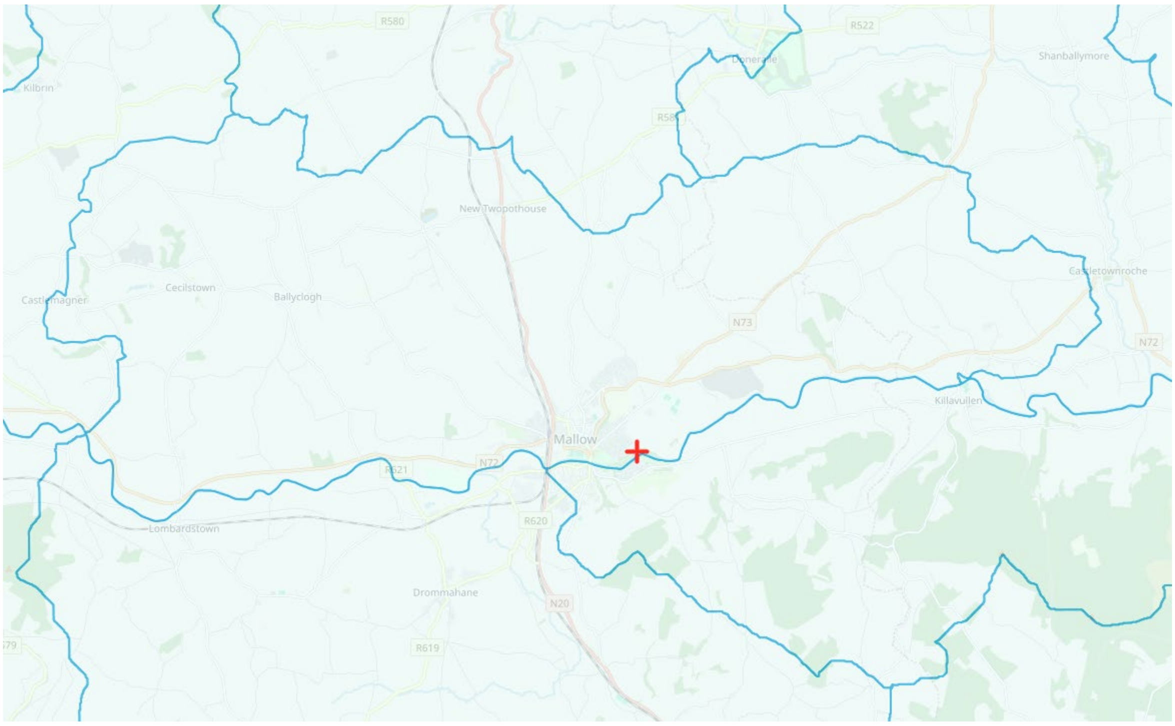


Figure 1.4 – EPA Sub Catchment Map

1.5 Proposed Development

The development will consist of the construction of 469 no. residential units (comprising a mix of 1, 2, 3, and 4 bed semi-detached, townhouse, and duplex/apartment units), creche, and all associated ancillary site development works including vehicular access, parking, footpaths, drainage, amenity areas, and a wastewater treatment plant at Castlepark, Castlelands (townland), St Jospeh's Road, Mallow, Co. Cork.

Figure 1.4 – Proposed Development

1.6 Principle Design Considerations

During the design of the storm water drainage for the proposed site, including SuDS, the following key documents / standards were taken into consideration.

- Cork County Council Development Plan
- CIRIA report C753 The SuDS Manual-v6
- Greater Dublin Strategic Drainage Study (GDSDS)
- Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Water Sensitive Urban Design - Best Practice Interim Guidance Document, (CDP Objective 9.4) - The Department of Housing, Local Government and Heritage.
- Inland Fisheries Irelands Planning for Watercourses in the Urban Area – (CDP Para 11.221)- IFI

2 *Surface Water Design Overview*

The proposed storm water drainage system has been designed to cater for all surface water runoff from all hard surfaces within the proposed development including roadways, roofs, parking areas etc. The development has been split into 3 No. catchment areas.

Surface water generated from the proposed residential development will be conveyed through a proposed surface water network including SuDS and attenuated / managed on site prior to final discharge at Qbar greenfield run-off rates. .

Surface water discharge rates from the proposed surface water drainage network will be controlled by a vortex flow control devices (Hydrobrakes or equivalent) and associated detention basins. Surface water discharge will also pass via a full retention fuel / oil separators (sized in accordance with permitted discharge from the site). The storm sewer network was designed using Innovyze MicroDrainage modelling software. Outputs from the storm sewer design can be found in the Appendices of the Infrastructure Report.

The proposed surface water drainage network will collect surface water runoff from the site via a piped network prior to discharging off site via the detention basins, flow control devices and separator arrangement as noted above. Prior to entering the system, the stormwater generated will be treated through a number of nature-based solutions in line with adopted SuDs measures.

All flow velocities within the network fall within the limits of 0.75 and 3m/sec as set out in “Recommendations for Site Development Works” as published by the Department of Environment. The storm water network and infiltration basin are designed to accommodate the 100-year return period plus an additional 20% to account for the effects of climate change.

2.1 Proposed Sustainable Urban Drainage (SuDS) Strategy

For the proposed development a “SuDS triangle” was utilised to ensure all three functions are provided for within the SuDS strategy.

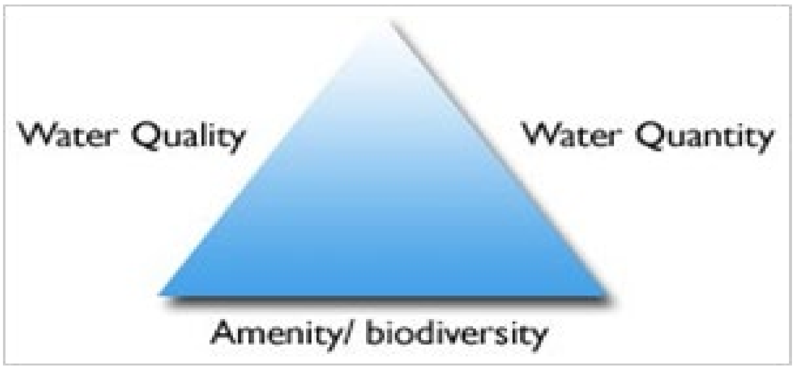


Figure 2.1– SuDS Triangle

By considering the three functions of the triangle, a SuDS system will allow for water quality treatment through natural processes by.

- Encouraging infiltration (where appropriate) and attenuating peak flows.
- Improving water quality by providing treatment to storm water prior to discharge.
- Providing habitat and function where possible for those using the area (including wildlife).

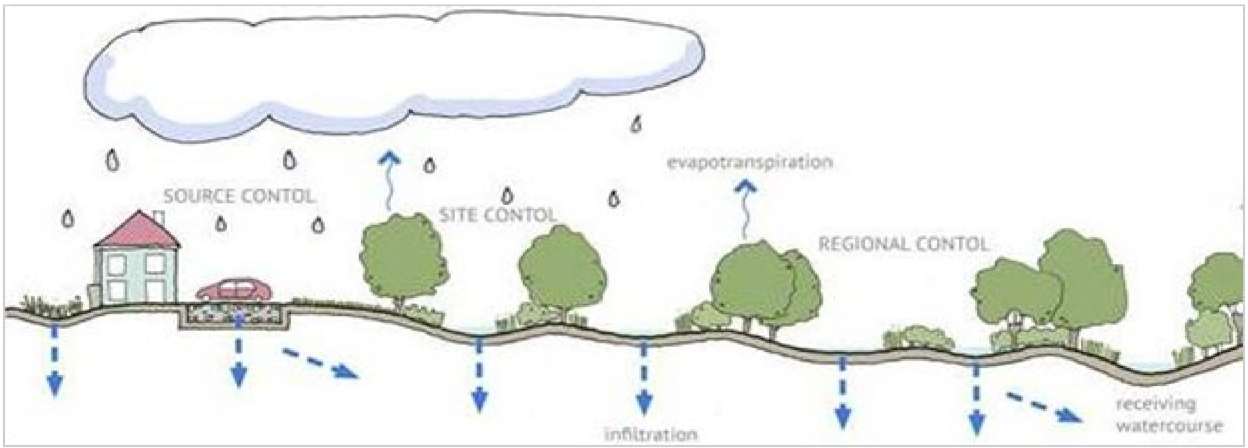


Figure 2.2– SuDS Treatment Train

The principles of a SuDS treatment train were used during the design of the surface water drainage system. The treatment train as illustrated in the image below provides an understanding of prevention and source control to reduced water run-off from a site and improve water quality.

Criterion 1: River Water Quality Protection

Satisfied by providing stormwater attenuation tanks and treatment of surface water run-off by SUDS features such full retention fuel/oil separators at surface water discharge points.

Criterion 2: River Regime Protection

Satisfied by attenuating surface water run-off in association with flow control devices prior to discharge off site at Greenfield runoff rate. Site critical duration storm used to assess attenuation volume.

Criterion 3: Level of Service (Flooding) for the Site

Satisfied by reviewing available flood hazard information (e.g., Lee CFRAM Study) relating to the site's proximity to tidal and fluvial flood plains (up to 1 in 100-year flood event).

Criterion 4: River Flood Protection

Satisfied by attenuating surface water discharge to greenfield runoff rates, addressing flood risk associated with the 1 in 100-year storm and avoiding development in flood plains.

Following a comprehensive review of the design of the storm water drainage system we considered all options under the SuDS guidance policies referred to in the Greater Dublin Drainage Strategy. A preliminary feasibility of the applicable SuDS Techniques was conducted using the facility on the website of Irishsuds.ie (Guidance and Tools). The preliminary analysis indicated that the following techniques were possibly suitable Attenuation Tanks, Basins, Permeable Paving, Soakaways, Swales and Rainwater Harvesting.

Each proposal was examined and evaluated on its merits / suitability under site specific constraints for use in the proposed development site. Our design approach summary is as follows:

2.2 SuDS Appraisal

The SUDS selection process used for this site is in accordance with SUDS selection flow chart, Volume 3, Section 6.5, Figure 48 of the GDSDS. The characteristics of the site are utilised to select the various SUDS techniques that would be applicable.

The following methodologies are being implemented as part of a SuDS treatment train approach:

2.2.1 Permeable Pavement

Permeable pavement reduces the overall impermeable area of the hard-standing area, which will reduce the impact of the discharge and improve the quality of the effluent from the proposed development.

Permeable paving has been proposed in a number of areas namely private driveways. No area containing permeable paving will be included in areas that will be taken in charge by the Local Authority. Driveways are in individual private ownership. In order to propose permeable paving, the detailed design required obtaining infiltration results. It is proposed to infiltrate runoff through the subsurface media. An average of 30 m^2 of paving will be provided to each private dwelling. In order to infiltrate the runoff a permeable sub-stratum of 300mm permeable stone with a void ratio of approximately 30% is required. Full design calculations for the permeable paving are included in Appendix B.

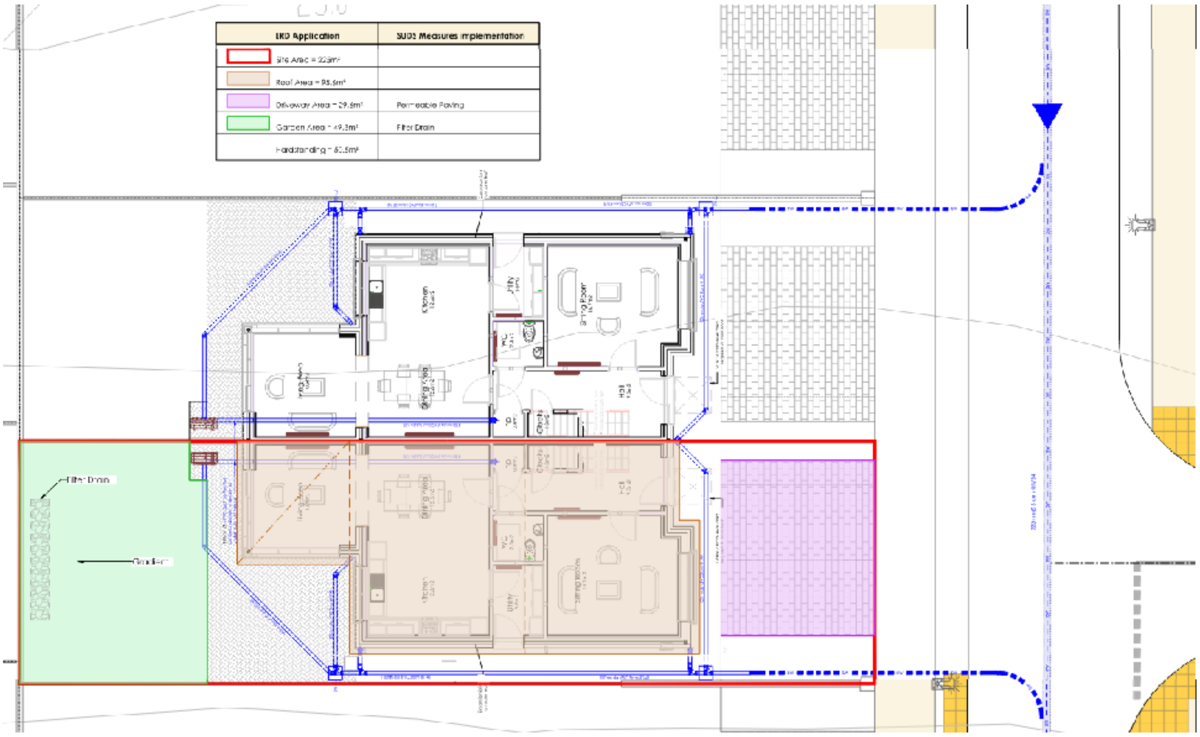


Figure 2.3– Typical Private Dwelling Layout

LRD Application	SUDS Measures implementation
Site Area = 225m²	
Roof Area = 95.6m²	
Driveway Area = 29.6m²	Permeable Paving
Garden Area = 49.3m²	Filter Drain
Hardstanding = 50.5m²	

Figure 2.4– Typical Private Dwelling Site and Breakdown of Areas

The inclusion of permeable paving (approx. 30 m^2 reduces the impermeable area of each private dwelling site by approx. 13% and has a direct correlation and reduction in net contributing runoff areas to be attenuated).

2.2.2 Rainwater Harvesting

In relation to rainwater harvesting an option is to provide a water butt with each individual dwelling. This could be located to the rear of each unit. This water butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants. The intension would be that these are provided retrospectively by the homeowner.

2.2.3 Infiltration Basins

It is proposed to incorporate infiltration basins in green spaces to compliment the SuDs strategy. These are vegetated depressions designed to store runoff on the surface and infiltrate it gradually into the ground. They are dry except in periods of heavy rainfall.

2.2.4 Filter Drain

Trenches filled with permeable material and a perforated collection pipe at the invert with an optional permeable 'sandy' topsoil at surface. These will treat, convey and attenuate runoff at source, and can infiltrate to the ground where the subgrade is suitable. These systems will allow some form of storage for small rainfall events and can result in water evaporation and adsorption in small quantities, therefore there will be less run-off from these areas in small rainfall events thus mimicking the natural response for this catchment. These will be located along the proposed pedestrian/cycle pathways and will allow groundwater to recharge to its natural state.

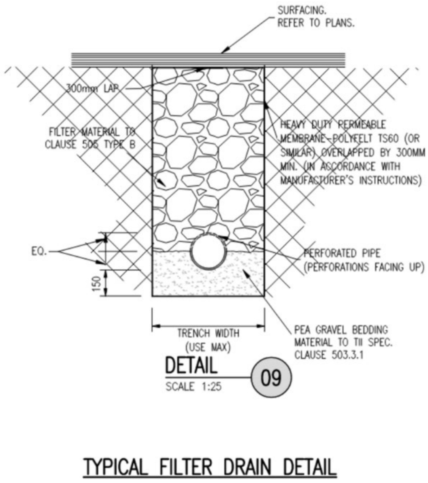


Figure 2.2.4– Typical Filter Drain Detail

The runoff and infiltration from the filter drains in the public areas have not been incorporated in any reduction of areas from an attenuation storage calculation perspective. Theoretically the installation of these filter drains contribute to a possible volumetric reduction in required attenuation but this potential reduction has not been factored into the attenuation calculations.

2.2.5 Tree Pits

Trees can be planted within a range of infiltration SuDS components to improve their performance, as root growth and decomposition increase soil infiltration capacity. Alternatively, they can be used as standalone within soil-filled tree pits, tree planters or structural soils, collecting and storing runoff and providing treatment via filtration and phytoremediation. Tree pits and planters will be designed to collect and attenuate runoff by providing additional storage within the underlying structure. The soils around trees can also be used to filter out pollutants from runoff directly. Tree pits are proposed to be in green space areas to treat and control runoff, while at the same time providing amenity value to adjacent pedestrian, and residential zones. It is also proposed, where possible to fit tree pits along the estate road to drain and treat surface water runoff from the road network. This will allow for treatment of first flush and low flows while high flows will discharge into the surface water network during extreme rainfall events. Rain water gullies will still be provided downstream of any tree pit to drain runoff during an extreme rainfall event.

Trees Pits are proposed as indicated on Drawing No. 6648-0028.

Calculations in relation to the infiltration rates of same are included in Appendix B. The proposed detail is as per Fig 2.7 below.

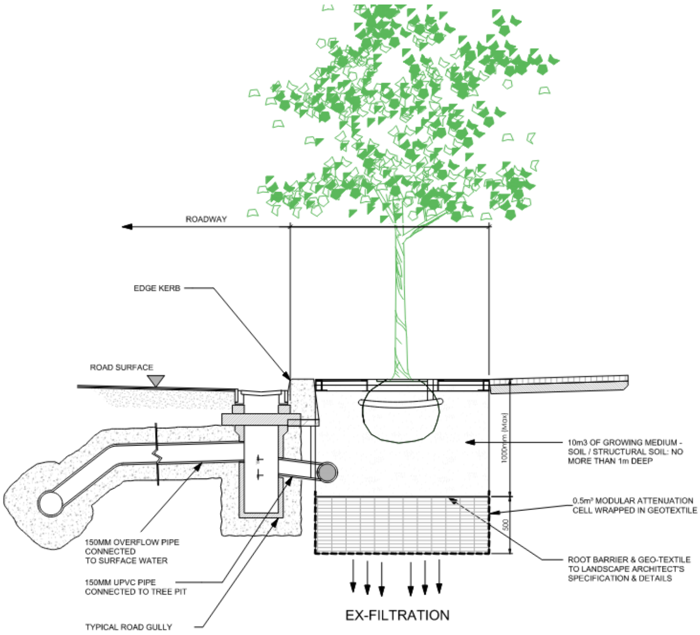


Figure 2.7– Tree Pit Detail

The analysis of these pits and associated infiltration/storage capacity would indicate that these tree pits could cater for the treatment and storage of runoff from approximately 20m^2 of adjacent impermeable pavement. From an overall calculation perspective however, this benefit has been omitted from the proposed attenuation storage required for the proposed development.

2.2.6 Detention Basin

The proposed attenuation system will provide treatment to the storm water before it passes to the local drainage network. The basin has been designed to be 'off-line' which provides treatment even in low flow conditions This minimises maintenance requirements and maintenance costs.

The system attenuates surface water to restrict the outflow to the equivalent of the existing agricultural runoff. This ensures the development will not give rise to any impact downstream of the site.

2.2.7 Flow Control Device

It is proposed to provide a hydrobrake, or similar approved, at the outfall of the surface water catchment to restrict the outflow of water from the subject site. The hydro-brakes will be fitted with a pull cord bypass and a penstock valve installed on the inlet to the manhole for maintenance purposes. The restricted outlet will be designed to the following

Catchment Ref	Basin Ref	Restricted Outlet
Catchment No. 1	Basin No. 1	35.30 l/sec
Catchment No. 2	Basin No. 2	5.70 l/sec
Catchment No. 3	Basin No. 3	3.50 l/sec

2.2.8 Petrol Interceptor

It is proposed to provide a petrol interceptor upstream of the attenuation tanks to ensure that any remaining hydro-carbons or pollutants within the runoff from trafficked areas are treated prior to outfall to the existing watercourse. It is proposed to provide a Conder Bypass Separator Types or similar approved.

In conclusion the water quality from this catchment should be of a high quality due to the above-mentioned measures, which are applied in a treatment train to treat the water before discharge at a restricted rate to the local network.

The above measures ensure a suitable management train is provided.

2.2.9 Swales

Broad, shallow drainage channels covered in grass which can treat, convey and attenuate runoff, at source, and can infiltrate to the ground where the subgrade is suitable. Swales can also promote biodiversity. This will be located adjacent to roads and hard-standing areas on the southern portion of the site receiving water from the adjoining roads and footpaths. There is no proposal to provide swales.

2.2.10 Rain Gardens

Rain Gardens are small, planted areas with stormwater controls that collect and treat stormwater runoff. Shallow landscaped basins make use of soils and vegetation in order to remove pollutants. This treated runoff would be collected in these basins and form part of a wider SuDS approach but are not proposed within the development.

2.2.11 Green / Sedum Roofs

Green and Sedum roofs involve covering a roof of a building with vegetation laid over a drainage layer and a waterproofing membrane. They are designed to intercept and store rainwater and therefore, reduce surface water runoff. They are suited to the flat type of roof on apartment buildings for example, There isn't scope to provide same in this development.

2.2.12 Raised Planters

It is proposed, as part of the landscaping of the development, to install raised planters within the courtyard areas of proposed apartment block units as an additional SuDS source control. This allows a small volume of water to be stored within the planter and integrated within the proposed surface water network of the development. The planter will have an overflow outlet pipe in times of storm events. The raised planters are to be installed as a SuDS measure that will have ecological and aesthetic benefits. As there are no apartment buildings proposed it is not anticipated that this strategy will be applied.

2.2.13 Existing Ditches, Trees and Hedgerows Within Site

Within the site where possible, existing ditches, trees and hedgerows are to be maintained. Incorporating these existing drainage features into the proposed overall SuDS strategy would provide for greater storage volume capacity within the site and will assist in the conveyance and treatment of the generated surface water runoff. The retention of existing trees and hedgerows will also assist in the reduction of surface water runoff by evapotranspiration. Any existing ditches that are to be retained, particularly along the existing field boundaries shall be cleaned out and assessed during the construction of the development. All ditches and existing drainage features being retained shall be incorporated into the proposed overall surface water network for the overall site.

2.3 Management Train

The management train commences with source control through the provision of permeable paving where possible and rain-water butts in the rear gardens. This will also reduce the water consumption required of each housing unit. This employment of these source controls along with the usage of localised tree pits will aid to reduce the peak runoff rate, placing less stress on the facilities downstream.

The second stage of the management train, site control, is provided by the introduction of the hydrocarbon interceptors and swales in open areas which provide a degree of treatment before discharging to the attenuation system.

The attenuation tanks and detention basins offer a third stage of treatment, regional control, by slowing the storm water discharge down and removing additional silts which may remain in the storm water.

3 *Surface Water System*

The existing watercourse on the southern boundary of the site has been chosen as the suitable surface water discharge point for the proposed development. The existing development discharges to same and it is proposed to connect upstream to the existing network so that there are no new outfalls proposed.

In order to reduce the effects of the surface runoff on potential flooding, a Stormwater Management Plan will be applied to surface water discharges into adjacent watercourses. The Stormwater Management Plan can be applied to control the rate of runoff from new development. The maximum permitted surface water outflow from the new development is to be restricted to that of the existing Greenfield site by the usage of attenuation storage.

Control of runoff by attenuation methods requires a hydraulic control to restrict the magnitude of flows passing downstream, together with an upstream storage capacity to contain the volume of runoff held back by the hydraulic control. The flows are proposed to be attenuated in the surface water system by adopting detention basins along with restricted outlets as the control devise. The storage volume required has been designed using the computer aided design package Windes 10.4.

The attenuation strategy for the site is for the detention of flows in interlinked detention basins.

3.1 Surface Water Drainage Network

The surface water drainage network for the proposed development was modelled using the Microdrainage software application. The surface water pipe lengths, slopes, contributing impermeable areas, upstream invert levels, upstream cover levels and pipe diameters were entered into the model using the drawings supplied.

3.2 Design Criteria:

The proposed surface water drains have been designed in accordance with the Greater Dublin Strategic Drainage Study (GDSDS), the Department of the Environment's Recommendations for Site Development Works for Housing Areas, the Department of the Environment's Building Regulations "Technical Guidance Document Part H Drainage and Waste Water Disposal" and BS EN 752: 2008 Drain and Sewer Systems Outside Buildings.

• Return period for pipe work design	2 years
• Return period for attenuation design	100 years
• Soil Type	2
• Allowable Outflow	44.50 l/second
• Time of entry	5 minutes
• M5 – 60	18.800mm
• Ratio "r"	0.250
• Pipe Friction (Ks)	0.6 mm
• Minimum Velocity (based on pipe flowing full)	1.0 m/s
• Rainfall Runoff from Roads and Footpaths	100%
• Rainfall Runoff from Roofs	80%
• Rainfall Runoff from Driveways	80%

- Rainfall Runoff from Green Areas 20%
- Rainfall Depth Factored for Climate Change (as per GDSDS) 20%

(in accordance with GDSDS Volume 2, Chapter 6, Table 6.2 – see below)

Climate Change Category	Characteristics
River flows	20% increase in flows for all return periods up to 100 years
Sea level	400+mm rise (see Climate Change policy document for sea levels as a function of return period)
Rainfall	10% increase in depth (factor all intensities by 1.1)
	Modify time series rainfall in accordance with the GDSDS climate change policy document

Table 6.2 Climate Change Factors to be Applied to Drainage Design

3.3 Storm Water Outfall

Storm water from the proposed development shall discharge into the existing watercourse located below the southern boundary of the site. It will connect to the existing network via a hydro brake manhole, which will limit the amount of water discharging to the network. The amount of water discharged from the hydro brake manhole will be determined by using the allowable Greenfield Runoff rate for the developable area of the site. It is to be noted that all on site storm water storage facilities have been sized to cater for all storm water generated within the site boundary of the development.

3.4 SuDS Calculations

Calculations of the various SuDS elements proposed are contained in Appendix B of this report. This report should also be read in conjunction with the Infrastructure Report submitted as part of the application. Detention Basin Sizes and Petrol Interceptor Sizing/Specifications have been included as part of the Stormwater Network Design in the Infrastructure report. The nature-based SuDS principles proposed will have a positive impact from a sustainable impact. Previously the volumetric attenuation capacity was calculated ignoring the benefits of all SuDS elements. As a result, the attenuation requirements are sizeable. The submitted redesign reduces the runoff from the site (and thus the attenuation volume required) by

- Introduction of permeable paving in private driveways

A contingency has been built in but providing Suds measures and not including their volumetric benefits in the attenuation calculations, namely

- Filter drains along public paths
- Tree-pit infiltration and storage

4 *Site Investigations*

DOSA Consulting Engineers and Priority Geotechnical Engineers conducted Site Investigations in February 2024.

The purpose of the site investigation was to investigate subsurface conditions using a variety of investigative methods. The scope of the site investigation works undertaken for this project included the following:

- Visit project site to observe existing conditions.
- Excavate. Trial Pits to a maximum depth of 2.30m BGL.
- Geotechnical Laboratory testing

4.1 Subsurface Exploration

During the ground investigation a programme of intrusive investigation were undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in- situ testing were undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be conducted on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

4.2 Trial Pits

The trial pits were excavated using a 21T tracked excavator as indicated in the Site Investigations Report. The trial pits were conducted to assess and classify the insitu ground material to obtain representative samples of the materials. The location of the trial pits were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged, and photographed by and prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered, and the characteristics of the strata encountered and presented on the trial pit logs.

4.3 Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Chemical testing as required by the specification, including pH, sulphate and organic matter content testing are being conducted by Element Materials Technology Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits and Particle Size Distribution (PSD) tests were conducted.

4.4 Ground Conditions

4.4.1 General

The ground conditions encountered during the investigation are summarised with reference to insitu and laboratory test results.

4.4.2 Groundwater

No groundwater was noted during the investigation.

Based on the information contained within the report, there will be no perceptible impacts from groundwater levels on proposed SuDS throughout the site.

4.4.3 Soil Infiltration Rate

The Soil Infiltration rates are indicated in the Appendices of the Report with an average rate of 1.57 x 10-4 m/second across the 3 test holes.

5 *Existing Site Hydrology*

The main hydrological feature of the area is the Blackwater River which flows in an easterly direction to the south of the site before discharging into Youghal harbour. The Caherduggan & Spa streams join the Blackwater River Lee in Mallow town. Figure 4-1 below illustrates the main hydrological features associated with the site.

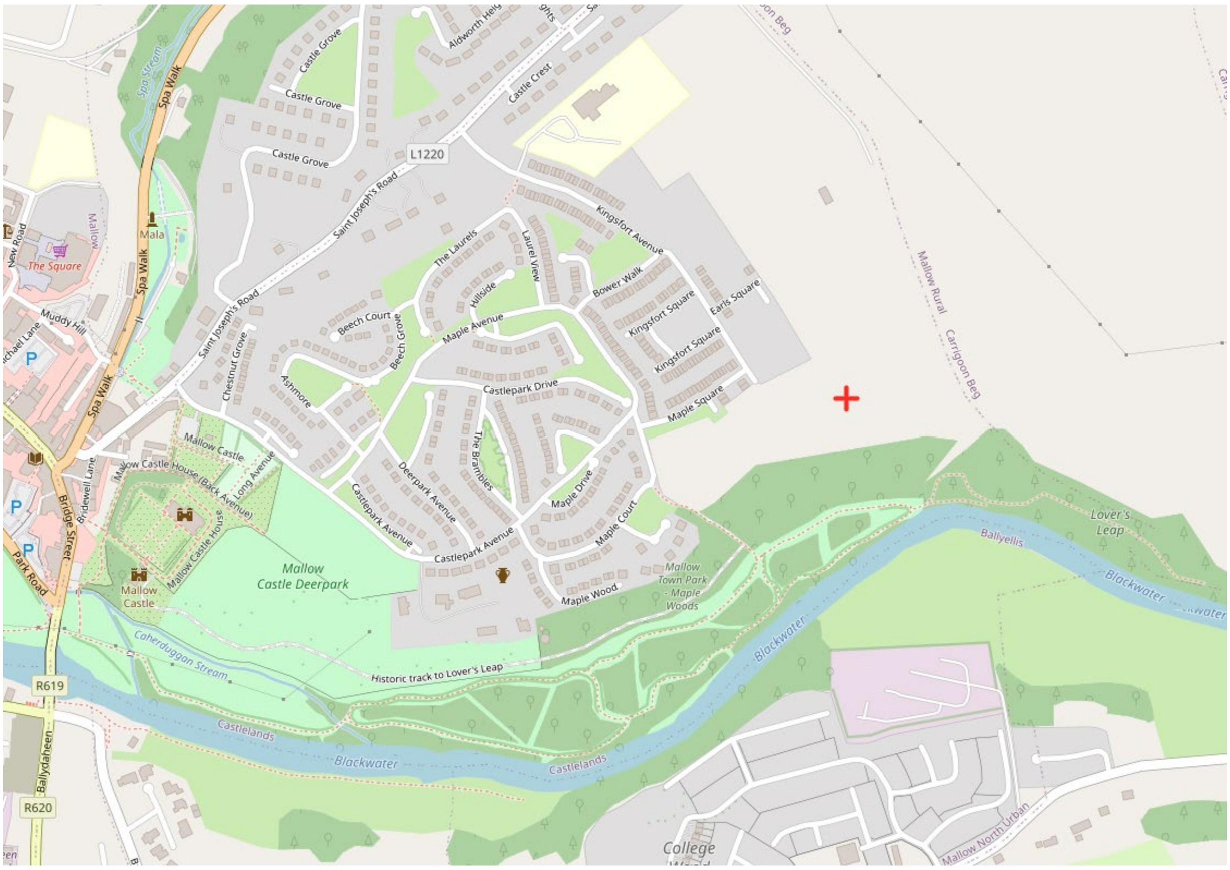


Figure 4.1: Hydrological Features of the Area

6 *Maintenance Regime for SuDS Devices*

The SuDS features proposed above for the site will require the following maintenance:

6.1 Permeable Paving

The permeable paving has a design life equivalent to standard block paving. The surface blocks require routine maintenance. There are four levels of cleaning that can be carried out on a paved area:

1. General dirt should be removed by regular dry brushing.
2. Where the paving has become dull, showing a loss of colour, a wet wash with a stiff bristle brush and garden hose can be adequate.
3. For more stubborn areas a power washer can be used, taking care not to remove the jointing materials (sand or mortar). The washer should be on a medium pressure setting or lower and should not be aimed directly at the paving surface, but at an angle of 30° approximately.

Cleaning detergents can be used; however, some detergents are acidic and overuse can damage some paving products. It is advisable to follow the manufacturer's instructions and rinse the areas fully. The resulting runoff should be carefully channelled to either drainage points or containers from where it can be safely disposed. Replace any washed-out jointing sand with new dried sand once the paving has dried.

6.1.1 Wet Swales:

Requires regular inspection of inlets and outlets, vegetation, mulching and the removal of nuisance plants and rubbish as necessary. Trees and vegetation should be trimmed every 2 years. Swale surface should be spiked, scarified and removed of 'thatch' every 3 years with regular inspection of surface infiltration to avoid areas of ponding. Repair erosion at inlets and outlets and re-turf surfacing as required. Wet swales will be maintained from adjacent access roads.

6.1.2 Detention Basins

The detention basins will require regular maintenance to ensure continuing operation to design performance standards. This will be relatively straightforward for landscape contractors and does not generally require any additional works above what is necessary for a standard public open space.

6.1.3 Tree Pits

Maintenance of trees will be greatest in the first few years, which will include regular inspection of tree condition including inlets and outlets, removal of invasive vegetation and possibly irrigation during long dry periods.

6.1.4 Filter Drains

Inspection of the system should be conducted monthly on the inlet / outlet pipework and any control systems for blockages. Inspection of pre-treatment systems including should be conducted every 6 months for catch pits manholes prior to the filter drain with removal of silt or other build-ups. Removal of silt build-up may be required more frequent. Annual cleaning of roof runoff gutters etc should be part of the generally maintenance of the drainage system to ensure debris is removed prior to entering the network. Perforated pipework should be cleared of blockage if required.

6.1.5 Hydrobrake Manhole:

Normally little maintenance is required as there are no moving parts within a hydrobrake, however, after installation, hydrobrakes should be inspected to ensure the hydrobrake orifice is not blocked on a monthly basis for three months and thereafter at six monthly intervals and hosed down if required. Remove rubbish or debris from hydrobrake if present. Hydro-Brake Flow Controls are fitted with a pivoting by-pass door, which allows the manhole chamber to be drained down should blockages occur.

6.1.6 Petrol Interceptor:

Systems 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. Systems 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, oils and grease should be removed where required.

The permeable paving has a design life equivalent to standard block paving. The surface blocks require routine maintenance. There are four levels of cleaning that can be conducted on a paved area:

1. General dirt should be removed by regular dry brushing.
2. Where the paving has become dull, showing a loss of colour, a wet wash with a stiff bristle brush and garden hose can be adequate.
3. For more stubborn areas a power washer can be used, taking care not to remove the jointing materials (sand or mortar). The washer should be on a medium pressure setting or lower and should not be aimed directly at the paving surface, but at an angle of 30° approximately.

Cleaning detergents can be used; however, some detergents are acidic, and overuse can damage some paving products. It is advisable to follow the manufacturer's instructions and rinse the areas fully. The resulting runoff should be carefully channelled to either drainage points or containers from where it can be safely disposed. Replace any washed-out jointing sand with new dried sand once the paving has dried.

The attenuation tanks will require regular maintenance to ensure continuing operation to design performance standards.

7 *Flood Risk*

According to the GSI and floodinfo.ie resources, there are no historic records of flooding near the site.

7.1 Fluvial risk

The proposed development is located approximately 100m north of Blackwater River. The entirety of the proposed development site is in Flood Zone C, an area at low risk of flooding (less than 0.1% Annual Exceedance Probability - AEP). The applicant is the owner of lands on the southern boundary of the development site which are within Flood Zone A, are at high risk of flooding (more than 1%AEP). It is proposed that a footpath could be installed by the applicant which would facilitate connection from the proposed development to the existing riverside amenity path to the south. Therefore, the proposed use at this area is for an open space and footpath, a water compatible use and, as such, appropriate for development in Flood Zone A. The extreme flood water level from Blackwater River is at 46.37m AOD for the 0.1%AEP. All highly and less vulnerable development is proposed above this level, between 61.75m AOD and 85.15m AOD. The risk of fluvial flooding to the development is therefore low.

A Justification Test will not be required for the proposed development.

7.2 Pluvial risk

The development is located on a sloping greenfield site. St Joseph's Road north of the site lies on a ridge and forms the local high point. There are limited catchments upstream the development site and as such no overland flows from outside the development would enter the site and cause risk of pluvial flooding.

7.3 Groundwater risk

The site is underlain by Dinantian pure unbedded limestone which is a Regionally Important karstified bedrock aquifer (Rkd) dominated by diffuse flow. This type of bedrock is highly productive, and groundwater can travel over large distances through the karstified faults and joints. The nearest Geological Survey Ireland (GSI) mapped karst feature is approx. 500m west of the site near the N72, at an elevation below 50m AOD.

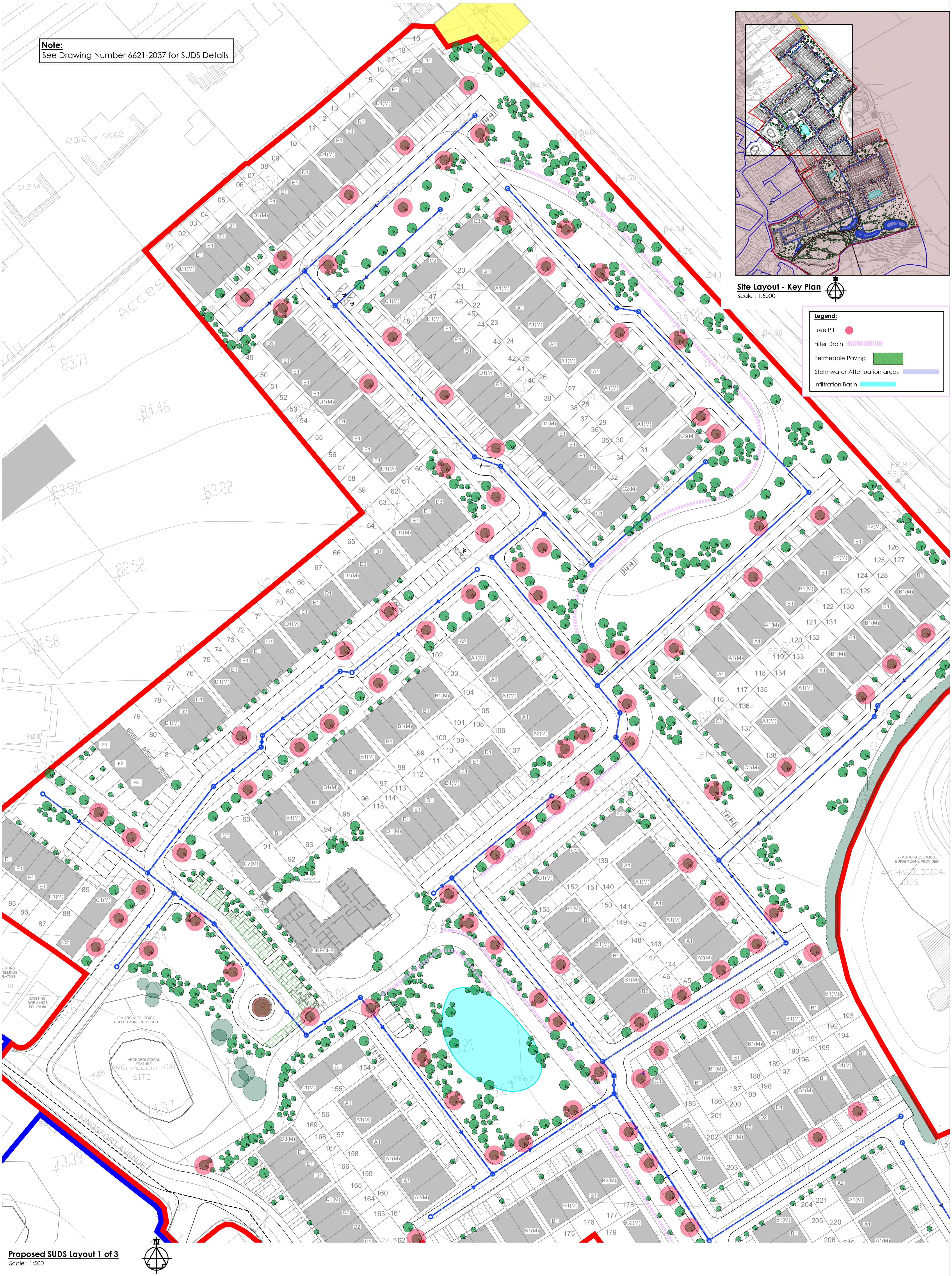
There is no groundwater level monitoring available within the site. Due to the karstified nature of the bedrock the local groundwater flow direction may not reflect the topography, however the regional groundwater flow direction will be towards rivers. Therefore, the groundwater flow direction beneath the site is likely to be south towards the River Blackwater.

The GSI groundwater flooding maps do not indicate risk of flooding at the site.

Taking the above into consideration, the risk of groundwater flooding to the site is considered low.

Please refer to the Site-Specific Flood Risk Assessment (Document No. 305321-ARUP-ZZ-XX-RP-CF-000001- Flood Risk Assessment) complied by Arup for further details.

Appendix A –Schematic SuDS Train



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B	K.M.	S.O'G	S.O'G	27.09.'24	Issued for LRD Application
A	G.S.	S.O'G	S.O'G	18.12.23	Issued for Pre Planning Application

CLIENT: Reside (Castlepark) Ltd.
PROJECT: Castlepark, Mallow, Co. Cork
DRAWING TITLE: Schematic SUDS Layout 1 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2027	B

Proposed SUDS Layout 2 of 3
Scale : 1:500

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B	K.M.	S.O'G	S.O'G	27.09.'24	Issued for LRD Application
A	G.S.	S.O'G	S.O'G	18.12.23	Issued for Pre Planning Application

CLIENT: Reside (Castlepark) Ltd.
PROJECT: Castlepark, Mallow, Co. Cork
DRAWING TITLE: Schematic SUDS Layout 2 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2028	B

Proposed SUDS Layout 3 of 3
Scale : 1:500

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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
B	K.M.	S.O'G	S.O'G	27.09.24	Issued for LRD Application
A	G.S.	S.O'G	L.O'T	15.11.23	Issued for Pre Planning Application

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Schematic SUDS Layout 3 of 3

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	2029	B

Appendix B –SuDS Calculations

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — A = **4.0** m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — r = **0.360**

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — d = **300** mm

Width of pit — w = **1000** mm

Length of pit — l = **1000** mm

Percentage free volume — V_{free} = **30** %

Soil infiltration rate — f = **157.×10^{-6}** m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d$ = **600000** mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.36;	6.8;	1.90;	12.9;	0.05;	0.03;	0.02
10	0.51;	9.6;	1.96;	18.8;	0.08;	0.06;	0.02
15	0.62;	11.7;	1.97;	23.0;	0.09;	0.08;	0.01
30	0.79;	14.9;	1.98;	29.4;	0.12;	0.17;	0.00
60	1.00;	18.8;	1.94;	36.5;	0.15;	0.34;	0.00
120	1.22;	22.9;	1.91;	43.7;	0.17;	0.68;	0.00
240	1.48;	27.8;	1.87;	52.0;	0.21;	1.36;	0.00
360	1.67;	31.4;	1.84;	57.7;	0.23;	2.03;	0.00
600	1.90;	35.7;	1.80;	64.4;	0.26;	3.39;	0.00
1440	2.42;	45.5;	1.74;	79.3;	0.32;	8.14;	0.00

Required storage volume — S_{req} = **0.02** m^3

Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free}$ = **0.09** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 1min 47s

PASS - Soakaway discharge time less than or equal to 24 hours

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — A = **23.7** m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — r = **0.360**

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — d = **300** mm

Width of pit — w = **5800** mm

Length of pit — l = **5100** mm

Percentage free volume — V_{free} = **30** %

Soil infiltration rate — f = **24.9×10^{-6}** m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d$ = **3270000** mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m³)	Outflow (m³)	Storage required (m³)
5	0.36;	6.8;	1.90;	12.9;	0.30;	0.02;	0.28
10	0.51;	9.6;	1.96;	18.8;	0.45;	0.05;	0.40
15	0.62;	11.7;	1.97;	23.0;	0.55;	0.07;	0.47
30	0.79;	14.9;	1.98;	29.4;	0.70;	0.15;	0.55
60	1.00;	18.8;	1.94;	36.5;	0.87;	0.29;	0.57
120	1.22;	22.9;	1.91;	43.7;	1.04;	0.59;	0.45
240	1.48;	27.8;	1.87;	52.0;	1.23;	1.17;	0.06
360	1.67;	31.4;	1.84;	57.7;	1.37;	1.76;	0.00
600	1.90;	35.7;	1.80;	64.4;	1.53;	2.93;	0.00
1440	2.42;	45.5;	1.74;	79.3;	1.88;	7.03;	0.00

Required storage volume — S_{req} = **0.57** m^3

Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free}$ = **2.66** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 58min 21s

PASS - Soakaway discharge time less than or equal to 24 hours

Tekla Tedds	Project: Residential Development, Castlepark, Mallow				Job no.: 6621	
DOSA Joyce House Barrack Square Ballincollig, Cork	Calcs for: SuDS Measures - Tree Pit				Start page no./Revision: 1	
	Calcs by: S.O.'Grady	Calcs date: 16/08/2024	Checked by	Checked date	Approved by	Approved date

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.05

Design rainfall intensity

Location of catchment area — Other

Impermeable area drained to the system — A = **30.0** m^2

Return period — Period = **100** yr

Ratio 60 min to 2 day rainfall of 5 yr return period — r = **0.360**

5-year return period rainfall of 60 minutes duration — M5_60min = **18.8** mm

Increase of rainfall intensity due to global warming — $p_{climate}$ = **0** %

Soakaway / infiltration trench details

Soakaway type — Rectangular

Minimum depth of pit (below incoming invert) — d = **1000** mm

Width of pit — w = **1000** mm

Length of pit — l = **1000** mm

Percentage free volume — V_{free} = **95** %

Soil infiltration rate — f = **157.×10⁻⁶** m/s

Wetted area of pit 50% full — $a_{s50} = l \times d + w \times d$ = **2000000** mm^2

Table equations

Inflow (cl.3.3.1) — $I = M100 \times A$

Outflow (cl.3.3.2) — $O = a_{s50} \times f \times D$

Storage (cl.3.3.3) — $S = I - O$

Note: The following Z2 table values are user defined.

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m^3)	Outflow (m^3)	Storage required (m^3)
5	0.36;	6.8;	1.90;	12.9;	0.39;	0.09;	0.29
10	0.51;	9.6;	1.96;	18.8;	0.56;	0.19;	0.38
15	0.62;	11.7;	1.97;	23.0;	0.69;	0.28;	0.41
30	0.79;	14.9;	1.98;	29.4;	0.88;	0.57;	0.32
60	1.00;	18.8;	1.94;	36.5;	1.10;	1.13;	0.00
120	1.22;	22.9;	1.91;	43.7;	1.31;	2.26;	0.00
240	1.48;	27.8;	1.87;	52.0;	1.56;	4.52;	0.00
360	1.67;	31.4;	1.84;	57.7;	1.73;	6.78;	0.00
600	1.90;	35.7;	1.80;	64.4;	1.93;	11.30;	0.00
1440	2.42;	45.5;	1.74;	79.3;	2.38;	27.13;	0.00

Required storage volume — S_{req} = **0.41** m^3

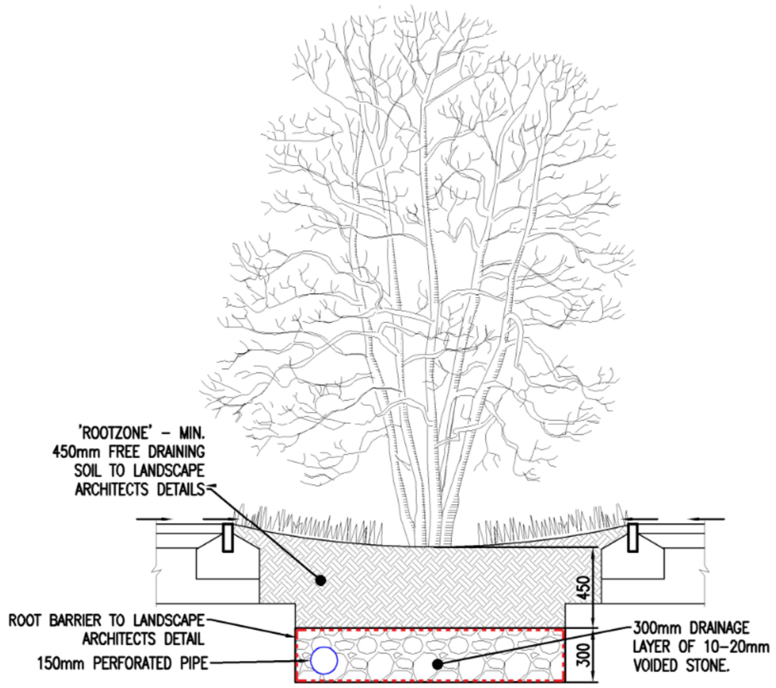
Soakaway storage volume — $S_{act} = l \times d \times w \times V_{free}$ = **0.95** m^3

PASS - Soakaway storage volume

Time for emptying soakaway to half volume — $t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f)$ = 10min 53s

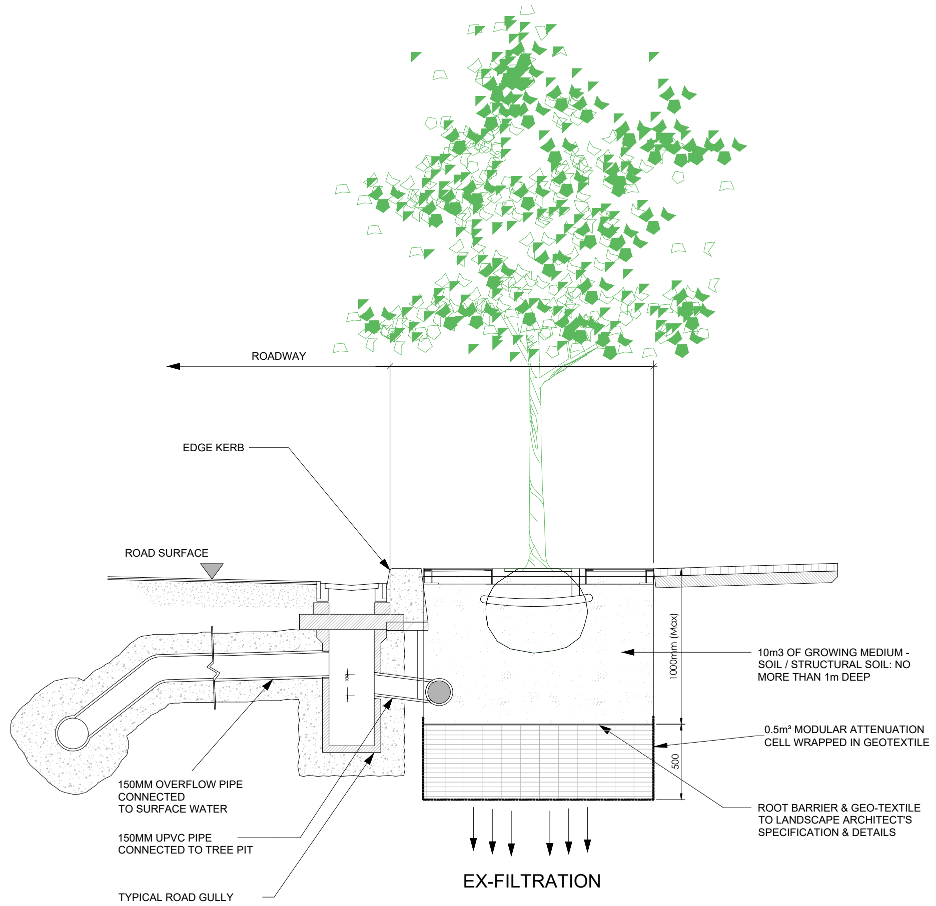
PASS - Soakaway discharge time less than or equal to 24 hours

Appendix C –Miscellaneous SuDS Drawings

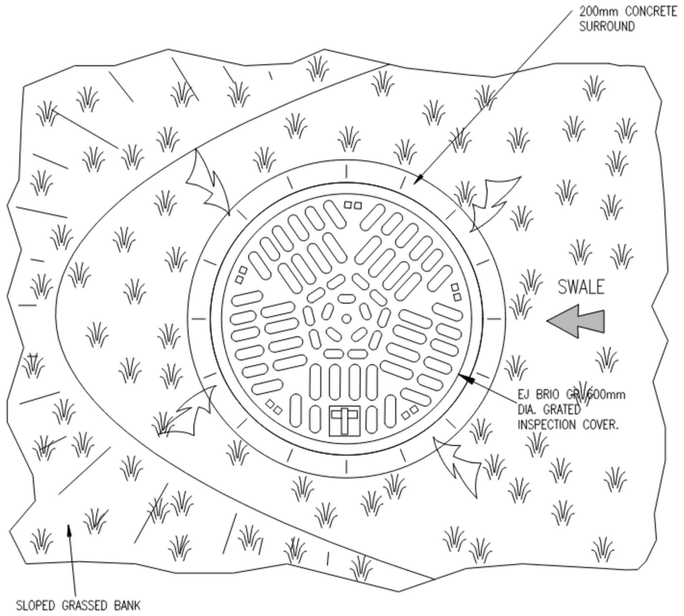


TYPICAL SECTION THROUGH RAIN GARDEN/BIORETATION TREE PIT

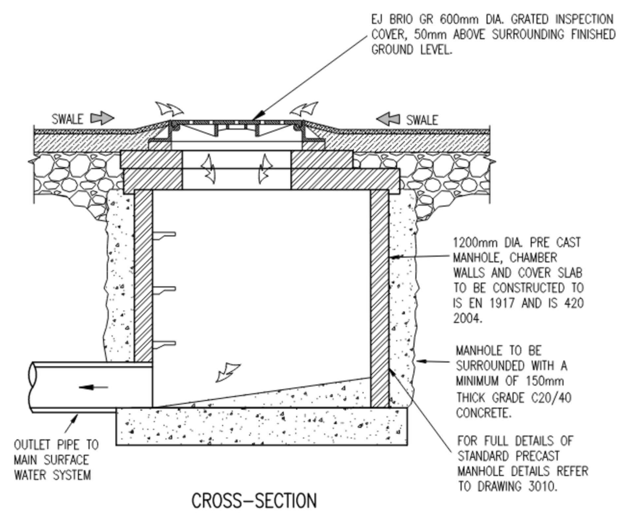
SCALE 1:25 @ A1



TYPICAL ROAD GULLY TO TREE PIT DETAIL (TYPE 1)



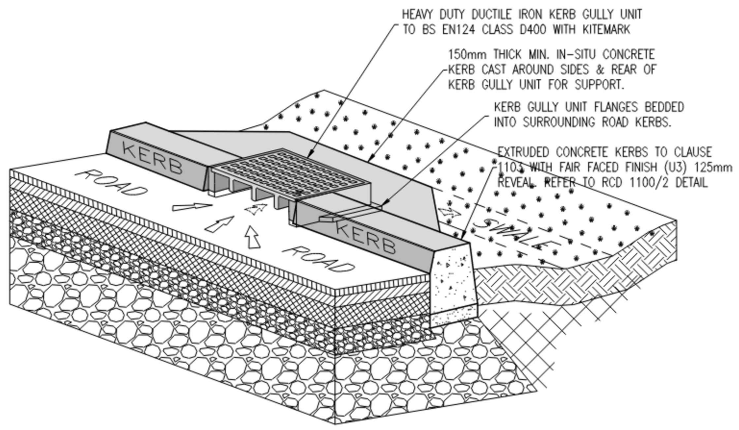
PLAN
SCALE 1:10



CROSS–SECTION
SCALE: N.T.S.

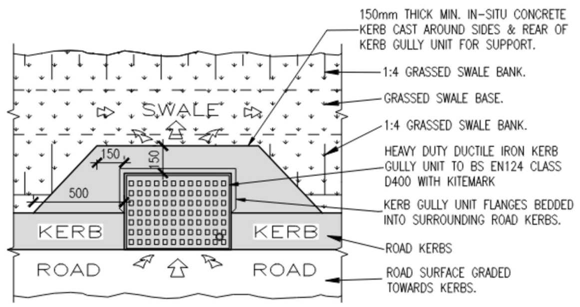
GRATED MANHOLE INLET CHAMBER

[FOR ROAD DRAINAGE]



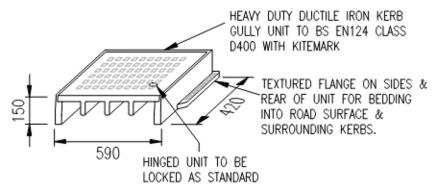
LATERAL INLET KERB GULLY SCHEMATIC

[FOR ROAD DRAINAGE]
SCALE: NTS



LATERAL INLET KERB GULLY PLAN

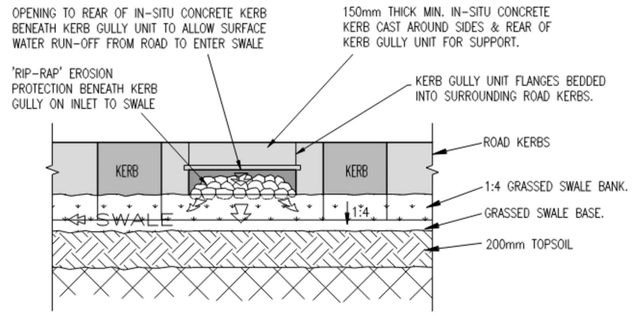
[FOR ROAD DRAINAGE]
SCALE: NTS



[DENOTED BY 'KG' ON PLAN]

LATERAL INLET KERB GULLY DETAIL

[LOCATED ALONG KERBLINES TO ALLOW ROAD SURFACE WATER RUN–OFF INTO SWALES]
SCALE: NTS



LATERAL INLET KERB GULLY – REAR ELEVATION

[FOR ROAD DRAINAGE]
SCALE: NTS

DOSA
DENIS O'SULLIVAN & ASSOCIATES
CONSULTING ENGINEERS

Joyce House
Barrack Square
Ballincollig
Co Cork
P31 KP84

021 4871781
info@dosa.ie
www.dosa.ie

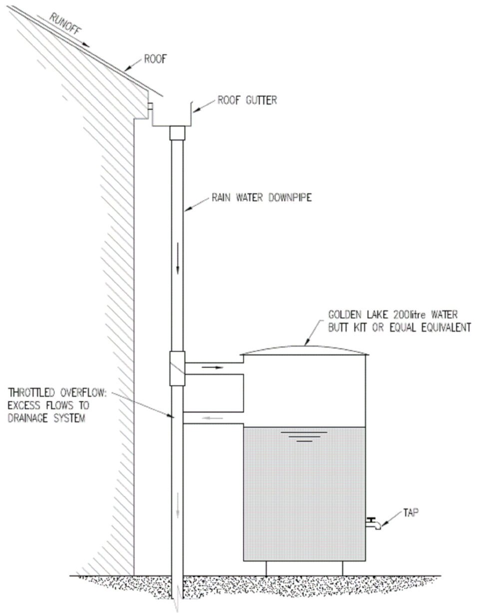
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
A	D.O'S.	S.O'G	L.O'T	16.08.24	Issued for Planning

CLIENT: Reside (Castlepark) Ltd.

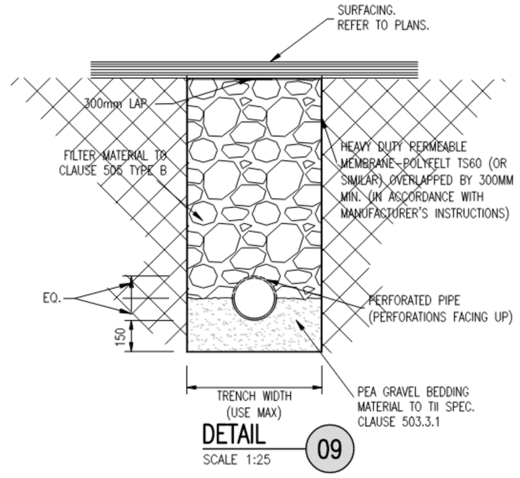
PROJECT: Castlepark, Mallow, Co. Cork

DRAWING TITLE: Proposed SUDS Details (1 of 2)

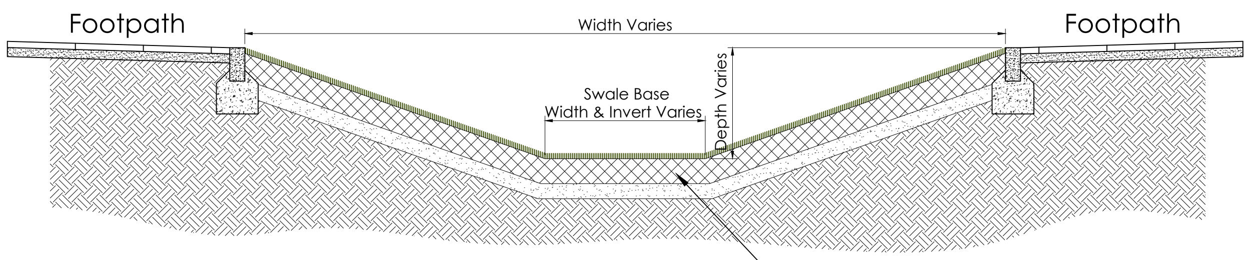
SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	0024	A



TYPICAL WATER BUTT DETAIL
SCALE: NTS



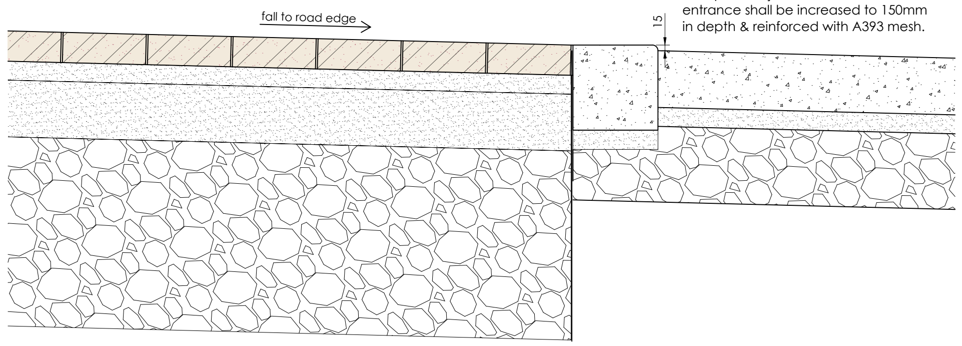
TYPICAL FILTER DRAIN DETAIL



Wet Swale Typical Section
Scale 1:25

Surface Construction: Parking Bay
80mm Permeable paving block to B.S.1338 & Architects specification & approval & laying pattern on
50mm laying material jointing to manufacturers specification (typically type 2/6.3 GC 80/20 to I.S. EN 13342) on
150mm road base course cement stabilised coarse graded aggregate as GBGM B to NRA CL 822 on
500mm Sub base layer 4mm to 20mm coarse grade clear crushed rock to I.S. EN 13242:2002 (se note on particle size distribution) on geotextile layer to clause 609 (NRA).

Concrete Pedestrian Pavement:
100mm C40/50 concrete on 50mm blinding on 100mm min compacted clause 803/804 sub base. Expansion joints at maximum 3m centres. Brush (non slip) finish, no bull nose trowel finish at expansion joint location. Vehicular entrance shall be increased to 150mm in depth & reinforced with A393 mesh.



Typical Permeable Paving Driveway Cross- Section
Scale 1:10

Joyce House
Barrack Square
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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
A	D.O'S.	S.O'G	L.O'T	16.08.24	Issued for Planning

CLIENT
Reside (Castlepark) Ltd.

PROJECT
Castlepark, Mallow, Co. Cork

DRAWING TITLE
Proposed SUDS Details (2 of 2)

SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
A1	1:500	6621	0027	A

Appendix D –Site Investigation Results

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **SA01**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:**		**Date** 06/02/2024
		Level:		
Location: Co. Cork		**Dimensions (m):** 2.70 x 0.80		**Scale** 1:25
Client:		**Depth:** 2.30m BGL		**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing			Depth (m)	Level (m OD)	Legend	Stratum Description
	Depth (m)	Type	Results				
				0.50			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to course angular rounded.
	2.00	B		2.30			Brown slightly Clayey slightly Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded.
							End of Pit at 2.300m

Depth scale: 1, 2, 3, 4, 5

Stability: Good
Plant: 14t Excavator.
Backfill: Arisings.
Groundwater: None encountered.
Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

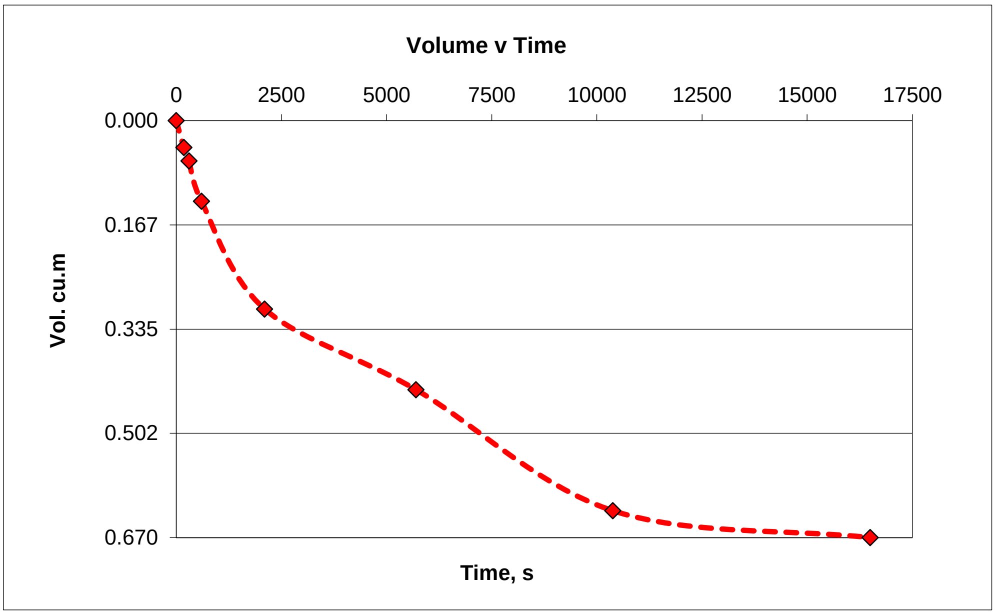
Project Nr. P24011
Project Name Castlelands Mallow
Location SA01
Cycle 1
Date: 06/02/2024

l, m **2.70** b, m **0.80** d, m **2.30**
l_base, m **2.70** d_eff, m **1.30**
l_eff, m **2.70**

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:35	0	1.00	0	1.30	0.00	0.000
	3	1.02	180	1.28	0.02	0.043
	5	1.03	300	1.27	0.03	0.065
	10	1.06	600	1.24	0.06	0.130
	35	1.14	2100	1.16	0.14	0.302
	95	1.20	5700	1.10	0.20	0.432
	173	1.29	10380	1.01	0.29	0.626
	275	1.31	16500	0.99	0.31	0.670

Area	2.160 m^2	$V_{p75\text{-}25\ theory}$	volume	1.4040	m^3
50% Area_eff, a_{p50}	6.710 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.3348	m^3
50% Area_act, a_{p50}	5.625 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	6471	s

Infiltration Coefficient *f* 9.20E-06 ms^-1



NOTES:
See SA01 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA01**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **SA02**
Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:** **Level:**	**Date** 06/02/2024
Location: Co. Cork		**Dimensions (m):** 3.20 x 0.80	**Scale** 1:25
Client:		**Depth:** 2.00m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.30			Hard Yellowish Brown Sandy slightly Gravelly CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 63-200mm.*
							Yellowish Brown Clayey Gravelly SAND. Sand fine to course, Gravel fine to course angular sub-rounded. *Cobble content between 63-200mm.*
	2.00	B		2.00			End of Pit at 2.000m

Stability: Good.
Plant: 14t Excavator.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.00m bgl, scheduled depth reached.

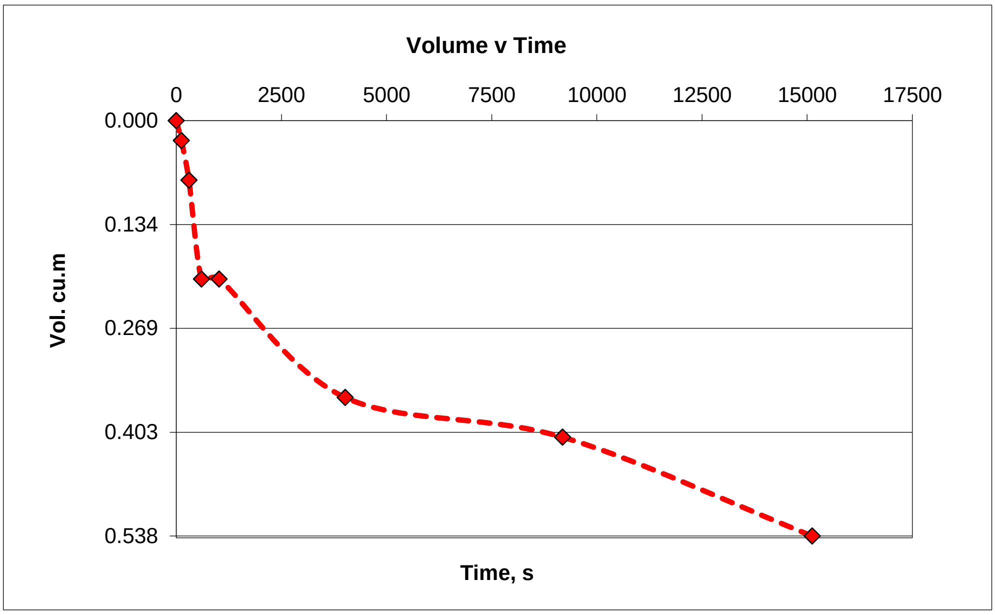
Project Nr.	P24011
Project Name	Castlelands Mallow
Location	SA02
Cycle	1
Date:	06/02/2024

l, m	**3.20**	b, m	**0.80**	d, m	**2.00**
l_base, m	**3.20**			d_eff, m	**1.30**
l_eff, m	**3.20**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
12:58	0	0.70	0	1.30	0.00	0.000
	2	0.71	120	1.29	0.01	0.026
	5	0.73	300	1.27	0.03	0.077
	10	0.78	600	1.22	0.08	0.205
	17	0.78	1020	1.22	0.08	0.205
	67	0.84	4020	1.16	0.14	0.358
	153	0.86	9180	1.14	0.16	0.410
	252	0.91	15120	1.09	0.21	0.538

Area	2.560 m^2	$V_{p75\text{-}25\ theory}$	volume	1.6640 m^3
50% Area_eff, a_{p50}	7.760 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	0.2688 m^3
50% Area_act, a_{p50}	6.920 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	8048 s

Infiltration Coefficient *f* 4.83E-06 ms^-1



NOTES:
See SA02 log for detailed soil description; clayey gravelly SAND.
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA02**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Priority Geotechnical Ltd.
Tel: 021 4631600
Fax: 021 4638690
www.prioritygeotechnical.ie

Trial Pit No **SA03** Sheet 1 of 1

Project Name: Castlelands Mallow	**Project No.** P24011	**Co-ords:** **Level:**	**Date** 06/02/2024
Location: Co. Cork		**Dimensions (m):** 3.00 x 0.80	**Scale** 1:25
Client:		**Depth:** 2.30m BGL	**Logged** DOC

Water Strike & Backfill	Samples & In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m OD)	Legend	Stratum Description
				0.20			Yellowish Brown Sandy slightly Gravelly CLAY. Sand fine to course, Gravel fine to medium angular sub-rounded.
				1.70			Yellowish Brown Gravelly Sandy CLAY with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles angular sub-angular with mudstone lithology. *Cobble content between 63-280mm.* *Red oxidised layer at 0.5-0.8m bgl.* *Colour change to brown at 0.8-1.7m bgl.*
	2.00	B		2.30			Brown very Sandy Clayey GRAVEL with low Cobble content. Sand fine to course, Gravel fine to course angular sub-rounded, Cobbles sub-angular sub-rounded with Mudstone lithology. *Cobble content between 68-160mm.*
							End of Pit at 2.300m

1
2
3
4
5

Stability: Very Poor to Good.
Plant: 14t Excavator.
Backfill: Arisings.

Groundwater: None encountered.

Remarks: Trial pit terminated at 2.30m bgl, scheduled depth reached.

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA	

Photographic Record

Number:	**SA03**	**Project** **Project No** **Engineer**	Castlelands, Mallow, Co. Cork. P24011 DOSA

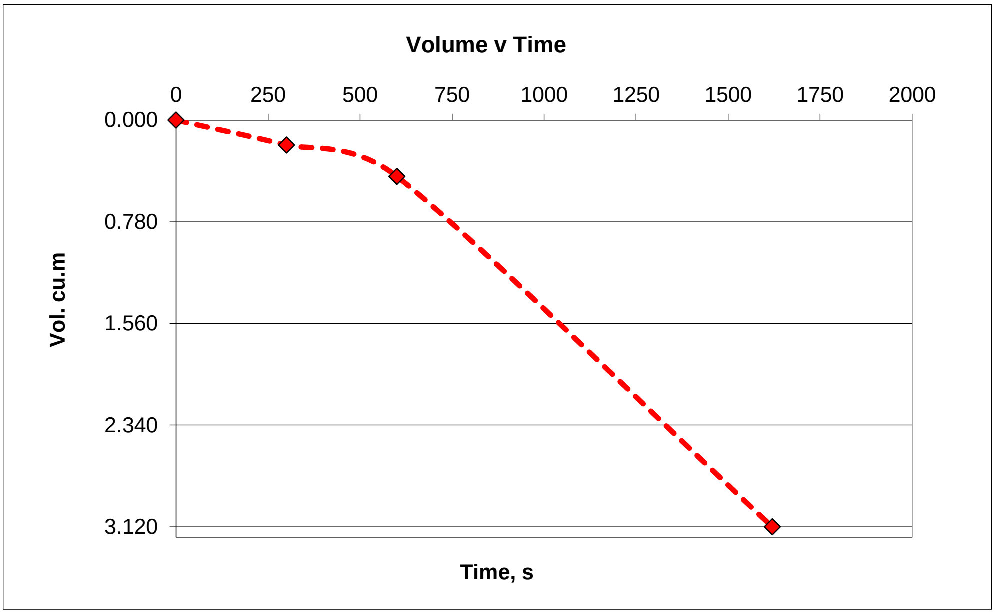
Project Nr. P24011
Project Name Castlelands Mallow
Location SA03
Cycle 1
Date: 06/02/2024

l, m **3.00** b, m **0.80** d, m **2.30**
l_base, m **3.00** d_eff, m **1.30**
l_eff, m **3.00**

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
13:28	0	1.00	0	1.30	0.00	0.000
	5	1.08	300	1.22	0.08	0.192
	10	1.18	600	1.12	0.18	0.432
13:55	27	2.30	1620	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75-25\ theory}$	volume	1.56 m^3
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75-25\ actual}$	volume	1.56 m^3
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ 75-25\ actual}$	time	465 s

Infiltration Coefficient *f* 4.57E-04 ms^-1



NOTES:
See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over effective depths.

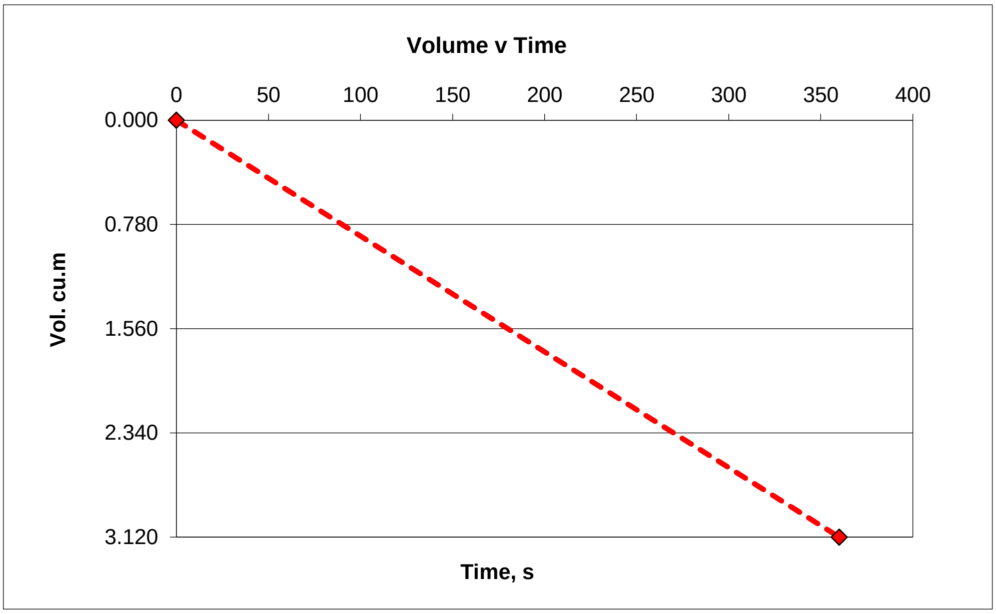
Project Nr. P24011
Project Name Castlelands Mallow
Location SA03
Cycle 2
Date: 06/02/2024

l, m	**3.00**	b, m	**0.80**	d, m	**2.30**
l_base, m	**3.00**			d_eff, m	**1.30**
l_eff, m	**3.00**				

	Time, min	Measure, m bgl	Time, sec	Depth water, m	Fall, m	Volume
15:35	0	1.00	0	1.30	0.00	0.000
15:41	6	2.30	360	0.00	1.30	3.120

Area	2.400 m^2	$V_{p75\text{-}25\ theory}$	volume	1.5600	m^3
50% Area_eff, a_{p50}	7.340 m^2	$V_{p\ 75\ -\ 25\ actual}$	volume	1.5600	m^3
50% Area_act, a_{p50}	7.340 m^2	$t_{p\ \ 75\text{-}\ 25\ actual}$	time	175	s

Infiltration Coefficient *f* 1.75E+02 ms^-1



NOTES:
See SA03 log for detailed soil description; clayey GRAVEL
No groundwater encountered. Pit assumed unsaturated.
Infiltration calculated over actual fall
Further tests termianted due to pit collapse

Appendix E –SuDS Selection Table

TABLE 3
CORK COUNTY COUNCIL SUDS SELECTION HIERARCHY SHEET FOR SMALL-SCALE DEVELOPMENT

SuDS Measures		**Measures to be used on site**	**Rational for selecting / not selecting measure including discharge rate applied with supporting calculations**
Water butt – 150L capacity or more (based water use demand) with means of overflow		Measure to be used in rear gardens on site	This could be located to the rear of each unit. This water butt will only have the ability to catch the rear sloping side of the dwelling and the reuse would be for watering plants
Permeable paving – consider for all hard paved areas without heavy traffic		Permeable paving will be installed in the proposed parking areas adjacent the Creche to promote infiltration.	Permeable pavement reduces the overall impermeable area of the hard-standing area, which will reduce the impact of the discharge and improve the quality of the effluent from the proposed development
Bio-retention planter – disconnect downpipe connection into drains and allow roof runoff into planter with means of overflow		Not to be used on site	More suitable in apartment buildings of which there are none on site
Green / Blue Roof – requires a minimum substrate depth (growth medium) of at least 80 mm excluding the vegetative map		Not to be used on site	More suitable in apartment buildings of which there are none on site
Rain garden - disconnect downpipe/RWP into the planted flower bed		Not to be used on site	More suitable in apartment buildings of which there are none on site
Other			

Appendix 12.6 Kelliher Electrical Public Lighting Drawings & Report

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

DATE: 9 October 2024

DESIGNER: Declan Doyle

PROJECT No: KE/RE/CPC/02 rev 2

PROJECT NAME: Castle Park Castlelands Mallow phase 2

KELLIHERS LIGHTING

Lighting to IS EN 13201-2: 2015

Residential Lighting To class P3, Walkway lighting to class P4

Dimming To U14 Regime, 3000k c/temp.

A) Philips Lumistreet Eco LED40 L95 DW 4.00klm, 26w CLO
B) Philips Luma Micro BGP702 DRXN1 1.20klm, 8w CLO
C) Philips Lumistreet Micro BGP291 DX51 3.00klm, 19w CLO
C/W Nema 7 Pin Socket & photocell

6m Columns - Estate & walkways

Outdoor Lighting Report

PREPARED BY: Declan Doyle
Lighting Design Manager

Kellihers Electrical
M50 Business Park, Ballymount Road Upper, Dublin 12
declan.doyle@rexel.ie
Tel: +353 (0)1 4566717 Mob: +353 (0)86 8552936

www.astrotek.ie | www.kellihers.com |www.rexel.ie

Layout Report

General Data

Dimensions in Metres Angles in Degrees

Calculation Grids

ID	Grid Name	X	Y	X' Length	Y' Length	X' Spacing	Y' Spacing
1	Site 1	1033.33	913.75	192.56	331.72	1.49	1.49
2	Site 2	882.00	578.58	282.30	88.12	1.49	1.49
3	Grid 3	1149.05	676.31	169.60	243.27	1.54	1.52
4	Grid 4	1142.30	694.79	158.34	64.50	1.52	1.50
5	Grid 5	885.62	586.14	244.90	55.20	1.49	1.49
6	Walkway	975.55	987.03	161.48	179.17	1.50	1.49

Luminaires

Luminaire A Data

Supplier	
Type	LumiStreet gen2 Eco
Lamp(s)	LED40 L95@100kh /730 T25
Lamp Flux (klm)	4.00
File Name	BGS010 T25 FP LED40 L95@100kh-730 D W.ies
Maintenance Factor	0.76
Imax70,80,90(cd/klm)	682.8, 25.9, 0.0
No. in Project	74

Luminaire B Data

Supplier	Philips
Type	BGP702 DRXN1
Lamp(s)	LED-HB 5.2S 730
Lamp Flux (klm)	1.20
File Name	Luma Gen2 Micro_BGP702_DRXN1_1200_6LED_5.2S_CLO_L90_730.ies
Maintenance Factor	0.76
Lum. Int. Class	G3
No. in Project	60

Luminaire C Data

Supplier	Philips
Type	BGP291 DX51
Lamp(s)	LED-HB 5.2S 730
Lamp Flux (klm)	3.00
File Name	LumiStreet Gen2 Micro_BGP291_DX51_3000_20LED_5.2S_CLO_L90_730.ies
Maintenance Factor	0.76
Lum. Int. Class	G3
No. in Project	32

Layout

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
PH1-12	A	981.91	1103.61	6.00	39.00	0.00	0.00	0.00			
PH1-14	A	979.50	1077.69	6.00	35.00	0.00	0.00	0.00			
PH1-33	A	1018.78	937.36	6.00	225.00	0.00	0.00	0.00			
PH1-55	A	1061.59	872.31	6.00	212.00	0.00	0.00	0.00			
PH1-65	A	1091.33	827.76	6.00	263.00	0.00	0.00	0.00			

9750277272

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
PH1-68	A	1075.25	736.70	6.00	113.00	0.00	0.00	0.00			
PH1-71	A	1028.19	717.57	6.00	113.00	0.00	0.00	0.00			
11	A	961.15	1122.92	6.00	44.00	0.00	0.00	0.00			
12	A	940.89	1144.98	6.00	44.00	0.00	0.00	0.00			
13	A	925.85	1161.33	6.00	44.00	0.00	0.00	0.00			
14	A	904.63	1165.75	6.00	309.00	0.00	0.00	0.00			
15	A	923.48	1184.81	6.00	313.00	0.00	0.00	0.00			
16	A	943.58	1203.08	6.00	313.00	0.00	0.00	0.00			
17	A	963.64	1221.75	6.00	313.00	0.00	0.00	0.00			
18	A	971.40	1206.45	6.00	43.00	0.00	0.00	0.00			
19	A	985.39	1188.92	6.00	48.00	0.00	0.00	0.00			
20	A	1005.40	1167.17	6.00	48.00	0.00	0.00	0.00			
21	A	1023.22	1153.46	6.00	45.00	0.00	0.00	0.00			
PH1-13	A	974.91	1101.48	6.00	306.00	0.00	0.00	0.00			
22	A	1058.99	1089.16	6.00	127.00	0.00	0.00	0.00			
23	A	1075.22	1113.58	6.00	273.00	0.00	0.00	0.00			
24	A	1056.77	961.62	6.00	127.00	0.00	0.00	0.00			
25	A	1033.53	946.47	6.00	127.00	0.00	0.00	0.00			
27	A	1037.53	1069.54	6.00	127.00	0.00	0.00	0.00			
28	A	1007.09	1091.78	6.00	225.00	0.00	0.00	0.00			
28	A	1062.15	1008.53	6.00	127.00	0.00	0.00	0.00			
30	A	998.52	1054.52	6.00	37.00	0.00	0.00	0.00			
31	A	1007.82	1034.98	6.00	311.00	0.00	0.00	0.00			
32	A	974.39	1007.89	6.00	314.00	5.00	0.00	0.00			
33	A	993.07	1023.09	6.00	311.00	5.00	0.00	0.00			
34	A	1042.48	1133.30	6.00	75.00	0.00	0.00	0.00			
34	A	1079.63	1034.30	6.00	308.00	0.00	0.00	0.00			
36	A	1031.37	1018.06	6.00	220.00	0.00	0.00	0.00			
36	A	1099.43	1055.42	6.00	308.00	0.00	0.00	0.00			
38	A	1042.73	992.22	6.00	44.00	0.00	0.00	0.00			
39	A	1058.34	973.30	6.00	44.00	0.00	0.00	0.00			
39	A	1124.42	1067.32	6.00	195.00	0.00	0.00	0.00			
52	A	1055.70	897.63	6.00	302.00	0.00	0.00	0.00			
53	A	1077.38	911.55	6.00	302.00	0.00	0.00	0.00			
54	A	1102.64	915.66	6.00	207.00	0.00	0.00	0.00			
55	A	1111.64	887.79	6.00	37.00	0.00	0.00	0.00			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
56	A	1143.94	895.21	6.00	290.00	0.00	0.00	0.00			
57	A	1171.27	906.49	6.00	293.00	0.00	0.00	0.00			
58	A	1019.64	1053.96	6.00	130.00	0.00	0.00	0.00			
59	A	1201.32	910.72	6.00	173.00	0.00	0.00	0.00			
63	A	1116.49	829.24	6.00	118.00	0.00	0.00	0.00			
64	A	1142.23	839.94	6.00	111.00	0.00	0.00	0.00			
65	A	1168.00	850.46	6.00	114.00	0.00	0.00	0.00			
66	A	1193.63	861.17	6.00	113.00	0.00	0.00	0.00			
68	A	1214.48	849.29	6.00	201.00	0.00	0.00	0.00			
62	C	1168.02	747.65	6.00	205.00	0.00	0.00	0.00			
69	A	1225.51	822.84	6.00	202.00	0.00	0.00	0.00			
70	A	1229.82	804.87	6.00	185.00	0.00	0.00	0.00			
71	A	1133.53	776.47	6.00	293.00	0.00	0.00	0.00			
72	A	1165.00	789.52	6.00	293.00	0.00	0.00	0.00			
73	A	1187.03	792.68	6.00	293.00	0.00	0.00	0.00			
74	A	1214.36	804.00	6.00	293.00	0.00	0.00	0.00			
75	C	1126.20	757.87	6.00	117.00	0.00	0.00	0.00			
76	C	1159.74	771.66	6.00	112.00	0.00	0.00	0.00			
77	A	1231.32	795.37	6.00	202.00	0.00	0.00	0.00			
78	A	1238.48	777.10	6.00	202.00	0.00	0.00	0.00			
79	A	1246.22	758.75	6.00	202.00	0.00	0.00	0.00			
81	C	1180.62	777.63	6.00	113.00	0.00	0.00	0.00			
82	C	1215.50	786.11	6.00	20.00	0.00	0.00	0.00			
83	C	1227.16	758.12	6.00	20.00	0.00	0.00	0.00			
84	B	1217.88	759.91	6.00	113.00	0.00	0.00	0.00			
85	C	1157.94	760.32	6.00	202.00	0.00	0.00	0.00			
86	C	1222.28	769.86	6.00	26.00	0.00	0.00	0.00			
87	C	1232.04	746.25	6.00	24.00	0.00	0.00	0.00			
88	C	1137.95	756.53	6.00	22.00	0.00	0.00	0.00			
89	C	1145.14	739.26	6.00	26.00	0.00	0.00	0.00			
90	C	1152.56	721.25	6.00	26.00	0.00	0.00	0.00			
91	C	1157.90	708.44	6.00	23.00	0.00	0.00	0.00			
93	B	1193.86	764.99	6.00	291.00	0.00	0.00	0.00			
94	B	1203.24	741.53	6.00	115.00	0.00	0.00	0.00			
95	B	1203.47	771.66	6.00	204.00	0.00	0.00	0.00			
96	B	1215.06	743.42	6.00	204.00	0.00	0.00	0.00			

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Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
97	B	1141.12	729.08	6.00	114.00	0.00	0.00	0.00			
98	B	1125.98	741.45	6.00	204.00	0.00	0.00	0.00			
99	B	1138.11	711.87	6.00	203.00	0.00	0.00	0.00			
100	B	1154.26	702.69	6.00	290.00	0.00	0.00	0.00			
101	B	1187.34	716.54	6.00	290.00	0.00	0.00	0.00			
102	B	1214.36	727.69	6.00	291.00	0.00	0.00	0.00			
103	B	1238.19	737.46	6.00	289.00	0.00	0.00	0.00			
104	B	1264.21	748.27	6.00	291.00	0.00	0.00	0.00			
105	B	1175.29	757.47	6.00	293.00	0.00	0.00	0.00			
106	B	1184.85	733.97	6.00	115.00	0.00	0.00	0.00			
107	B	899.98	597.48	6.00	291.00	0.00	0.00	0.00			
108	B	927.56	609.04	6.00	292.00	0.00	0.00	0.00			
109	B	951.16	618.78	6.00	292.00	0.00	0.00	0.00			
110	B	973.98	628.19	6.00	292.00	0.00	0.00	0.00			
111	B	999.96	639.07	6.00	292.00	0.00	0.00	0.00			
112	B	1023.30	656.75	6.00	292.00	0.00	0.00	0.00			
113	B	922.26	622.28	6.00	292.00	0.00	0.00	0.00			
114	B	944.97	631.69	6.00	292.00	0.00	0.00	0.00			
115	B	906.94	620.47	6.00	23.00	0.00	0.00	0.00			
116	B	952.52	639.57	6.00	204.00	0.00	0.00	0.00			
117	B	985.58	671.93	6.00	308.00	0.00	0.00	0.00			
118	B	1001.52	683.50	6.00	305.00	0.00	0.00	0.00			
119	B	1004.33	654.07	6.00	23.00	0.00	0.00	0.00			
120	B	991.35	661.57	6.00	111.00	0.00	0.00	0.00			
121	B	1010.77	669.66	6.00	111.00	0.00	0.00	0.00			
122	B	1028.55	677.03	6.00	114.00	0.00	0.00	0.00			
123	B	1025.36	684.84	6.00	313.00	0.00	0.00	0.00			
124	B	1017.04	694.87	6.00	301.00	0.00	0.00	0.00			
125	A	955.82	685.17	6.00	40.00	0.00	0.00	0.00			
126	C	964.49	672.69	6.00	11.00	0.00	0.00	0.00			
127	C	913.04	637.10	6.00	113.00	0.00	0.00	0.00			
128	C	924.67	641.98	6.00	113.00	0.00	0.00	0.00			
129	C	936.44	646.80	6.00	113.00	0.00	0.00	0.00			
130	A	897.03	637.59	6.00	111.00	0.00	0.00	0.00			
131	A	954.94	661.61	6.00	110.00	0.00	0.00	0.00			
132	C	888.09	621.83	6.00	203.00	0.00	0.00	0.00			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
133	C	895.36	604.30	6.00	202.00	0.00	0.00	0.00			
134	C	984.89	633.79	6.00	110.00	0.00	0.00	0.00			
135	C	963.93	656.07	6.00	24.00	0.00	0.00	0.00			
136	A	1034.57	701.09	6.00	217.00	0.00	0.00	0.00			
137	C	1050.25	691.81	6.00	203.00	0.00	0.00	0.00			
138	C	1036.16	675.00	6.00	22.00	0.00	0.00	0.00			
139	C	1057.39	674.61	6.00	202.00	0.00	0.00	0.00			
140	C	1042.67	661.01	6.00	25.00	0.00	0.00	0.00			
141	A	1101.75	737.91	6.00	204.00	0.00	0.00	0.00			
142	C	1107.43	692.11	6.00	22.00	0.00	0.00	0.00			
143	C	1100.84	707.87	6.00	23.00	0.00	0.00	0.00			
144	C	1092.91	726.97	6.00	21.00	0.00	0.00	0.00			
145	A	907.78	651.45	6.00	290.00	0.00	0.00	0.00			
146	A	930.22	660.36	6.00	293.00	0.00	0.00	0.00			
147	A	1017.83	711.07	6.00	38.00	0.00	0.00	0.00			
148	B	1071.32	668.61	6.00	289.00	0.00	0.00	0.00			
149	B	1101.70	680.93	6.00	292.00	0.00	0.00	0.00			
150	B	1052.57	702.78	6.00	291.00	0.00	0.00	0.00			
151	B	1079.62	713.97	6.00	290.00	0.00	0.00	0.00			
152	B	1070.57	687.39	6.00	22.00	0.00	0.00	0.00			
153	B	1087.51	695.26	6.00	208.00	0.00	0.00	0.00			
157	C	987.98	648.86	6.00	201.00	0.00	0.00	0.00			
158	A	875.02	638.27	6.00	290.00	0.00	0.00	0.00			
155	A	1123.89	868.92	6.00	37.00	0.00	0.00	0.00			
156	A	1133.27	854.44	6.00	120.00	0.00	0.00	0.00			
139	B	997.65	1195.17	6.00	60.00	0.00	0.00	0.00			
140	B	1018.46	1178.44	6.00	40.00	0.00	0.00	0.00			
141	B	1034.50	1160.98	6.00	37.00	0.00	0.00	0.00			
142	B	1050.37	1143.50	6.00	37.00	0.00	0.00	0.00			
143	B	1059.72	1121.43	6.00	352.00	0.00	0.00	0.00			
144	B	1050.57	1107.34	6.00	300.00	0.00	0.00	0.00			
145	B	1028.91	1099.64	6.00	302.00	0.00	0.00	0.00			
146	A	1020.12	1084.86	6.00	134.00	0.00	0.00	0.00			
147	B	1004.99	1068.38	6.00	9.00	0.00	0.00	0.00			
148	B	1022.26	1039.55	6.00	7.00	0.00	0.00	0.00			
149	B	1012.94	1024.90	6.00	309.00	0.00	0.00	0.00			

Layout Continued

ID	Type	X	Y	Height	Angle	Tilt	Cant	Out-reach	Target X	Target Y	Target Z
150	B	996.83	1011.60	6.00	311.00	0.00	0.00	0.00			
151	B	979.38	997.17	6.00	312.00	0.00	0.00	0.00			
152	B	1039.23	1020.07	6.00	218.00	0.00	0.00	0.00			
153	B	1060.89	995.51	6.00	245.00	0.00	0.00	0.00			
154	A	936.22	1169.30	6.00	222.00	0.00	0.00	0.00			
155	B	1184.76	894.98	6.00	311.00	0.00	0.00	0.00			
156	B	1167.70	881.14	6.00	315.00	0.00	0.00	0.00			
157	B	1155.31	866.88	6.00	318.00	0.00	0.00	0.00			
158	B	1142.91	852.24	6.00	310.00	0.00	0.00	0.00			
159	A	1193.88	877.78	6.00	293.00	0.00	0.00	0.00			
160	A	1111.71	765.32	6.00	316.00	0.00	0.00	0.00			
161	C	1170.34	728.03	6.00	114.00	0.00	0.00	0.00			
162	C	1205.78	788.04	6.00	112.00	0.00	0.00	0.00			
163	B	1127.65	691.65	6.00	296.00	0.00	0.00	0.00			
164	C	969.78	641.88	6.00	26.00	0.00	0.00	0.00			
165	B	1017.26	646.15	6.00	293.00	0.00	0.00	0.00			
166	B	1037.30	654.47	6.00	294.00	0.00	0.00	0.00			

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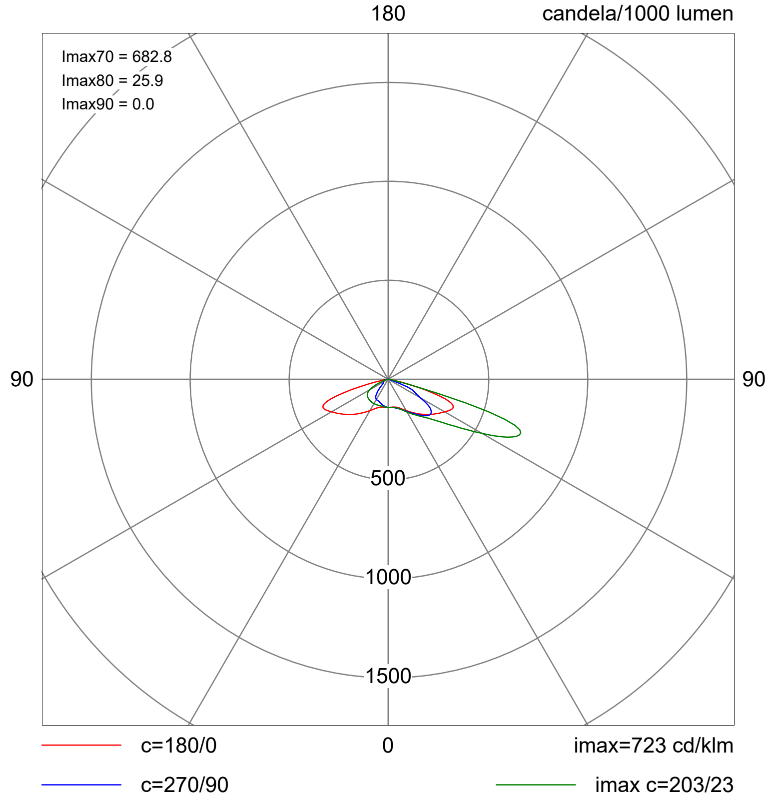
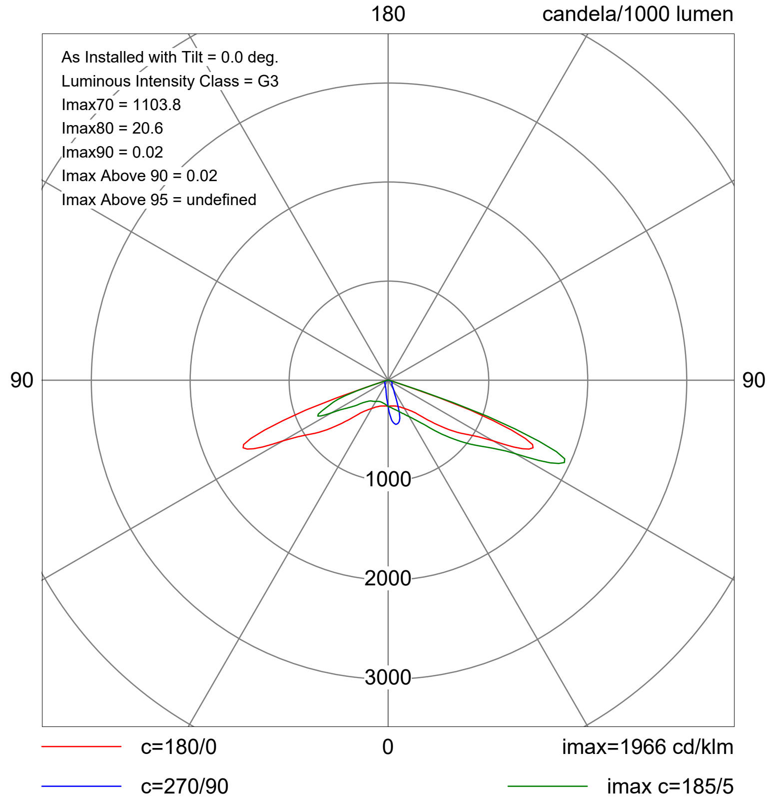
Polar Diagrams

Luminaire A LumiStreet gen2 Eco



Luminaire B BGP702 DRXN1



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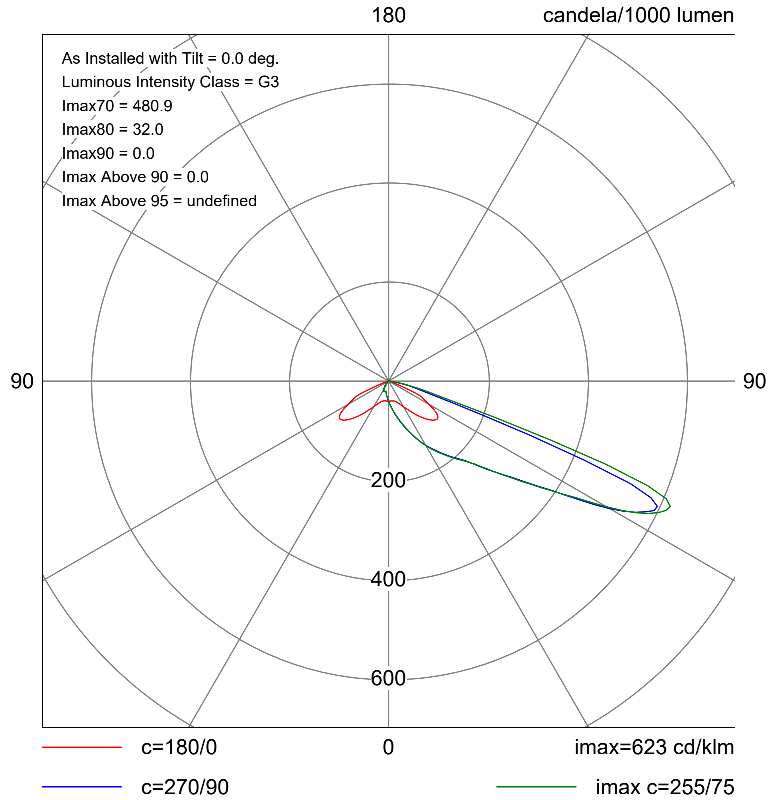
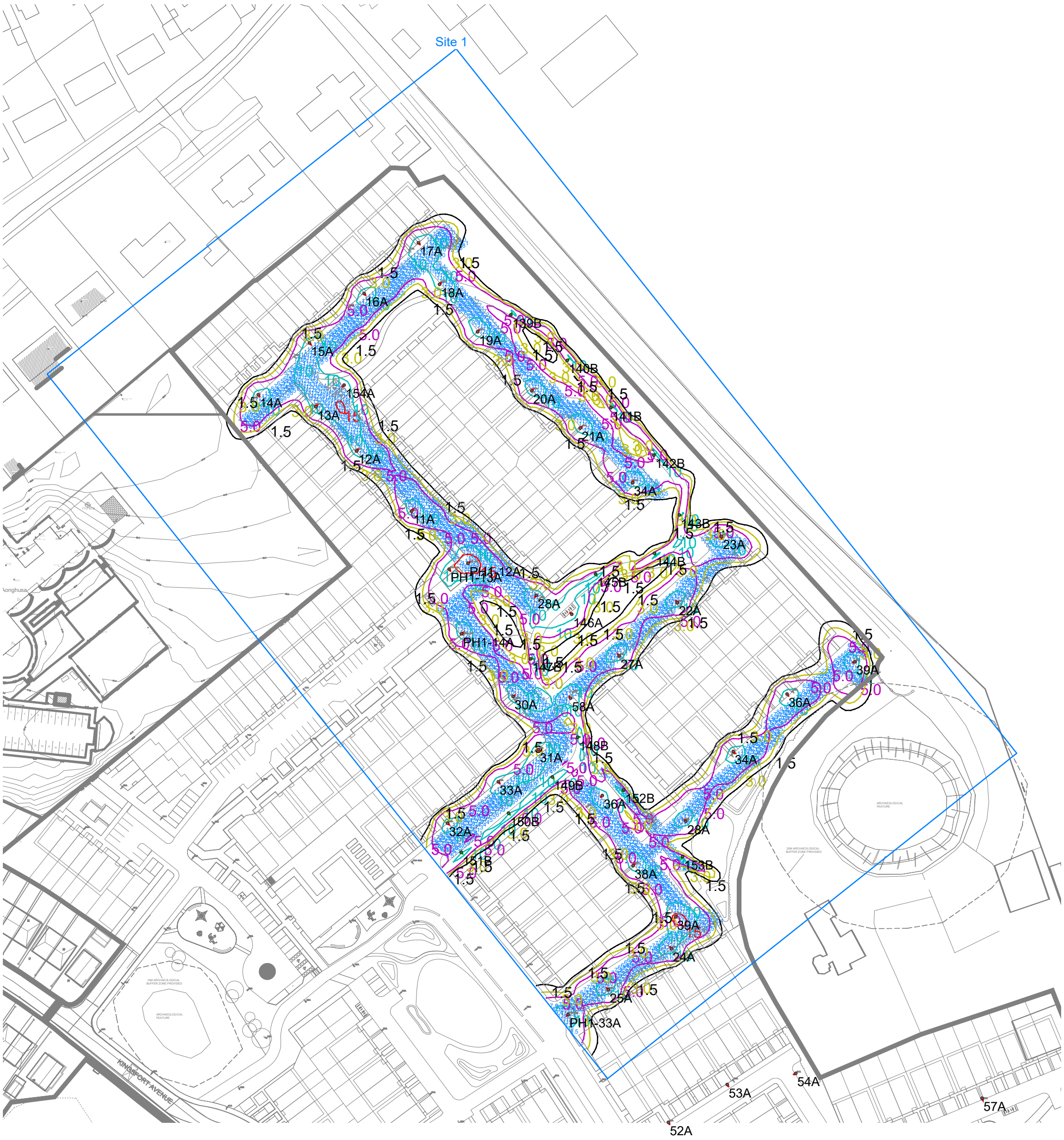
Polar Diagrams Continued

Luminaire C BGP291 DX51



Horizontal Illuminance (lux)

Site 1



Results

Eav	8.21
Emin	2.09
Emax	19.09
Emin/Emax	0.11
Emin/Eav	0.25
Emax/Eav	2.32

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Horizontal Illuminance (lux)

Site 2

Results

Eav	7.66
Emin	2.02
Emax	17.73
Emin/Emax	0.11
Emin/Eav	0.26
Emax/Eav	2.31

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Horizontal Illuminance (lux)

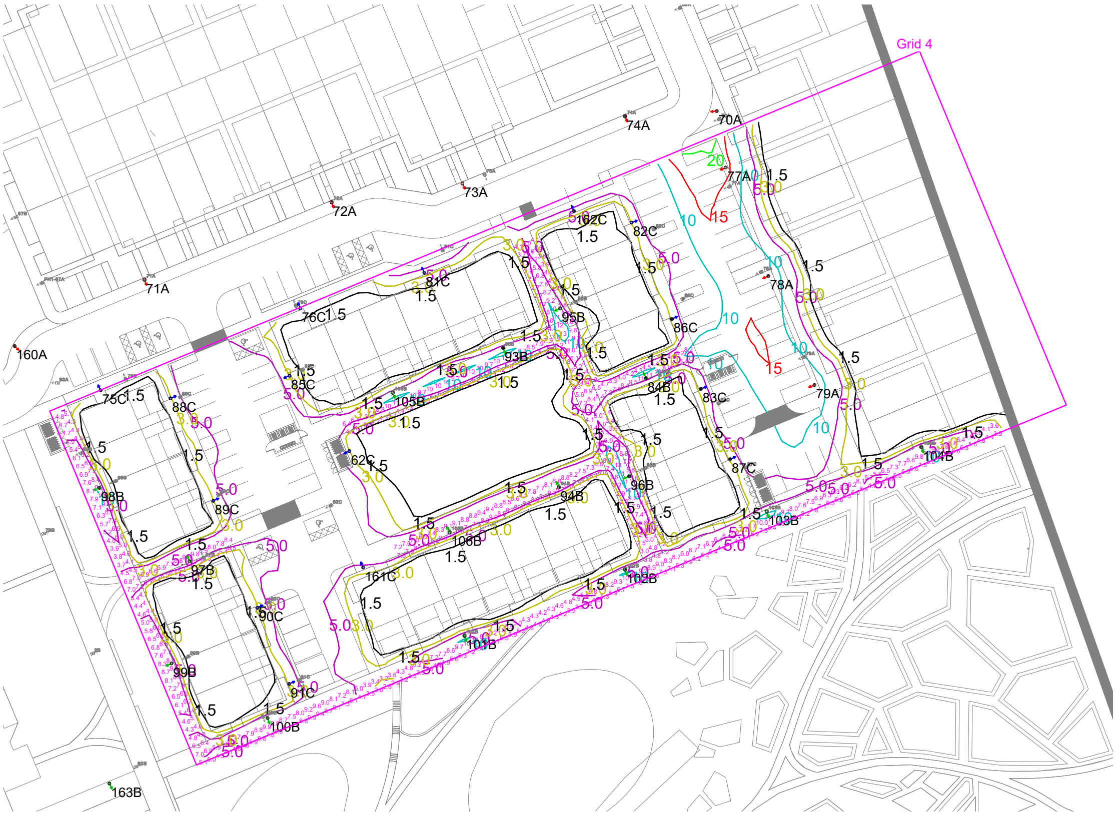
Grid 3

Results

Eav	7.95
Emin	1.70
Emax	22.21
Emin/Emax	0.08
Emin/Eav	0.21
Emax/Eav	2.79

Horizontal Illuminance (lux)

Grid 4



Results

Eav	6.56
Emin	1.83
Emax	12.96
Emin/Emax	0.14
Emin/Eav	0.28
Emax/Eav	1.97

Horizontal Illuminance (lux)

Grid 5

Results

Eav	6.98
Emin	1.59
Emax	13.46
Emin/Emax	0.12
Emin/Eav	0.23
Emax/Eav	1.93

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Horizontal Illuminance (lux)

Walkway

Results

Eav	7.23
Emin	1.45
Emax	13.98
Emin/Emax	0.10
Emin/Eav	0.20
Emax/Eav	1.93

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Site 1
Results - Horizontal Illuminance (lux)
Eav= 8.21
Emin= 2.09
Emax= 19.09
Emin/Emax= 0.11
Emin/Eav= 0.25
Emax/Eav= 2.32

Site 2
Results - Horizontal Illuminance (lux)
Eav= 7.66
Emin= 2.02
Emax= 17.73
Emin/Emax= 0.11
Emin/Eav= 0.26
Emax/Eav= 2.31

Grid 3
Results - Horizontal Illuminance (lux)
Eav= 7.95
Emin= 1.70
Emax= 22.21
Emin/Emax= 0.08
Emin/Eav= 0.21
Emax/Eav= 2.79

Grid 4
Results - Horizontal Illuminance (lux)
Eav= 6.56
Emin= 1.83
Emax= 12.96
Emin/Emax= 0.14
Emin/Eav= 0.28
Emax/Eav= 1.97

Grid 5
Results - Horizontal Illuminance (lux)
Eav= 6.98
Emin= 1.59
Emax= 13.46
Emin/Emax= 0.12
Emin/Eav= 0.23
Emax/Eav= 1.93

Walkway
Results - Horizontal Illuminance (lux)
Eav= 7.23
Emin= 1.45
Emax= 13.98
Emin/Emax= 0.10
Emin/Eav= 0.20
Emax/Eav= 1.93

Luminaire Data
Luminaire A LumiStreet gen2 Eco Lamp LED40 L95@100kh /730 T25 MF 0.76

Luminaire B BGP702 DRXN1 Lamp LED-HB
5.2S 730 MF 0.76

Luminaire C BGP291 DX51 Lamp LED-HB
5.2S 730 MF 0.76

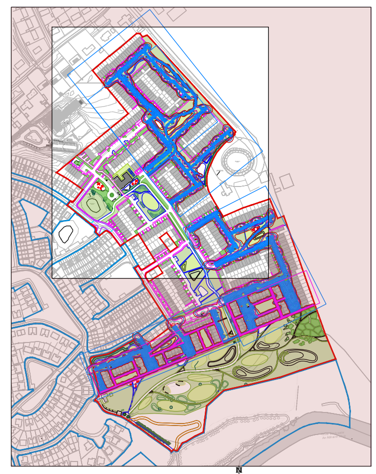
Key
- Luminaire A Column
- Luminaire B Column
- Luminaire C Column
- Beam Aiming Target
- Photometric Centre

All Dimensions in metres

GENERAL NOTES

1. ALL DIMENSIONS ARE GIVEN IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SCOPE OF WORKS. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF KELLIHERS FOR CLARIFICATION PRIOR TO ANY WORK COMMENCING.
3. CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS. DISCREPANCIES ARE TO BE NOTIFIED TO THE CONTRACTOR AND DESIGN FOR RESOLUTION.
4. ALL WORKS TO COMPLY WITH PREVIOUSLY AGREED AND ISSUED SPECIFICATIONS
5. ALL EXTERNAL LIGHTING LAYOUTS ARE DESIGNED IN ACCORDANCE WITH BS5489:1-2020.

KELLIHERS ELECTRICAL LTD.
M50 BUSINESS PARK ,
BALLYMOUNT,
DUBLIN 12



Proposed Site Layout - Key Plan
Scale : nts

Site Layout
Scale 1:500

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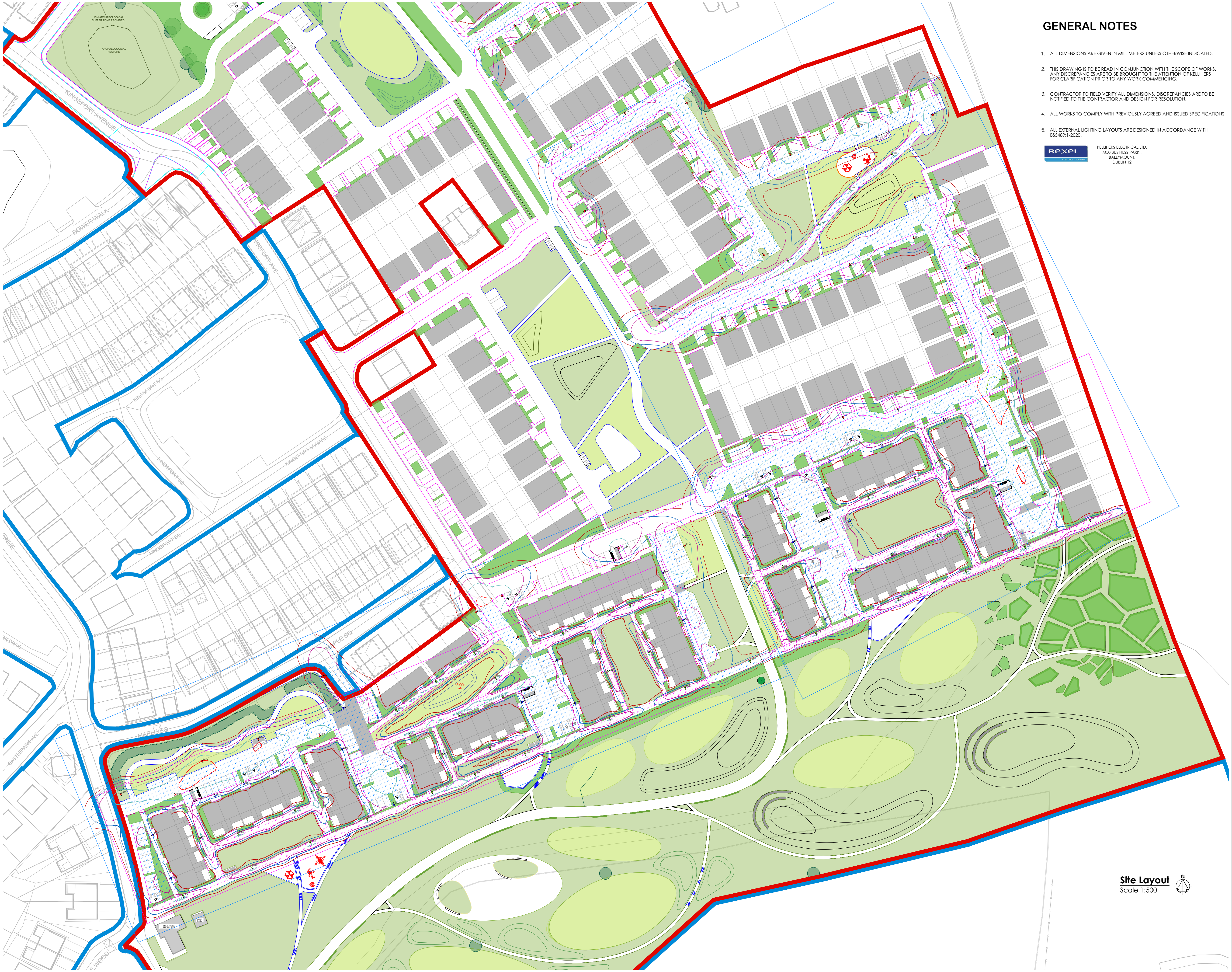
REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
A	DMD	DMD	DMD	10.10.'24	Issued for Planning

CLIENT	DRAWING TITLE
Reside (Castlepark) Ltd.	Proposed Lighting Layout (01 of 02)

PROJECT	SHEET	SCALE	PROJECT NO.	DRAWING NO.	STATUS/ISSUE
Castlepark, Mallow, Co. Cork	A0	1/500	6621	2080	A

Proposed Site Layout - Key Plan
Scale : nts



Site Layout
Scale 1:500

GENERAL NOTES

1. ALL DIMENSIONS ARE GIVEN IN MILLIMETERS UNLESS OTHERWISE INDICATED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SCOPE OF WORKS. ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF KELLIHERS FOR CLARIFICATION PRIOR TO ANY WORK COMMENCING.
3. CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS, DISCREPANCIES ARE TO BE NOTIFIED TO THE CONTRACTOR AND DESIGN FOR RESOLUTION.
4. ALL WORKS TO COMPLY WITH PREVIOUSLY AGREED AND ISSUED SPECIFICATIONS
5. ALL EXTERNAL LIGHTING LAYOUTS ARE DESIGNED IN ACCORDANCE WITH BS5489:1-2020.

KELLIHERS ELECTRICAL LTD,
M50 BUSINESS PARK ,
BALLYMOUNT,
DUBLIN 12

Site 1
Results - Horizontal Illuminance (lux)
Eav= 8.21
Emin= 2.09
Emax= 19.09
Emin/Emax= 0.11
Emin/Eav= 0.25
Emax/Eav= 2.32

Site 2
Results - Horizontal Illuminance (lux)
Eav= 7.66
Emin= 2.02
Emax= 17.73
Emin/Emax= 0.11
Emin/Eav= 0.26
Emax/Eav= 2.31

Grid 3
Results - Horizontal Illuminance (lux)
Eav= 7.95
Emin= 1.70
Emax= 22.21
Emin/Emax= 0.08
Emin/Eav= 0.21
Emax/Eav= 2.79

Grid 4
Results - Horizontal Illuminance (lux)
Eav= 6.56
Emin= 1.83
Emax= 12.96
Emin/Emax= 0.14
Emin/Eav= 0.28
Emax/Eav= 1.97

Grid 5
Results - Horizontal Illuminance (lux)
Eav= 6.98
Emin= 1.59
Emax= 13.46
Emin/Emax= 0.12
Emin/Eav= 0.23
Emax/Eav= 1.93

Walkway
Results - Horizontal Illuminance (lux)
Eav= 7.23
Emin= 1.45
Emax= 13.98
Emin/Emax= 0.10
Emin/Eav= 0.20
Emax/Eav= 1.93

Luminaire Data
Luminaire A LumiStreet gen2 Eco Lamp LED40 L95@100kh /730 T25 MF 0.76

Luminaire B BGP702 DRXN1 Lamp LED-HB 5.2S 730 MF 0.76

Luminaire C BGP291 DX51 Lamp LED-HB 5.2S 730 MF 0.76

Key
- Luminaire A Column
- Luminaire B Column
- Luminaire C Column
- Beam Aiming Target
- Photometric Centre

All Dimensions in metres

DOSA
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REV.	DRAWN	CHKD	APPRVD	DATE	DETAILS
A	DMD	DMD	DMD	10.10.'24	Issued for Planning

CLIENT	Reside (Castlepark) Ltd.
PROJECT	Castlepark, Mallow, Co. Cork
DRAWING TITLE	Proposed Lighting Layout (02 of 02)
SHEET	A0
SCALE	1/500
PROJECT NO.	6621
DRAWING NO.	2081
STATUS/ISSUE	A

Castlelands LRD, Mallow

CHAPTER 13 Biodiversity

Appendix 13.1 Survey Details

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Bat Survey Results – Castlelands, Mallow

Date of Surveys:

Survey 1 = 11/05/2023 (building B – Low PBR)

Survey 2 = 15/05/2023 (building A – Moderate PBR)(survey 1 of 2)

Survey 3 = 29/05/2023 (building A – Moderate PBR)(survey 2 of 2)

Survey	Surveyors	Weather Conditions	Results
1 (11/05/2023)	CBH, GK	Weather at Start (21:00): Cloud cover 7/8, warm evening, no precipitation, wind NW F0-1, temp 10oC. Weather at Finish (23:00): Cloud cover 7/8, no precipitation, cool night, calm, no wind, temp 4oC.	All buildings were internally inspected for evidence of the presence of bats, building C provided negligible PBR due to poor condition and exposed nature of the building. Building B was pretty well sealed apart from a single opening to rear, and some cracks around the door frame and between the wall cavity. Building A had Moderate potential for roosting bats. Droppings were observed in building A and B however, difficult to discern origin, most likely mouse/rat. Lots of cobwebs and insects, no staining on wood. No bat passes during emergence survey of building B.
2 (15/05/2023)	CBH, GK, EJD	Weather at Start (21:00): Cloud cover 0/8, calm, warm evening, no precipitation, temp 6oC. Weather at Finish (23:00): Cloud cover 6/8, calm, cool night, no precipitation, temp 2oC.	Emergence survey 1 of building A, a single bat pass occurred at 10PM, however it was flying high and not picked up by the detector, it was visually observed by surveyor EJD. It flew

Survey	Surveyors	Weather Conditions	Results
			from the north (near building C) moving down between building A and B. Was not seen again. Possibly commuting/foraging bat. None were seen to emerge from building A. Many locals approached surveyors on this night, offering use of bathroom/tea making facilities and querying the reason for these surveys. Some staining on wood beams at detector no.3 location.
3 (29/05/2023)	CBH, GK	Weather at Start (21:00): Cloud cover 3/8, visibility excellent, warm, no breeze, calm, temp 18oC. Weather at Finish (23:00): Cloud cover 5/8, warm, no breeze, occasional drops of rain at start of survey but this was very brief, calm, temp 8oC.	First bat observed flying south – south west over the building at 22:01 exactly. Following the fence boundary to the west.. not picked up on detector, visually observed by CBH. Flew over GK at detector no. 2 and continued north. Appeared to circled back several times as it fed. No bats were observed to leave the building, as such this bat is considered a commuting/foraging bat.

Castlelands LRD, Mallow

CHAPTER 14 Cultural Heritage & Archaeology

Appendix 14.1	Field Inspection Photographic Record
Appendix 14.2	Archaeological Inventory Descriptions
Appendix 14.3	Excavation Database Descriptions
Appendix 14.4	Geophysical Survey Report
Appendix 14.5	Archaeological Test Trenching Report

Ocotober 2024

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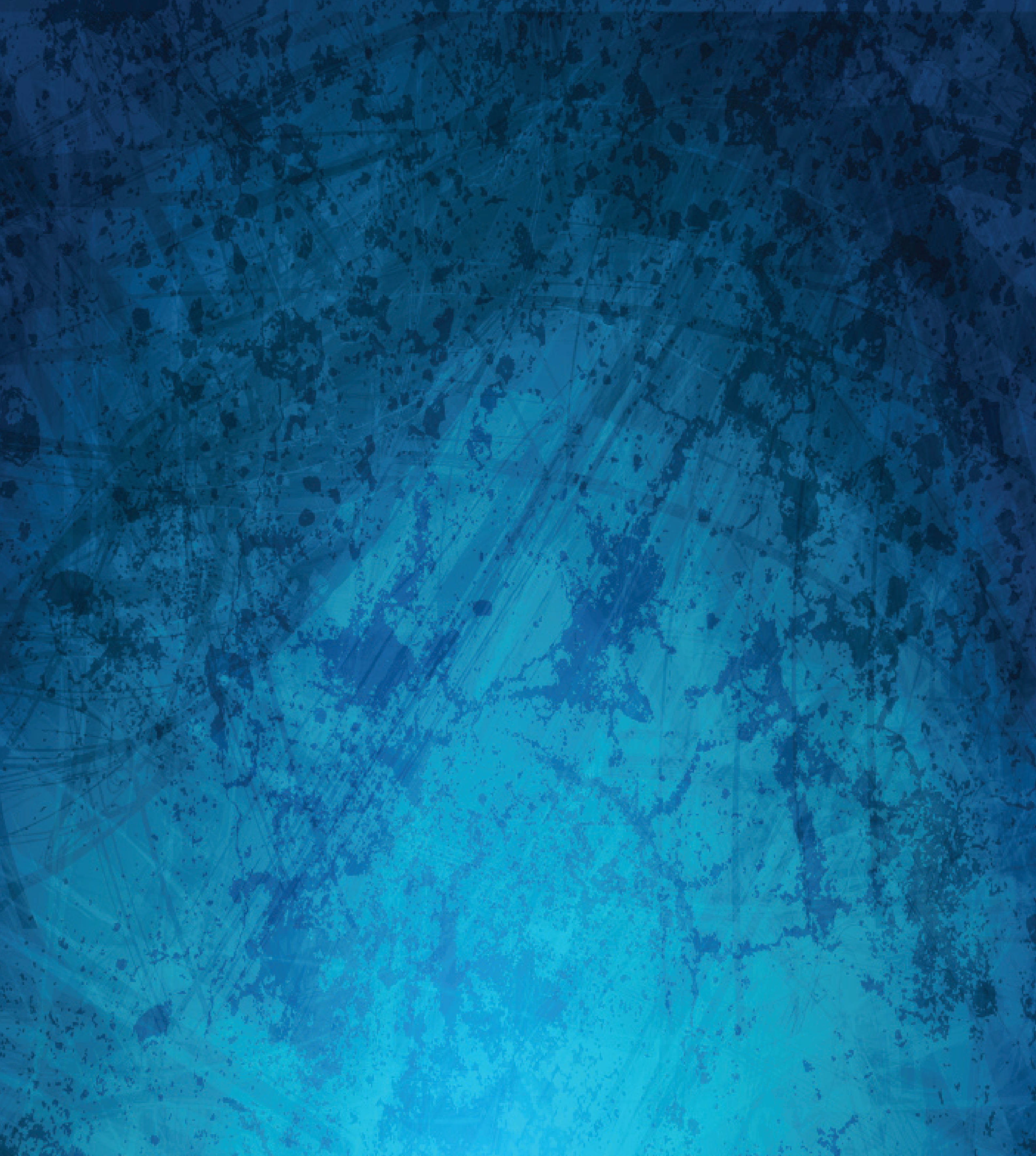

Appendix 14.1 Field Inspection Photographic Record

Ocotober 2024

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Appendix 14.1: Field Inspection Photographic Record

Plate 14.1 Drone photograph of the central and northern positions of the site, facing north-northeast

Plate 14.2 Drone photograph of ringfort (CO033-012----), facing north-northeast

Plate 14.3 Drone photograph of the south-eastern portion of the site, facing southeast

Plate 14.4 Drone photograph of the southern portion of the site, facing southwest

Plate 14.5 Photograph taken within the central portion of the site, facing northeast along an existing access track

Plate 14.6 Spoil heap in southern position of site, facing northwest

Plate 14.7 View of house foundations from previous unfinished housing development from north

Plate 14.8 View of trees within ringfort (CO033-012----) beyond foreground hedgerow, from within proposed development site (facing east)

Plate 14.9 Trees within ringfort (CO033-012----) beyond fence and hedgerows, from within proposed development site (facing south)

Plate 14.10 View towards site of *fulacht fia* (CO033-090----) from within proposed development site, facing southwest

Plate 14.11 View towards site of *fulacht fia* (CO033-090----) within housing estate green, facing south

Plate 14.12 Drone view of 19th century building (centre of frame) in southwest area of the proposed development site, facing southwest

Plate 14.13 View of south side of 19th century building (left of frame) in southwest area of the proposed development site, facing north (modern outbuilding visible in right side of frame)

Plate 14.14 View of west side of the 19th century building within modern housing estate road in foreground

Appendix 14.2 Archaeological Inventory Descriptions

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Appendix 14.2: Archaeological Inventory Descriptions

CO033-090---- Fulacht fia **Townland: CASTLELANDS (Fermoy By.)** In tillage. Spread of burnt material (24m N-S; 18.6m E-W). Second fulacht fiadh (10457) c. 60m to SW.
CO033-091---- Fulacht fia **Townland: CASTLELANDS (Fermoy By.)** In tillage. Irregular spread of burnt material (24m E-W; 14.5m N-S). Second fulacht fiadh (10456) c. 60m to NE.
CO033-007001- Kiln – lime **Townland: CASTLELANDS (Fermoy By.)** Overgrown pair of lime kilns of late-19th/early 20th-century appearance, built against natural slope in quarry, on E side of Mallow. Large quarry indicated at site on 1842 OS 6-inch map with subrectangular structure at S end named 'Salt Works'. Random rubble limestone walls encase core of kilns. Front elevation (SE) staggered, with NE kiln set back c. 4m from SW kiln. SW kiln (H c. 7m; Wth c. 6.6m) has brick-arched recess (Wth c. 2.5m; D c. 1.2m), base filled with rubble; rear wall of brick with stoking hole (0.2m x 0.12m), lower portion of sloping-iron sheets, ope at base. Remains of wooden roof over forecourt, originally supported by wall on NE side of recess and by ledge along wall at SW side of recess. Outline of infilled funnel (diam c. 2m) visible on top of kiln. NE kiln (H 8m; Wth c. 5.7m) has brick-arched recess (H 2.35m; Wth 2.55m; D 1.9m) supported by iron bands, limestone arch over brick arch; rear wall of brick with stoking hole (0.3m x 0.16m), lower portion of sloping stone slab and wide sheets of iron, ope (H 0.4m; Wth 1.16m) at base. Walls extend forward from front elevation which probably supported roof cover over recess. Infilled funnel (diam 2m.) to rear, exposed upper portion lined with iron encrusted with earth, which Sleeman (1990, 97) suggests is possibly remains of iron salt pan. Top of kilns (5.2m NW-SE; c. 14.5m NE-SW) enclosed by wall on NE side with remains of structure at NW end. Roofless ruined 2-story structure to SW, possibly associated with the salt works. Forecourt area built over, top of kiln used as car park and structure to SW partially demolished subsequent to site inspection.
CO033-010---- Ringfort **Townland: CASTLELANDS (Fermoy By.)** In pasture, on gentle S-facing slope, in demesne of Mallow Castle. Circular area (22.5m N-S; 22m E-W) enclosed by low earthen bank (int. H 0.1m; ext. H 1.1m); external fosse (D 0.8m). Causeway (Wth 3m) across fosse to SSE rises gently towards interior. Counterscarp bank (H 0.4m) ESE->SW, broken where causeway crosses fosse. Interior planted with trees on 1842 OS 6-inch map; numerous humps and hollows across surface appear to be result of removal of tree roots. Estate wall to N extends along base of fosse; wall to E immediately outside fosse. Enclosure clear of overgrowth.
CO033-011001- Ringfort **Townland: CASTLELANDS (Fermoy By.)** In tillage, on E-facing slope. Depicted as hachured circular enclosure (diam. c. 28m) on 1842 and 1935 OS 6-inch maps; as hachured circular raised area (diam. c. 20m) on 1905 OS 6-inch map. No visible surface trace of site; according to local information, levelled c. 1980. Faint soilmark visible in aerial photograph (CASAP, Jan. 1986) shows arc of N half of enclosure, remainder hidden from view by tree shadows. Circular enclosure (CO033-01102-) immediately to W. See Purcell, A. 2002 'Castlelands, Mallow; Possible ringfort', in I. Bennett (ed.), Excavations 2000: summary accounts of archaeological excavations in Ireland, 50. Wordwell Ltd, Bray. See also Excavations 2001, 47-8.
CO033-011002- Redundant record **Townland: CASTLELANDS (Fermoy By.)** Levelled bank of possible circular enclosure visible as penannular soilmark in aerial photograph (CASAP, January 1986); open to E; soil in interior darker than surrounding field. Ringfort (12269) immediately to E. This record was formerly classed as an Enclosure based on evidence visible in an aerial photograph (CASAP, January 1986). However, following archaeological testing, in advance of a residential development, the dark circular area visible in the aerial photograph was found to be as a result of a geological feature. Underlying bedrock, just below topsoil within a small circular area, corresponds with the circular anomaly highlighted through the aerial photograph (see Purcell, A. 2002 'Castlelands, Mallow; Possible ringfort', in I. Bennett (ed.), Excavations 2000: summary accounts of archaeological excavations in Ireland, 50. Wordwell Ltd, Bray.). In light of the above this record is now classed as a Redundant record.
CO033-012---- Ringfort – rath CASTLELANDS (Fermoy By.) In tillage, on gentle SSW-facing slope, c. 450m to N of River Blackwater. Depicted as hachured circular enclosure (diam. c. 40m) on 1842, 1905 and 1935 OS 6-inch maps. Inaccessible due to overgrowth; interior appears to be enclosed by earthen bank with external fosse surviving all round. Revisit in 1991 noted fosse infilled and no longer evident; some dumping has taken place along line of bank to S and recently constructed trackway skirts W half.
CO033-013---- Enclosure **Townland: KEATLEYSCLOSE**

Cropmark of fosse of circular enclosure (diam. c. 30m) visible in aerial photograph (GSIAP, W413, July 1975; CUCAP, BDS11, July 1970); concentric outer fosse NNW->S; field fence shown on 1905 and 1935 OS 6-inch maps kinks either to skirt or follow the line of the outer fosse from S->NNW. Aerial photograph (CASAP, July 1989) shows field fence levelled and E half of site now within sports field. The kink of the field fence suggests some upstanding remains of enclosure when fence was built post 1842.
CO033-068---- Designed landscape - tree ring **Townland: BALLYELLIS** No inventory description
CO033-089---- Enclosure **Townland: KEATLEYSCLOSE** Cropmark of two concentric fosses of circular enclosure (diam. c. 30m) visible in aerial photograph (CASAP, July 1989). Field fence crosses centre of enclosure on N-S axis.
CO033-113---- Ringfort **Townland: CARRIGOON MORE** In tillage, on N-facing slope. Cropmark, visible in aerial photograph (GSIAP, W413, July 1975) shows bank and fosse of circular enclosure of ringfort dimensions. Arc of field fence, shown on 1842, 1905 and 1935 OS 6-inch maps, respects enclosure W->N; fence upstanding in aerial photograph. Field fence now levelled and partly noted as soil mark; no visible surface trace of remainder of enclosure.
CO033-117---- Kiln – lime **Townland: BALLYELLIS** Built against rock face in quarry; second lime kiln to E recently removed. Overgrown random-rubble walls encase earthen core. Front elevation (H c. 5m) faces N with wall on W side projecting out into forecourt; buttress on E side. Lintelled corbelled recess (H 3m; Wth 2.6m; D 2.8m): sloping slabs to rear with stoking hole. Limestone-lined funnel (diam. c. 2.5m) almost totally infilled.
CO033-140---- Excavation – miscellaneous **Townland: CASTLELANDS (Fermoy By.)** Discovered during archaeological monitoring in advance of a large-scale housing estate within the demesne of Mallow Castle. A small pit (0.45m x 0.7m; D 0.18m) was excavated in close proximity to a levelled rath (CO033-011001-). The fill was found to contain a reddish brown silty clay with moderate inclusions of charcoal flecks and small round stones. Three sherds of possible Bronze Age or Neolithic pottery were recovered from the base of the pit. (Lane 2004a, 84).

Appendix 14.3 Excavation Database Descriptions

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Appendix 14.3: Excavation Database Descriptions

Site Name	Licence No.	Description
Castlelands, Mallow	04E1204	Ten test-trenches were excavated in the vicinity of these three sites to identify their extent and establish appropriate buffer zones around them in advance of proposed development. Both fulachta fiadh are ploughed out and the ringfort is within a dense grove of trees adjoining a garden. Four test-trenches were excavated around the periphery of both fulachta fiadh and these revealed burnt-mound material (burnt, shattered stone and blackened soil) mixed with topsoil. The extent of the spread of burnt-mound material comprising both sites was recorded. Two trenches were excavated in the garden, which adjoins the ringfort. No features or finds of archaeological significance were revealed in the trenches.
St Joseph	97E0395	Three test-trenches were opened. Nothing of an archaeological nature was noted.
St Joseph's Road, Castlelands, Mallow	05E0256	Monitoring was carried out in advance of the development of a housing estate. No features or finds of archaeological significance were revealed. Two fulachta fiadh located within the development site were tested by the author under licence number 04E1204 during 2004 (Excavations 2004, No. 306). These sites were secured within an agreed buffer zone and will remain as undisturbed green areas.
St Joseph's Road, Spaglen, Mallow	03E0720	A Grant of Planning was issued for the development of a dwelling-house and associated works at Grove House, Castle Grove, Mallow, Co. Cork. The development lies just inside the zone of archaeological potential for a holy well, so monitoring was required. The site slopes slightly downhill from east to west. According to local information, the site was originally much lower and has been backfilled over the years with builders' rubble. Four test-trenches were excavated on the line of the four main walls of the house to investigate subsurface conditions. Rubble to a depth of 2.3m was noted in some of the trenches. At the higher end of the site topsoil was dug to a depth of 0.5m, where natural boulder clay was found. No finds or features of an archaeological nature were noted in the trenches or during monitoring of the remainder of the development.
Castlelands, Mallow	00E0830	Seven test-trenches were excavated in the vicinity of three known sites in advance of a residential development in Castlelands townland near Mallow. Much of the site had been stripped of topsoil under previously issued planning conditions. Two of the sites are ringforts—SMR 33:10, which is outside the development area, and 33:01101, which is within a proposed green area within the development area. The latter has been levelled, and no visible trace of it survives. The other site, SMR 33:01102, is a possible circular enclosure and had been identified from an aerial photograph. This site lies within the proposed development area. The upstanding ringfort 33:10 is south of the development site and is separated from it by a substantial wall. A trench was opened north of the wall inside the area of the development. No archaeological features or finds were revealed in this trench, nor were any archaeological remains visible in the surrounding topsoil-stripped ground. Thus deposits associated with the ringfort do not appear to extend into the development site. Archaeological deposits were located in one of the four trenches opened in the area of the levelled ringfort, 33:01101. These deposits probably represent part of the fill of the ringfort ditch. Their location in relation to the other test-trenches opened suggests that surviving deposits associated with the ringfort are confined to a small area, and the surrounding ground has been very heavily disturbed. The deposits will be preserved in situ. Trenches opened in the area of the possible circular enclosure, 33:01102, indicate that this is a geological feature. Underlying bedrock was found to be just below topsoil within a small circular area that corresponds with the circular anomaly highlighted through an aerial photograph. Further work will be undertaken in conjunction with archaeological consultation.
Castlelands, Mallow	00E0830 ext.	Planning permission was granted in 1997 for a large-scale housing estate at Castlelands, within the demesne of Mallow Castle. An assessment of the site, which included testing in the area of a levelled ringfort, was carried out by Avril Purcell in May

Site Name	Licence No.	Description
		2001 (Excavations 2001, No. 205). Monitoring of the present phase of the development revealed one feature in an area close to the levelled ringfort. This was a small pit measuring 0.45m by 0.7m with a maximum depth of 0.18m. The fill was red/brown silty clay with moderate inclusions of charcoal flecks and small round stones. Three pieces of possible Bronze Age or Neolithic pottery were recovered from the base of the feature.
Castlelands, Mallow	00E0830 ext.	Test-trenching was initially undertaken on the site during 2000 (Excavations 2000, No. 146). Parts of the site lie within the zone of archaeological potential for three sites: two ringforts and a circular enclosure. The site assessment during 2000 indicated that the circular enclosure was a geological feature and that deposits associated with the ringfort SMR 33:10 were not located within the site and thus would not be affected by the development. However, the extent of survival of deposits associated with the levelled ringfort 33:11(01) was not certain. Deposits of archaeological potential were revealed in one trench, Trench 6, opened across the site. Further assessment of this area was necessary to determine the extent of survival of the potential archaeological deposits. Four additional test-trenches were opened across the area of the levelled ringfort to further assess the extent of its survival. Deposits of archaeological potential were revealed in two of the four test-trenches. In Trench 8, a spread 3.3m long within the trench possibly represented the truncated remains of the ringfort ditch. In Trench 9, a spread 4.3m long was revealed which again may represent the truncated remains of the ringfort ditch. The developer has agreed to the preservation in situ of these deposits. The area in question will remain a green area and will be flanked by an access road. The road will be constructed outside of the area of known archaeological deposits. Archaeological monitoring of this work was recommended.
Castlelands, Mallow, Cork	04E0103	Testing was carried out at this site, which lies outside the zone of archaeological potential for a ringfort and for a possible circular enclosure. No finds or features of an archaeological nature were noted.
Castlelands, Mallow, Cork	04E0389	The sites of five proposed houses lie within the zone of archaeological potential for a ringfort, which in turn lies in the Deer Park of the demesne of The Castle, an 18th/19th-century country house (SMR 33:9(02)) in Mallow. An earlier 16th-century ruined fortified house, Mallow Castle (SMR 33:9(01)), stands c. 350m to the south-east. Seven test-trenches were excavated across this site on the proposed locations for four of the houses. The fifth house site could not be tested due to the large volume of material dumped in the area. No archaeological finds or features were noted in the trenches.
Castlelands	06E0829	Eight test-trenches were excavated at the site of a proposed housing development to the east of Mallow which was adjacent to a fulacht fiadh and a ringfort. Stratigraphy in the trenches consisted of a mid-brown stony soil, 0.2–0.35m deep, over orange/ brown stony subsoil. Some field drains and possible ridge and furrow marks were noted. No archaeological finds or features were noted during testing.
Castlelands, Mallow	15E0449	An archaeological assessment was undertaken at the site of a proposed primary school on the north-eastern outskirts of Mallow town, off St Joseph's Rad. This site is composed of an area of fallow land (1.88ha) with existing residential areas to the south (Kingsfort Avenue) and west (St Joseph's Road). Six trenches were excavated across the site as far as the natural subsoil. No archaeological features were recorded.
Spaglen, Cork	23E0077	A total of 22 linear test trenches were excavated across three fields in the townland of Spaglen, Mallow, County Cork in April 2023. Archaeological features or deposits were identified in five of the excavated test trenches. The features and deposits identified within trenches in the southern field consisted of a portion of a probable circular enclosure with associated activity and ex-situ burnt mound-like material, while in the northern field, a cluster of post-holes close to one large pit and one isolated pit that contained burnt bone within its fill were identified. The revealed activity appears to be multi-period and likely spans from the late prehistoric period into the medieval period.
Ballyellis, Mallow, Cork	03E0088	Planning permission was granted for a development of 298 houses within Ballyellis Demesne, Mallow, Co. Cork. The site fell within the zones of archaeological potential

Site Name	Licence No.	Description
		for a possible ringfort, a tree ring and a limekiln. During monitoring of the first phase of groundworks on the site in January 2003, four potential archaeological features were uncovered and excavated. Charcoal, two sherds of possible Neolithic pottery and a quern stone were recovered. Further monitoring took place in October 2003. No features or artefacts of archaeological interest were found during the second phase of monitoring.
Ballyellis, Mallow, Cork	21E0444	Archaeological monitoring was recommended as a condition of planning for the Mallow Water and Sewerage Scheme. A full archaeological presence was maintained during the removal of topsoil to the east of the existing pumping station at Mallow Bridge as well as during the excavation of the new pumping station, storm tank and trenching for the sewerage pipe. No features or finds of archaeological significance were found in any of the areas that were stripped of topsoil. No further archaeological mitigation is required in respect of this development.
Ballydahin, Mallow, River Blackwater, Cork	18E0123	A wading and a dive survey of the deeper parts of a new pipeline across the Blackwater River to the east of Mallow Bridge was undertaken as part of the Mallow Sewerage Network Upgrade. An area of the river encompassing the site of the proposed works and measuring c. 100m by 30m was subject to an underwater visual and metal detection survey. 100% coverage of the study area was achieved using transepts at 1m intervals. No archaeology was found.
River Blackwater at Castlelands and Bearforst Lower, Mallow, Cork	21E0403	Archaeological monitoring of the Mallow Sewerage Scheme was completed in 2021 where the project crosses the River Blackwater in Castlelands townland, Co. Cork, in fulfilment of Planning Condition 41. The location lies close to the Mallow Castle complex (CO033-09001-) and is downstream from Mallow Bridge (CO033-094, NIAH 20816010). Excavation into the riverbed occurred in a series of 12 stages in which a block of the river channel was coffer-dammed; the riverbed within the coffer-dam was machine-excavated to the required depth; the excavated risings were transported off-site to a dump area; the sewer pipe inserted, and the work area back-filled. The archaeological monitoring observed the excavation process, inspected the risings both at the excavation face and at the dump area, and conducted metal-detection of the risings at the dump area.The riverbed retains a depth of river cobble and till that lies above bedrock. No archaeological features were observed. A series of objects were recovered that include several interesting pieces. None of the objects were associated with in-situ features and may be regarded as individual losses. The assemblage speaks to the late medieval and early modern history of Mallow. One object deserves particular mention and may be considered a worthy piece for museum display; namely a lead mount or plaque fragment that may have been part of a small box or casket. It retains the image of a clothed male figure and may date to the sixteenth century.
Mallow Castle, Cork	E005519	This report presents the preliminary findings of an archaeological excavation at Mallow Castle, Castlelands townland, Co. Cork under Ministerial Consent number C000893 and registration number E005519. The first castle at Mallow was built in 1185 under the instructions of King John (Berry 1893a). The location of the twelfth-century castle keep is unknown; however, it is likely that it was set within the bawn, perhaps where the fortified house (CO033-009001-) now sits, or under the site of the country house (CO033-009003-). A large tower-house and surrounding bawn reportedly served as the castle for the Earls of Desmond until the late sixteenth century (Berry 1893a & b). In the late sixteenth century, Sir Thomas Norreys, a senior English administrator in charge of managing Munster, built a fortified house (CO033-009001-) at the site. Today, this is a ruin of a rectangular three-storey house with four-storey towers. The house was assaulted and ruined by the Confederate forces in 1645 and burned down in 1689 (Grove White 1905–25, vol. 4, 85). The inhabitants are reputed to have retreated to stables (CO033-009002-) (Bence-Jones 1978, 200). The country house (CO033-009002-) is a large multiperiod complex, the majority of which appears eighteenth and nineteenth century in date, but some internal walls are up to 1m thick and are thought to include sixteenth-century stables, where

Site Name	Licence No.	Description
		people hid in the seventeenth century (Bence-Jones 1978, 200). These excavation works focused on the poorly preserved mural tower on a bawn (CO033-009004-/CO033-009006-) at the southeast of the Mallow castle complex. The tower was partway through conservation works being undertaken by the Office of Public Works and the aim of the excavation was to investigate a hole leading from the tower interior into a garderobe shaft and set of possible steps to its west (see excavation attached plan). The excavation revealed that the hole that led from the interior of the tower into the garderobe is a secondary feature that punched through into the earlier garderobe. It was 0.22m wide and 0.2m deep; its base was lined by brick, its sides by stone and it was capped with slate. It likely served as a drain and may date from the late sixteenth century, the same time that the nearby fortified house was built by Sir Thomas Norreys. Typological analysis of a loose brick from this structure retrieved during the excavation may add weight to or refute this supposition, and scientific characterisation has further potential to source the clay for this seemingly early brick. No steps were revealed to the west of the tower remnant, however, a series of foundations and revetted edges were. One of these, an east–west wall (C.8), although not very substantial may be the bawn. The others that extended from its southern face may either have supported, buttresses to the bawn, steps or a slipway from the bawn down toward the river, or some other form of projecting superstructure. A semi-articulated pair of animal bones were found in a mortar deposit post-dating a short wall remnant (C.10) that abutted the main east–west wall (C.8) and the standing tower remnant (C.15). It is intended to identify and then obtain a radiocarbon date on a sample of that bone. Four mortar samples were also retrieved, one from a layer found inside the tower and running under the standing tower wall faces, one from the core of the garderobe wall, one from mortar binding the drain, and one from the mortar in which the animal bone was found. It is intended to have all four mortar samples analysed and should suitable carbonised material exist in the first three, these may also be considered for radiocarbon dating. No medieval artefacts were found during the excavation, however glass, pottery, brick, tile, clay pipe, animal bone and slate of post-medieval to modern date was retrieved. These will be analysed and reported on as advised by relevant specialists. This summary will be updated upon completion of the final excavation report.
MALLOW: Bridge Street, Cork	97E0058	One trial-trench and three trial-pits were opened on this site. Some 17th-century levels were noted from a depth of 1.2m to 2.2m. It was difficult to say whether these were habitation levels or secondary levels created by dumping in the past. Above these levels, there was evidence for filling of the site with stone chips and clay. It was on this fill that the previous development on the site took place. It was proposed to lay a raft foundation 400mm thick resting on a 200mm-thick layer of hard-core for the new building, not exceeding a total depth of 600mm. The laying of this foundation was archaeologically monitored and it did not interfere with the 17th-century levels on the site.
MALLOW: Bridewell Lane, Cork	97E0259	In December 1997 a modern building on Bridewell Lane was demolished. The site is located on the east side of Bridewell Lane within the area of the medieval town. The demolition, levelling of the site and excavation of foundations were to be monitored in compliance with a planning condition. A layer of rubble, 0.2m deep, underlay the concrete floor. A borehole for a well for the Clockhouse Mineral Company (c. 1950s) was located in the north-eastern corner of the site. Three holes, 1m2 and 0.5m deep, were dug against the eastern boundary wall of the site to position supports against the wall. The stone wall was built on yellow clay overlying limestone bedrock. The stratigraphy revealed was a loose sandy clay, which included rubble stone and red brick, overlying the natural yellow clay. Three foundation test-holes were dug by machine, two in the centre of the site. The stratigraphy revealed was the same as that already described. The third was dug in the south-west corner of the site, where a burnt horizon, 0.8m deep, underlay the loose sandy clay.

Site Name	Licence No.	Description
		Further monitoring remains to be done on the site, as the foundations for the development have yet to be excavated.
22 Bridge Street, Mallow, Cork	03E1147	Testing was undertaken at 22 Bridge Street, Mallow, Co. Cork, as a condition of planning for the construction of a mixed development. Five trenches were excavated across the site. Two trenches had to be abandoned, due to the presence of live services. No archaeological features or artefacts were identified.
98–101 Davis Street, Mallow, Cork	06E0451	Test-trenching was carried out as part of the planning schedule for a residential and commercial development at the rear of 98–101 Davis Street within the archaeological zone of constraint for Mallow town. A series of trenches were excavated by mechanical digger at the site and ancillary works. No features or finds of archaeological significance were revealed.
MALLOW: 74–75 Davis Street, Cork	00E0831	The proposed development site lies within the zone of archaeological potential for the medieval town of Mallow. Following the demolition of the buildings on site, four 1m-wide test-trenches were opened by mechanical digger. Loose rubble fill of 19th/20th-century date was found to a depth of 0.4m. This overlay natural orange subsoil. No archaeological finds or features were noted.
108–109 Thomas Davis Street, Mallow, Cork	03E0235	A request for further information, requiring testing, was issued to progress an application for a Grant of Planning for the construction of a four-storey building at 108 and 109 Thomas Davis Street, Mallow, Co. Cork. The site lies within the historic town of Mallow and within the zone of archaeological potential for a church and graveyard (SMR 33:6(02, 012)). There were no archaeological levels or features noted on the proposed development site during testing.
151 MAIN STREET, MALLOW, Cork	09E0013	Testing of a proposed development site at 151 Main Street, Mallow, Co. Cork, was carried out as a condition of planning permission. The proposed development consists of the construction of an extension to the rear of a house which is also a protected structure. The site is within the zone of archaeological potential for Mallow town (CO033–093). The standing remains on the site consist of a three-storey gable-roofed retail premises fronting on to Main Street. Three test-trenches were excavated on the site. No finds, features or deposits of archaeological interest were uncovered.
63 Davis Street, Mallow, Cork	03E0961	Planning permission was granted for the demolition of existing buildings on this site and the subsequent construction of a three-storey building. The site is within the zone of archaeological potential for the historic town of Mallow. The Grant of Planning required that testing be carried out. One trench was excavated along the centre of the site. A 0.2m-thick layer of rubble material overlay a yellowish-brown sandy natural boulder clay. No archaeological finds or levels were noted in the test-trench.
Spaglen and Castlelands, Mallow, Derry	08E0491	Monitoring of the laying of a new sewerage pipeline in Spaglen, Mallow, Co. Cork, was undertaken between May and September 2008 as part of the Mallow Sewage Scheme. The work extended northwards from Spa Walk for a distance of c. 2.05 km. The southernmost c. 300m of the proposed pipeline was within the zone of archaeological potential for a limekiln (CO033–00701), a spa works/bath (CO033–00702), two holy wells (CO033–00703 and CO033–00704) and the historic town of Mallow (CO033–093). No features or finds of archaeological interest were identified.
NEW ROAD, MALLOW, Cork	04E0450	Two test-trenches were excavated on the site in advance of development. No features or finds of archaeological significance were revealed.
MALLOW: Fair Street, Cork	98E0281	A site assessment consisting of one test-trench was carried out on 22 June 1998 off Fair Street, Mallow. One east-west trench was opened to the depth of 1m. It was found to contain 20th-century loose rubble fill. No finds or features of archaeological significance were noted.

Site Name	Licence No.	Description
Patrician Academy, Mallow, Cork	21E0574	Archaeological testing took place at the site of the proposed development a new school building adjacent to the existing Protected Structure at the Patrician Academy in Mallow. The Patrician Academy is a protected structure on Cork County Council's Development Plan, RPS No. 78. It is also included in the National Inventory of Architectural Heritage's Interim Survey for Cork County (Reg. No. 20815078). The site does not include any recorded archaeological monuments or fall within a National Monuments Service Zone of Notification. However, the historic 25' map of c. 1900 does indicate a burial ground to the south-west corner of the site. A geophysical survey was conducted in available green spaces within the grounds of the school by Joanna Leigh Surveys in August 2021. No responses of archaeological potential were recorded. Modern landscaping and services were prominent in the data sets. It was not possible to fully survey the area where the burials were marked as the survey was severely restricted by modern flower beds, services, and tarmac areas. The programme of testing was carried out on 27 September 2021 using a 12-tonne backhoe excavator with a 1.9m-wide grading bucket. In total 3 test trenches were excavated at the location of the burial ground, in overcast and showery conditions. Two additional test trenches proposed in the submitted method statement were omitted from the testing programme due to the presence of underground live gas mains, broadband and other critical services. Test trench 1 was aligned east-west and was excavated at the location of the 'burial ground'. Towards the western end, at the location of a funerary monument, an area of deep fill (to a depth of approximately 600mm and measuring 1.2m in length east to west) was observed. The fill comprised 20th-century rubble, sandy silty grey-brown clay and two large rectangular stone slabs (each measuring roughly 250mm x 300mm) along with general refuse. It appeared to have a vertical cut to the west where the compact subsoil rose to a depth of roughly 200mm for the remainder of the trench. This may represent the remains of a crypt and indicates that the burials purported to have been here have been effectively removed at some point in the past. The two remaining north-south aligned trenches presented a consistent stratigraphy, with topsoil and sod overlying a mixed modern fill to a depth of between 200mm and 400mm over natural compact subsoil. Nothing of archaeological significance was noted in the trenches. Nonetheless it was recommended that topsoil stripping for the proposed development in the vicinity of the burial ground be monitored by a suitably qualified archaeologist.
Spaglen, Mallow, Cork	23E0624	Twenty trenches were excavated across two pasture fields following geophysical survey and in advance of a proposed residential development. The geophysical survey identified a portion of a previously unrecorded circular enclosure in the north-west corner of the proposed development site along with several other potential archaeological features which were described as positive responses possibly representing pits, post-holes, cut features, spreads or natural geology (Murphy 2023). Several trends (curvilinear, linear and oval) were defined, one of which was identified as possibly representing the remains of a ring ditch approximately 30m south of the enclosure. Three trenches were excavated across the enclosure which was defined by two shallow ditches, the inner one ranging between 0.5m deep and 1.5m wide to 0.17m deep and 0.9m wide and the outer one up to 1m wide and 0.2m deep and 0.8m wide and 0.5m deep. An internal spread approximately 2m diameter was identified within the enclosure but not further investigated. The features were generally poorly defined and ephemeral in nature. No finds were identified. A single trench was excavated across the trend representing the possible ring ditch which identified a shallow ditch (0.28m deep x 0.9m wide) at its northern side and a wide (2.7m) stoney band at its southern side. Internally a cluster of three possible post-holes or small pits were identified but not further investigated. No finds were identified. A number of large vertically cut pits identified in the geophysical survey were investigated in the trenches. Two were between 10m and 40m east of the enclosure, at the north-west of the proposed development site. One measured 3.5m diameter and

Site Name	Licence No.	Description
		the other 7m east-west by in excess of 5m. Limited investigation by hand indicated both had steeply-cut sides and were in excess of 0.3m depth. No finds were identified. A third pit was investigated at the southern end of the site in excess of 200m away. This measured 5.5m east-west by in excess of 4.4m. A single sherd of modern pottery was recovered from the top of the deposit but poor weather conditions made it impossible to determine the origin of the sherd (whether in topsoil or the upper fill). The feature is considered to be of archaeological significance. Further archaeological works will be carried out in advance of proposed development in combination with the proposed preservation *in situ* of the archaeological deposits identified in the north-west of the site.

Appendix 14.4 Geophysical Survey Report

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 14.4: Geophysical Survey Report

Archaeological Geophysical Survey

Lands at Castlelands, Mallow, County Cork

Detection Device Licence: 23R0470

Prepared by
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October 2023

Document Control Sheet

Client	Reside (Castlepark) Ltd				
Project Title	Lands at Castlelands, Mallow, County Cork				
Document Title	Archaeological Geophysical Survey				
Document No.	N/A				
Document Comprises	DCS	NTS	TOC	Pages	22
	Y	N	Y	Appendices	2

Vers.	*Status*	*Authors(s)*	*Reviewed by*	*Approved by*	*Office*	*Issue date*
01	Issue	Peter Looney	John Cronin	John Cronin	Cork	31/10/23

Project Summary

County	Cork
Townland	Castlelands
ITM	557084, 598818
Survey type	High resolution magnetic gradiometry survey
Detection device	Bartington Grad601 single axis dual sensor
Geology	Pale-grey massive mud-grade limestone (Geological Survey of Ireland)
Soils	Clayey drift with limestones
Ground cover	Short grass and stubble from harvested crops. Some disturbance noted from previous construction activity, in particular northward trackway through site.
Topography	Mostly flat
Archaeology	No recorded archaeology within field prior to survey. A ringfort (CO033-012---) is located to the southeast, *c.*15m from surveyed area.
Fieldwork	October 2023
Summary of results	Nothing that would indicate certain archaeology was noted from the results of the survey, though some anomalies of archaeological potential have been identified, particularly in the southeast of the area. The western side shows evidence for land clearance, while the northward orientated trackway, that can be identified from aerial images in the past 15 years, can be clearly seen in the results.

Contents

1. Introduction

A programme of geophysical survey was undertaken by Mr Peter Looney, with the assistance of Mr Paul Fingleton, at Castlelands, Mallow, County Cork (under detection device licence number **23R0470**) during October 2023. This was carried out in advance of the proposed construction of a residential development. This geophysical survey was one of the mitigation measures to be carried out in advance of the proposed development, the results of which will allow for a programme of targeted test trenching.

This programme of geophysical survey was commissioned by Reside (Castlepark) Ltd. as part of pre-planning archaeological mitigation measures ahead of a proposed Large-scale Residential Development (LRD). This survey will contribute towards an Archaeological Impact Assessment report.

During a pre-application meeting, a recommendation from Cork County Council was that '*a geophysical survey shall be carried out by a suitably qualified Geophysical archaeologist'*. The proposed development site was visited on 26th June 2023 by two suitably qualified archaeologists, Mr Colm Chambers and Mr Peter Looney, both of whom have completed multiple licensed geophysical surveys. It was their consensus that due to the disturbance associated with previous groundworks at the site, as part of an earlier unfinished development, only the northern portion of the site would be suitable for geophysical survey, an area of *c*.3.7ha.

The remaining area had been stripped of topsoil, some of which is present in large mounds, large areas of hardstanding trackways and former compounds are present, underground services are in place in some areas and waste material including metal was noted across the central and southern portions of the site. These factors would both hamper the ability to carry out a geophysical survey and mean that very little could be gained from such a survey of those areas. The disturbance is associated with previous groundworks at the site, as part of an earlier, unfinished development (Cork County Council ref. 0755006, 0655035), and the use of the subject area for compounds, access roads and storage during the construction of the housing estate to the west.

The recommendation to limit the survey to the northern 3.7ha of the site was agreed with Ms. Annette Quinn, Archaeologist with Cork County Council, on the 18th of September 2023.

The proposed survey utilised detailed magnetometry survey, which was carried out over an open area in the north of the proposed development site.

2. Context

Location

The proposed development area is located in the townland of Castlelands, *circa* 800m to the east of the historic centre of Mallow, County Cork (**Figure 1**). The site is located within an irregular-shaped area. The northern portion is in use as agricultural tillage land, while the remainder is currently wasteland, having previously been part of an incomplete development. The northern portion of the site, an area of *c.*3.7ha is the only portion of the site that is suitable for geophysical survey.

The proposed development site is bound by a residential development to the west, parklands, beyond which is the River Blackwater to the south, farmland and a single house to the east, a ringfort (CO033-012----) is between that house and the subject site, and housing fronting St. Joseph's Road is located to the northwest. A primary school is located to the west of the proposed survey area.

Figure 1: *Location of proposed development to the east of Mallow, County Cork (Source: Government of Ireland)*

Figure 2: *Survey area, consisting of the northern portion of a large land parcel (Source: client)*

Figure 3: *Looking northwest from central area of site, only the northern portion of the site was deemed suitable for geophysical survey*

Commented [SK1]: The site layout overlay will have to be updated once the final version is available - the houses next to the ring fort have been amended to provide the additional buffer area

Archaeological background

The *Archaeological Survey of Ireland* (ASI) records twelve archaeological sites within *circa* 500m of the proposed development site (PDS), these are mapped in **Figure 6** and listed in **Table 1** below. A ringfort is adjacent to the proposed survey area to the southeast.

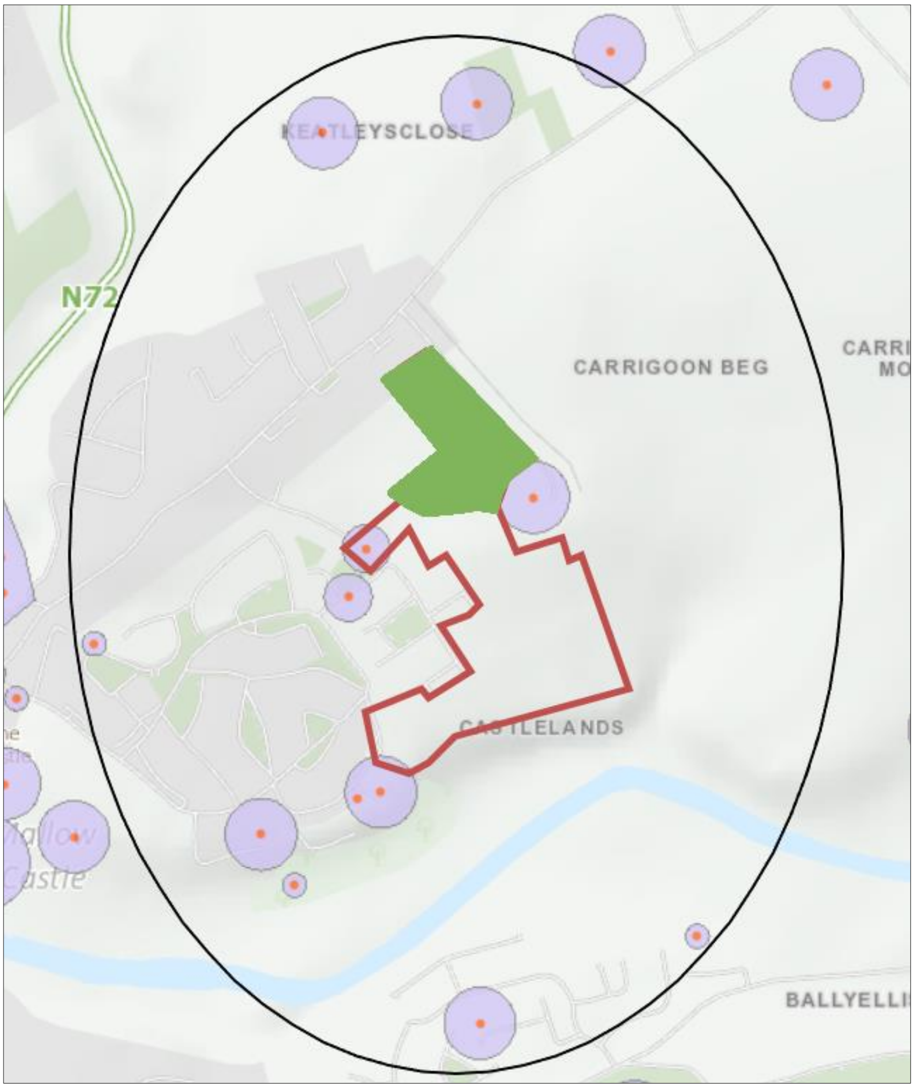

Figure 6: *Recorded archaeological sites (as recorded by ASI) within 500m of the subject site (portion suitable for geophysical survey shaded) (Source: Government of Ireland, Historic Environment Viewer)*

Table 1: *Recorded archaeological sites (as recorded by the ASI) within 500m of proposed development areas*

SMR Number	Class	Townland	ITM (E, N)
CO033-007001-	Kiln - lime	Castlelands (Fermoy By.)	556442, 598496
CO033-010----	Ringfort - rath	Castlelands (Fermoy By.)	556715, 598177
CO033-011001-	Ringfort - rath	Castlelands (Fermoy By.)	556918, 598244
CO033-012----	Ringfort - rath	Castlelands (Fermoy By.)	557178, 598736
CO033-013----	Enclosure	Keatleysclose	557088, 599394
CO033-068----	Designed landscape - tree-ring	Ballyellis (Fermoy By., Mallow Par.)	557079, 597859
CO033-088----	Kiln - lime	Castlelands (Fermoy By.)	556773, 598092
CO033-089----	Enclosure	Keatleysclose	556830, 599346
CO033-090----	Fulacht fia	Castlelands (Fermoy By.)	556897, 598652
CO033-091----	Fulacht fia	Castlelands (Fermoy By.)	556866, 598574
CO033-117----	Kiln - lime	Ballyellis (Fermoy By., Mallow Par.)	557445, 597999
CO033-140----	Excavation - miscellaneous	Castlelands (Fermoy By.)	556879, 598235

Excavations database

The Database of Irish excavation reports (available at Excavations.ie) contains summary accounts of all archaeological excavations carried out in Ireland from 1969 to present. This database was searched using map search as well as by townland names. A number of programmes of archaeological excavations and monitoring have taken place in the vicinity of the subject site.

Of particular note is the programme of test trenching (15E0449) that was undertaken in advance of the construction of the school adjacent to the northern part of this site and within the same field proposed for geophysical survey. Six test trenches were excavated during that testing programme and **no archaeological features were recorded**.

Two *Fulachtai fia* were recorded during mitigation works associated with a previous development to the west. These were both preserved *in situ.* One of these (CO033-090----) is within the current site boundary, but in an area that will not be developed and will be left as a green space. The geophysical survey area is 50m to the northeast of the *fulacht fia.*

Cartographic review

The detail on historic cartographic sources demonstrates the nature of past settlements and land use patterns in recent centuries and can also highlight the impacts of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded or partially levelled features of archaeological or architectural heritage interest. The cartographic sources examined for the study areas include the First Edition of the 1:10,560 "6-inch" Ordnance Survey (OS) maps (surveyed in 1841) (**Figure 7**) and the 1:2500 "25-inch" OS map (surveyed in 1903) (**Figure 8**).

These maps show that the subject lands comprise enclosed agricultural lands. A study of these maps reveals no evidence of unrecorded archaeological sites.

The first edition OS map shows a townland boundary crossing the subject site in a generally south-southeast to north-northwest direction, this is different to its current location, which is in line with the eastern site boundary. Castlelands townland was on the west of this divide while Carrigoon Beg was on the eastern side. The line of this townland boundary was tree lined in the southern part but may not have had a physical component in the northern part of the site (being indicated on the map with a dotted line and highlighted in pink on the colour edition), this is the area of the proposed geophysical survey. It was hoped that the results of the geophysical survey could identify whether there had been a physical element to the townland boundary depicted on that map.

The land was divided into generally rectangular fields. The boundaries were tree-lined and most included pathways. One pathway crossing the subject site in a west-southwest to east-northeast direction was labelled *Bower Walk.* The fields had trees depicted sporadically within them and the two ringforts in close proximity to the site were depicted but not labelled.

Figure 7: *Surveyed area (outlined) on 6-inch Ordnance Survey map, surveyed in 1841*

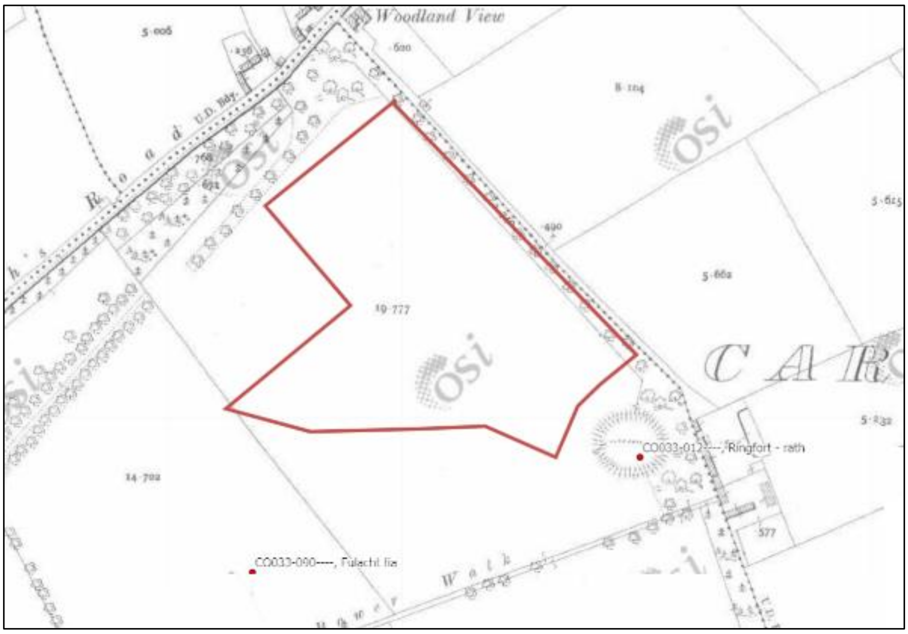

Figure 8: *Surveyed area (outlined) on 25-inch Ordnance Survey map, surveyed in 1903*

The 1:2500 (or '25-inch') OS map (**Figure 8**) depicted the townland boundary in its current location, bounding the site to the east, with the entire site within Castlelands and part of Mallow Castle Demesne. The remainder of the site was shown in a similar form to the earlier map.

3. Survey methodology

Methodology

The survey of all readily accessible greenfield areas was carried out using a Bartington 601-2 Fluxgate Gradiometer, with readings taken in traverses *c.*1m apart. The following equipment was employed:

- GPS Rover KQ GEO M8 with K8 data collector and FieldGenius 8.4 software
- Bartington 601-2 Fluxgate Gradiometer

The survey was completed in grids of 20m x 20m measured out on the ground (to suit the data gathering requirements of the equipment). The corner of each grid was georeferenced to provide for the accurate placement of the resulting interpreted data over the mapped area (using QGIS software).

No surface traces of any potential archaeological features were noted on the footprint of the proposed development during an inspection carried out prior to survey.

The methodology was approved by the Archaeological Licensing Section of the National Monuments Service and a licence to use a Detection Device under Section 2 (2) of the National Monuments (Amendment) Act, 1987, was issued by the Minister for Housing, Heritage and Local Government (Detection Licence. 23R0470) to Peter Looney.

Data collection and processing

High resolution magnetic gradiometry survey (1.0m x 0.25m) was undertaken within the survey area. All data was collected in 'zigzag' traverses. The data was downloaded on-site to a laptop computer for initial processing and storage. The data resulting from the Bartington system survey was processed using Snuffler software (Sussex Archaeology). Following GPS and magnetic gradiometer measurements on-site survey data was processed as follows:

- Zero median correction to balance data from entire sensor array
- Gridding of corrected data via nearest neighbour interpolation
- Processing of the data using the Snuffler application, processing steps consisted of interpolation, destripe and setting of display to +/-5 nT

The survey methodology, data presentation and report content adhere to the European Archaeological Council (EAC) (2016) 'Guidelines for the use of Geophysics in Archaeology'.

Data display

A complete greyscale image is presented below (**Figure 9**), as well as an interpretative image of the results (**Figure 10**). Numerous small-scale ferrous responses are evident throughout the survey results. Ferrous responses are a common occurrence in magnetic survey data and generally represent modern metal debris contained within the topsoil and are unlikely to be of archaeological significance.

Geology and Underlying drift

The drift geology combined with the bedrock have a marked effect on the results of a magnetometry survey. In cases where the base is known to contain a comparatively heavy iron content or possess a substantial magnetic signal, a magnetometry survey is inadvisable as the background signal will be far 'louder' than the expected weak potential differences provided by archaeological sites. In this instance the underlying geology of this area comprises pale-grey massive mud-grade limestone (source: Geological Survey of Ireland), while the soil profiles consist of clayey drift with limestones (Source: Teagasc Irish Soil Information System).

4. Results and discussion

Geophysics results

The greyscale image from the results of the survey can be seen in **Figure 9**, displayed at a range of +/-5 nT, while **Figure 10** is an interpretative image of those results. A number of **anomalies** (**Figure 10:1**) of possible archaeological interest were noted within the surveyed area, mostly in the south-eastern portion of the area. None of these have shapes that would indicate certain archaeological features, though these should be investigated further, especially given their proximity to a known monument; Ringfort (C0033-012----).

A number of likely former **field boundaries** (**Figure 10:2**) were identified from the results of the survey. Included in these is one that was depicted on the first edition OS map (**Figure 7**). This was depicted as a **townland boundary**, though as it was depicted with a dotted line, it was unclear whether there was a physical aspect to the boundary. The identification of a linear in that location proves that there was indeed a physical aspect to that boundary.

Smaller linears (**Figure 10:3**) were also noted, particularly in the northern part of the site. These were generally in groups and parallel to each other, generally orientated NE-SE or NW-SE. These are deemed to relate to agricultural practices; lazy beds, or deep furrows.

A **trackway** (**Figure 10:4**), which is evident in aerial photographs from recent years, can clearly be seen within the results of the geophysical survey, this was part of earlier construction works noted earlier in this report.

Numerous small to medium **dipolar ferrous responses** (**Figure 10:5**) were evident throughout the dataset, these likely to indicate modern metal debris contained within the topsoil and are unlikely to be of archaeological significance, small to medium pieces of metal building waste were identified in the southern portion of the surveyed area (see **Appendix 2: Plate 4**).

Areas of disturbance were also noted, these are seen close to metal fencing on the western side of the surveyed area and close to the electricity poles, while there were also areas of disturbance across the southern portion of the site, likely connected to previous construction work.

The western side of the side is relatively featureless in the greyscale results, largely lacking the linears noted in other parts of the surveyed area. This is likely the result of topsoil clearance in that area in advance of the earlier pre-development works on the site.

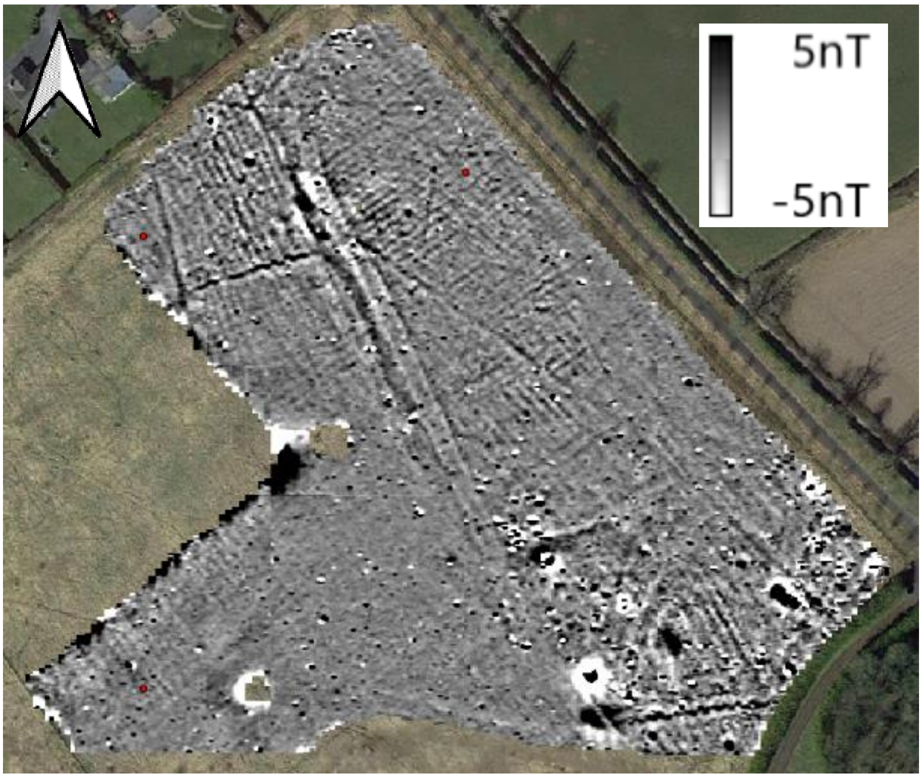

Figure 9: *Greyscale results (+/-5nT)*

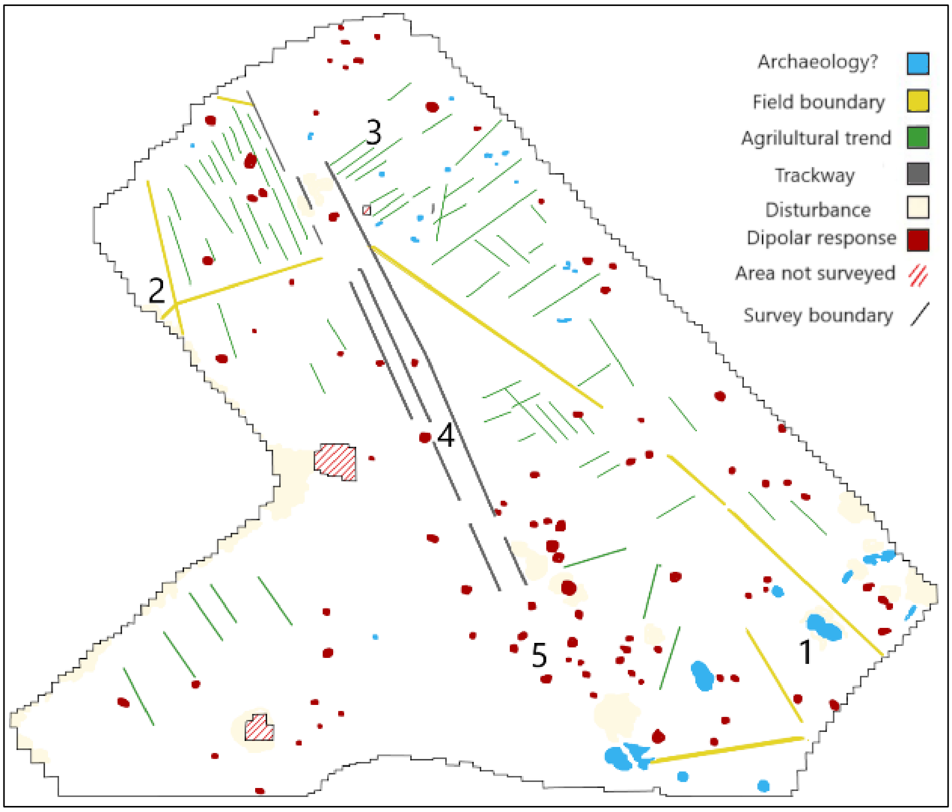

Figure 10: *Interpretative image based on the results of the geophysical survey*

5. Conclusions and recommendations

Conclusions

No anomalies that indicate certain archaeological activity were identified from the results of the geophysical survey, however several areas of archaeological potential were noted. These anomalies are mostly concentrated in the southeast of the surveyed area. Further magnetic responses of limited archaeological potential were noted across the site, though without any recognisable pattern.

The dataset also comprises responses indicative of agricultural activity: levelled field boundaries and ploughing activity.

The majority of the site, to the south of the survey area was not suitable for survey, this was due to construction work that had begun but was not completed, within the last 15 years. Portions within the area surveyed also displayed disturbance related to that work. This includes a hardcore trackway running in a SSE – NNW direction through the site, evidence of ground clearance in the southwest of the site and waste metal material scattered throughout much of the survey area, which caused dipolar ferrous responses.

Recommendations

Several ***areas of archaeological potential*** were identified through this geophysical investigation. The results of this survey can be used to inform a programme of targeted archaeological test trenching in advance of any proposed development. This can establish whether these anomalies are archaeological in nature and, if so, provide a greater understanding of the nature of these features. This will aid in identifying the best course of action if they are archaeological in nature.

This programme of archaeological testing, targeting the anomalies noted above, can investigate the nature, date, extent and significance of any archaeology present within the footprint of the proposed development area. This work should be undertaken by a suitably qualified archaeologist licensed by the National Monuments Service (Department of Housing, Local Government and Heritage).

6. References/sources

English Heritage. 2008. *Geophysical survey in archaeological field evaluation*, Research & Professional Guideline, No.1.

Environmental Protection Agency. *Teagasc Soil Map.* Available at: http://gis.teagasc.ie/soils/map.php [Accessed: 28/09/2023].

Geological Survey Ireland. *Spatial Resources.* Available at: http://spatial.dcenr.gov.ie/imf/imf.jsp?site=GSI_Simple [28/09/2023].

Government of Ireland. *Database of Irish Archaeological Excavation Reports*. Available at: http://www.excavations.ie/ [28/09/2023].

Government of Ireland. *Geohive mapviewer*. Available at: http://map.geohive.ie/mapviewer.html [28/09/2023].

Government of Ireland. *Historic Environment Viewer*. Available at: www.archaeology.ie [Accessed: 28/09/2023].

Government of Ireland. *Placenames Database of Ireland*. Available at: www.logainm.ie [Accessed: 28/09/2023].

Ordnance Survey Ireland. *Irish Townland and Historic Map Viewer.* Available at: http://maps.osi.ie/publicviewer/#V2,591271,743300,1,10 [Accessed: 28/09/2023].

Schmidt, A. et al. 2015 *Guidelines for the use of Geophysics in Archaeology*. Belgium: Europae Archaeologica Consilium.

Appendix 1: Technical information

Magnetometry

Geophysical survey is a systematic measurement for some property of the Earth which produces contrasting results within some aspect of the ground – magnetic, electrical or differences in buried surfaces for example. Magnetometry survey offers the most efficient ground coverage of the various geophysical survey techniques and responds to a wide variety of anomalies resulting from potential human activity. While there is no definitive process to categorically detect archaeology without intrusive tests such as excavation, magnetometry allows for the identification of the location, form and extent of a range of potential archaeological features not visible at the surface.

The Bartington Grad 601-2 fluxgate magnetometer is specifically designed for use in archaeological prospection. The gradiometer operates with a dual sensor capacity making survey very fast and effective. Magnetic gradiometers are sensitive to internal and external temperature fluctuation and frequent realignment of the instruments and zero drift correction ensure a constant high quality of data. The instrument was configured to ignore any possible interference from power lines (50Hz for Irish electrical supply).

Data display

XY Trace - The data are presented as a series of linear traces, enabling a near-perspective representation of measurements along individual lines of data recorded from each of the magnetometer sensors. This display option is useful for distinguishing between modern metal debris and potential archaeological responses. The XY trace display is particularly useful when identifying magnetically strong anomalies indicative of buried hearths, kilns and furnaces.

Greyscale

The greyscale format assigns a cell to each datum according to its location on the grid. The display of each data point is conducted at very fine increments, allowing the full range of values to be displayed within a given data set. This display method enables the identification of discrete responses at the limits of instrument detection.

Interpretation

An interpretation of the data is made using the various plots presented in the final report, in addition to examination of the raw and processed data. Knowledge and experience allow a detailed interpretation of the survey results with respect to archaeological potential.

Appendix 2: Photographic record

Plate 1: *Facing east in surveyed area, ringfort is in background to right hand side, marked by trees beyond hedgerows*

Plate 2: *Facing north within surveyed area*

Plate 3: *Facing north within surveyed area, modern disturbance evident*

Plate 4: *Example of metal waste material frequently seen in southern portion of surveyed area; such metal is responsible for dipolar responses in the survey results*

Plate 5: *Example of dug up roots, area had been overgrown with trees and bushes in previous years*

Appendix 14.5 Archaeological Test Trenching Report

Ocotober 2024

McCutcheon Halley
CHARTERED PLANNING CONSULTANTS

Appendix 14.5: Archaeological Test Trenching Report

JOHN CRONIN & ASSOCIATES
ARCHAEOLOGY | CONSERVATION | HERITAGE | PLANNING

Archaeological Assessment
Proposed residential development, Castlelands, Mallow, County Cork

Excavation Licence No. 24E0007

Prepared by
Peter Looney
John Cronin & Associates
3a Westpoint Trade Centre
Ballincollig
County Cork

February 2024

Contents

Core data

Excavation Licence Number	**24E0007**
Licence Holder	Peter Looney
Site Type	Mostly brownfield, disturbed from earlier unfinished development, partially greenfield in north of site
Testing Commenced	29/01/2024
Testing Completed	31/01/2024
ITM Reference	557100, 598661
Townlands	Castlelands
County	Cork
OS 6" Sheet	CO033
Archaeological Contractor	John Cronin & Associates
Summary of findings	Nineteen linear test trenches with a combined length of 830m were excavated across a proposed development site. Natural subsoil was identified at a depth of between 0.05m and 1.2m below modern surface level. Ten of the test trenches targeted anomalies that had been identified from the results of a geophysical survey of the northern portion of the site. While evidence of agricultural activity was revealed in some of the excavated trenches, **nothing of archaeological significance** was encountered during the testing programme.

1. Introduction

John Cronin & Associates were commissioned to undertake a programme of archaeological test trenching at the proposed location of a development site in the townland of Castlelands, Mallow, County Cork (**Figures 1** & **2**). There is one recorded site, a fulacht fia (CO033-090----), within the proposed development boundary, In addition, there is one ringfort (CO033-010----) located immediately outside the development boundary to the east.

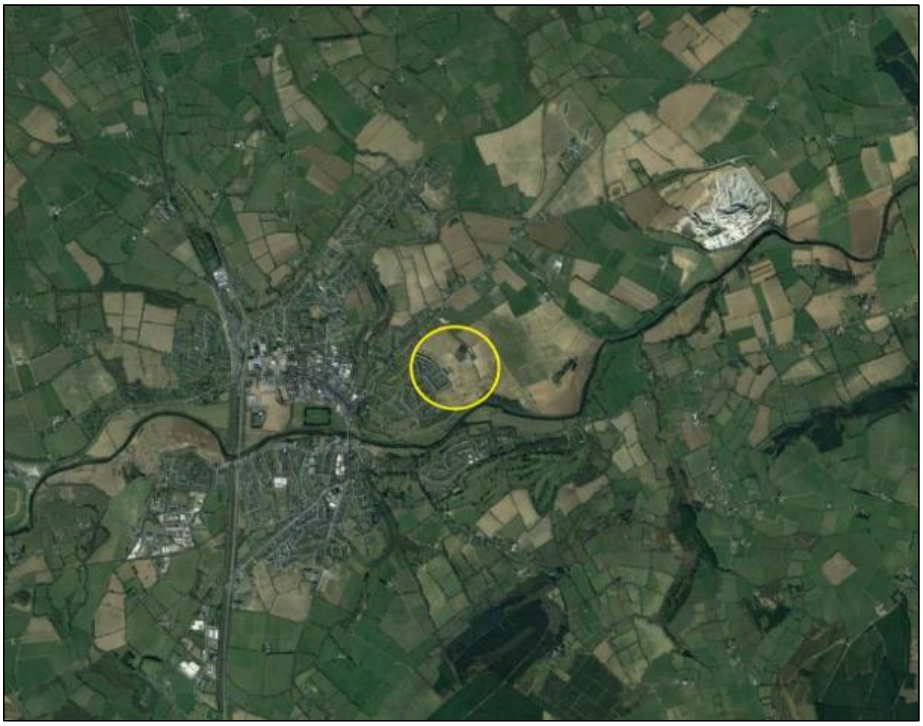

Figure 1: *General location of subject site (Source: Google Maps)*

The works entailed the archaeological excavation of 19 no. trenches with a combined length of 830m of which ten targeted geophysical anomalies identified during a geophysical survey (Detection device licence 23R0470) undertaken within the proposed development lands in October 2023. The archaeological investigations described in this report were carried out under Excavation Licence no. 24E0007, as issued by the National Monuments Service.

Section 2 of this report provides archaeological context for the general area within 500m of the proposed development. **Section 3** summarises the results of the archaeological test trenching, while **Section 4** details the preliminary conclusions arising from the site investigations. In summary. No archaeological features were uncovered within the excavated test trenches.

2. Context

Location

The proposed development area is located in the townland of Castlelands, *c.*800m to the east of the historic centre of Mallow, County Cork (**Figure 1**). The site is located within an irregular-shaped parcel. The northern portion and a small area in the east of the site is in use as agricultural tillage land and had been ploughed prior to the testing programme, while the remainder is currently wasteland, having previously been part of an incomplete development. The northern portion of the site, an area of *c.*3.7ha, is the only portion of the site that was suitable for geophysical survey. The proposed development site is bound by a residential development to the west, parkland beyond which is the River Blackwater to the south, farmland, a single dwelling and a ringfort (CO033-012----) to the east, and housing fronting St. Joseph's Road is located to the north. A primary school is located to the northwest of the site.

Figure 2: *Aerial view of site in 2022, before northern portion was reclaimed for tillage (Google Earth)*

Site description

A geophysical survey of a portion of the site was carried out by Mr. Peter Looney in October 2023, under detection device licence no. 23R0470.

The site was previously part of an unfinished development (Planning. Ref. Nos. 0755006, 0655035), and has been significantly disturbed. As a result of this disturbance, only the northern portion of the site was suitable for geophysical survey. This disturbance also limited the scope of the test trenching programme. No anomalies that indicated certain archaeological activity were identified from the results of the geophysical survey, however, several areas of archaeological potential were noted and the programme of test trenching targeted those anomalies of archaeological potential. Nine additional test trenches were also excavated within parts of the site which were not suitable for geophysical survey but deemed to be less disturbed.

The majority of the site has been stripped of topsoil, some of which is present in large mounds, the foundations of *c.*27 houses were built in the western part of the site, large areas of hardstanding trackways and former compounds are present, underground services are in place in some areas and waste material including metal was noted across the central and southern portions of the site.

Archaeological background

The *Archaeological Survey of Ireland* (ASI) records twelve archaeological sites (and one redundant record) within 500m of the proposed development site, these are listed in **Table 1** and mapped in **Figure 3** below.
There is one recorded site, a fulacht fia (CO033-090----) within the proposed development boundary, however this site will be preserved *in situ* within the site and no test trenches were excavated within 75m of it. A ringfort (CO033-010----) located adjacent to the site boundary to the east is separated from the development by hedgerows and a private access road.

Table 1: *Recorded archaeological sites within 500m of the proposed development area*

SMR Number	***Class***	***Townland***	***ITM (E, N)***	***Number - Figure 3***
CO033-007001-	Kiln - lime	Castlelands (Fermoy By.)	556442, 598496	1
CO033-010----	Ringfort – rath	Castlelands (Fermoy By.)	556715, 598177	2
CO033-011001-	Ringfort - rath	Castlelands (Fermoy By.)	556918, 598244	3
CO033-012----	Ringfort - rath	Castlelands (Fermoy By.)	557178, 598736	4
CO033-013----	Enclosure	Keatleysclose	557088, 599394	5
CO033-068----	Designed landscape - tree-ring	Ballyellis (Fermoy By., Mallow Par.)	557079, 597859	6
CO033-088----	Kiln - lime	Castlelands (Fermoy By.)	556773, 598092	7
CO033-089----	Enclosure	Keatleysclose	556830, 599346	8
CO033-090----	Fulacht fia	Castlelands (Fermoy By.)	556897, 598652	9
CO033-091----	Fulacht fia	Castlelands (Fermoy By.)	556866, 598574	10
CO033-117----	Kiln - lime	Ballyellis (Fermoy By., Mallow Par.)	557445, 597999	11
CO033-140----	Excavation - miscellaneous	Castlelands (Fermoy By.)	556879, 598235	12

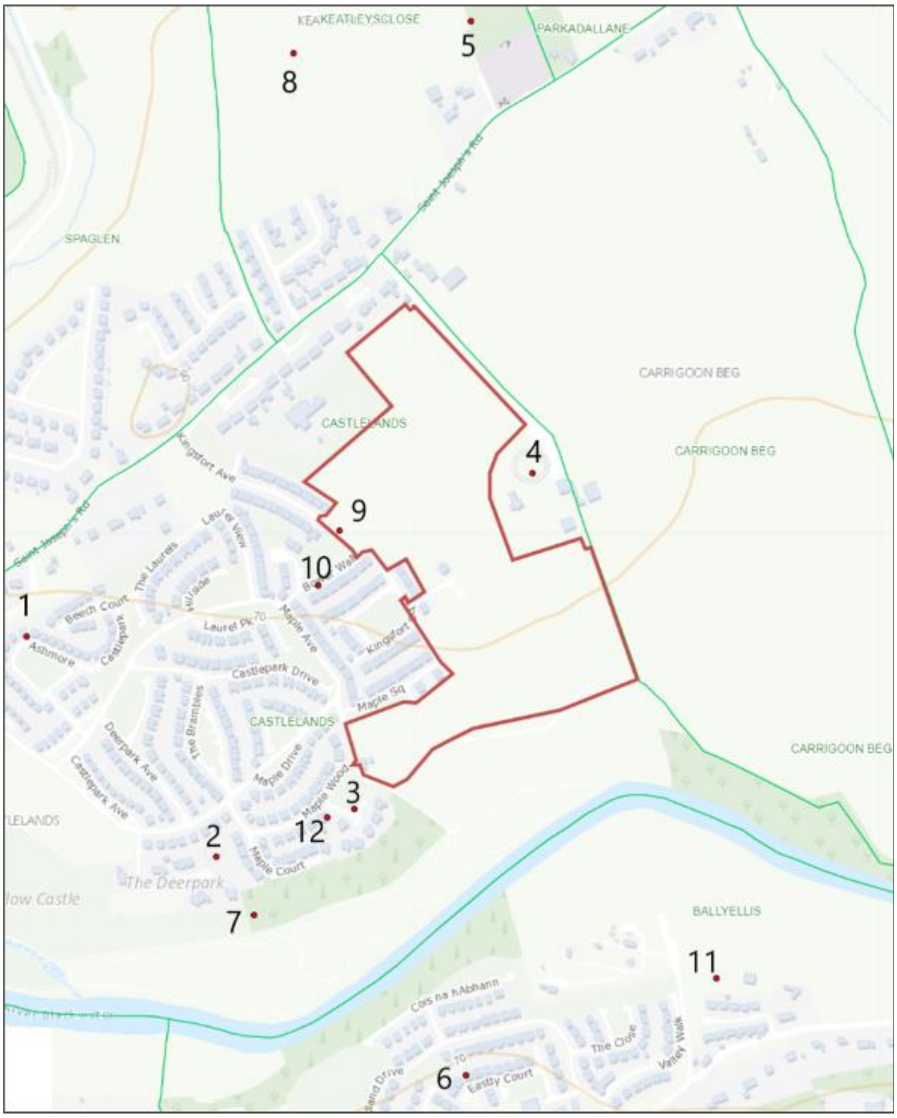

__Figure 3__: Recorded archaeological sites (red dots) within 500m of the subject site (Source: Government of Ireland)

The Excavations Database

The Database of Irish Excavation Reports (available at Excavations.ie) contains summary accounts of all archaeological excavations carried out in Ireland from 1969 to present. This database was searched using map search as well as by townland names. A number of programmes of archaeological excavations and monitoring have taken place in the vicinity of the subject site.

Of particular note is a programme of test trenching (15E0449) that was undertaken in advance of the construction of the school adjacent to and formerly within the same field as the northern part of the subject site. Six trenches were excavated as part of the testing programme and no archaeological features were recorded.

Two *fulachtaí fiadh* (CO033-090---- and CO033-091----) were uncovered during archaeological investigation and mitigation works associated with a previous development to the west. Both sites were preserved *in situ.* One of these (CO033-090----) is located within the current development boundary, however it is proposed to preserve this site *in situ* within a green space.

Cartographic Review

The detail on historic cartographic sources demonstrates the nature of past settlements and land use patterns in recent centuries and can also highlight the impacts of modern developments and agricultural practices. This information can aid in the identification of the location and extent of unrecorded or partially levelled features of archaeological or architectural heritage interest. The cartographic sources examined for this study area include the first edition of the 1:10,560 "6-inch" Ordnance Survey (OS maps (surveyed in 1841) (**Figure 4**) and the 1:2,500 "25-inch" OS map (surveyed in 1903) (**Figure 5**).

These maps show the subject lands to comprise enclosed lands within the demesne of Mallow Castle (as also recorded by the townland name; Castlelands). A study of these maps revealed no evidence of unrecorded archaeological sites.

The first edition 6-inch OS map shows a townland boundary crossing the subject site in a generally south-southeast to north-northwest direction, this is different to its current location, which is in line with the eastern site boundary. Castlelands townland is shown to the west of this divide while Carrigoon Beg townland is on the eastern side. The line of this townland boundary is tree lined in the southern part but based on the map alone, may not have had a physical component in the northern part of the site (being indicated on the map with a dotted line and highlighted in pink on the colour edition). The results of the geophysical survey indicated a linear feature in that area, which may be a physical element to the townland boundary depicted on the map. The land is divided into generally rectangular fields on the map. The boundaries are tree-lined and most included pathways. One pathway crossing the subject site in a west-southwest to east-northeast direction was labelled *Bower Walk.* The fields have trees depicted sporadically within them and two ringforts in close proximity to the site are depicted but not labelled.

The 25-inch OS map (**Figure 5**) depicts the townland boundary in its current location, bounding the site to the east, with the entire site within Castlelands and part of Mallow Castle Demesne. The remainder of the site is shown in a similar form to the earlier map.

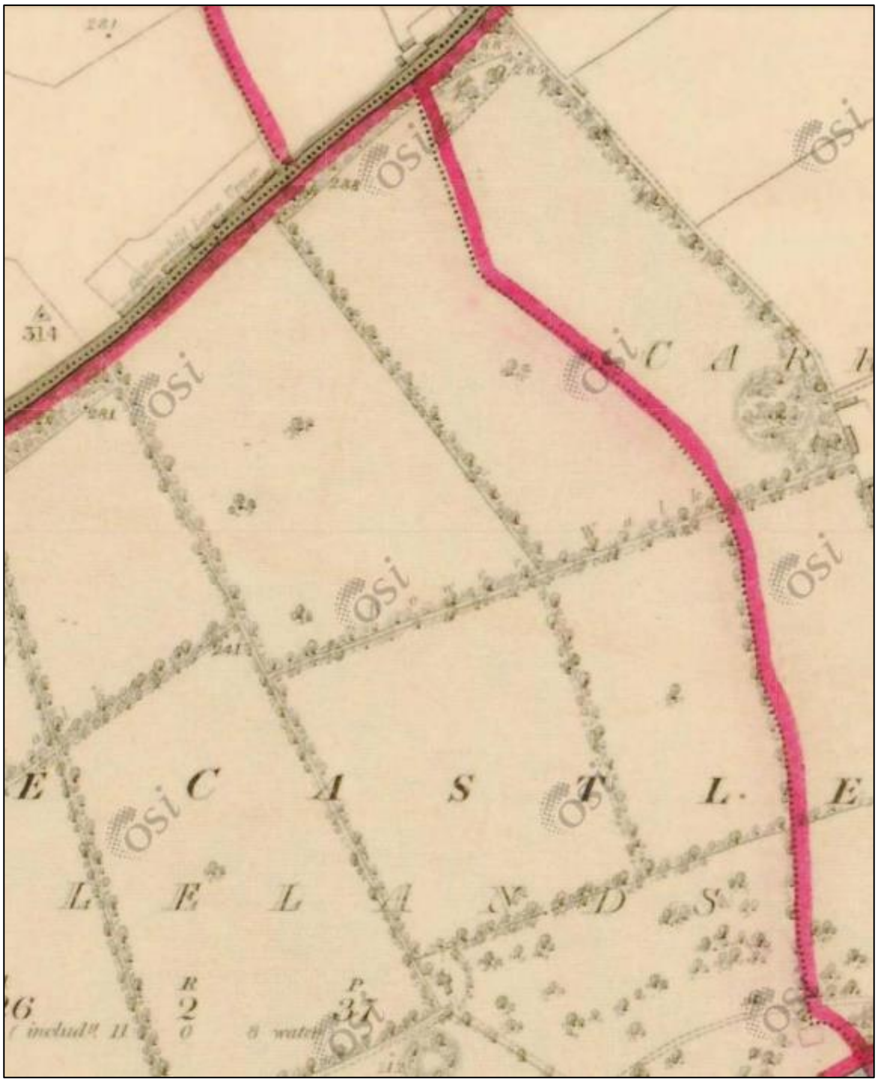

Figure 4: *Extract from the 6-inch Ordnance Survey map, surveyed in 1841*
(Source: Government of Ireland)

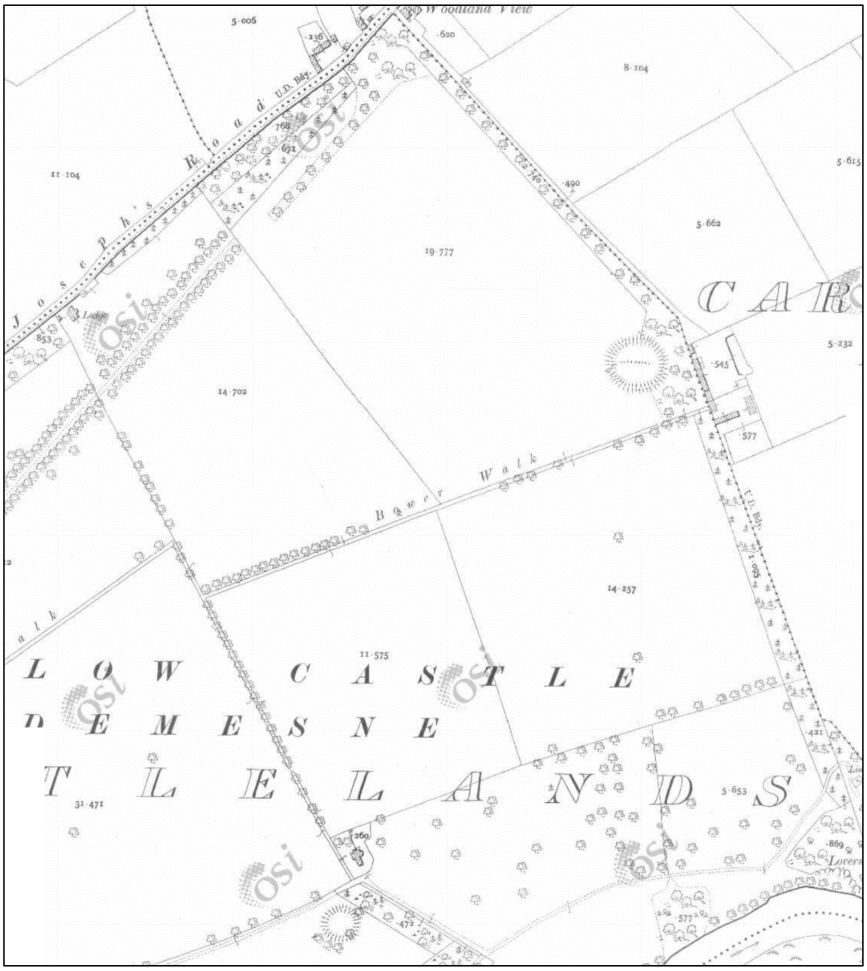

Figure 5: *Extract from the 25-inch Ordnance Survey map, surveyed in 1903*
(Source: Government of Ireland)

A selection of aerial photographs of the site were examined. These range in time from 1995 to present and are available to view on websites including Google Earth Pro, Geohive map viewer, the Historic Environment Viewer and Bing Maps. The earliest available image, from 1995, showed the site as farmland, in advance of the construction of the housing estate to the west. The subsequent images show the start of construction to the west of the site and increased activity within the site itself. One image from 1996-2000 (Geohive.ie) shows two spreads of darker material to the west of the subject site. These correspond with the locations of the two fulachtai fia (CO033-090---- and CO033-091----) which were identified during archaeological mitigation measures in advance of construction work in that area. The aerial images from the following few years (2001-2010) show increased activity and disturbance within the subject site, as part of a development that was not completed.

Geophysical survey of the subject site

A geophysical survey (carried out under detection device licence number 23R0470) was undertaken at the proposed development site by Peter Looney in October 2023 (see **Figures 6 & 7**). Due to considerable groundworks undertaken previously within the majority of the site, only the northern portion of the site was deemed suitable for a geophysical survey.

Nothing that would indicate certain archaeology was noted from the results of the survey, however some anomalies of archaeological potential were identified, particularly in the southeast of the surveyed area, although such anomalies could also be caused by more recent ground disturbance. The western side shows evidence for land clearance, while the northward orientated trackway, which can be identified from aerial images in the past 15 years, can be clearly seen in the results.

Further magnetic responses of limited archaeological potential were noted across the site, though without any recognisable pattern. The dataset also comprises responses indicative of agricultural activity; levelled field boundaries and parallel lines from cultivation. Areas of magnetic disturbance were noted against the field boundaries in the west of the site, where ferrous wire fencing was located.

***Figure 6**: Greyscale image of geophysical survey results (Looney, 2023)*

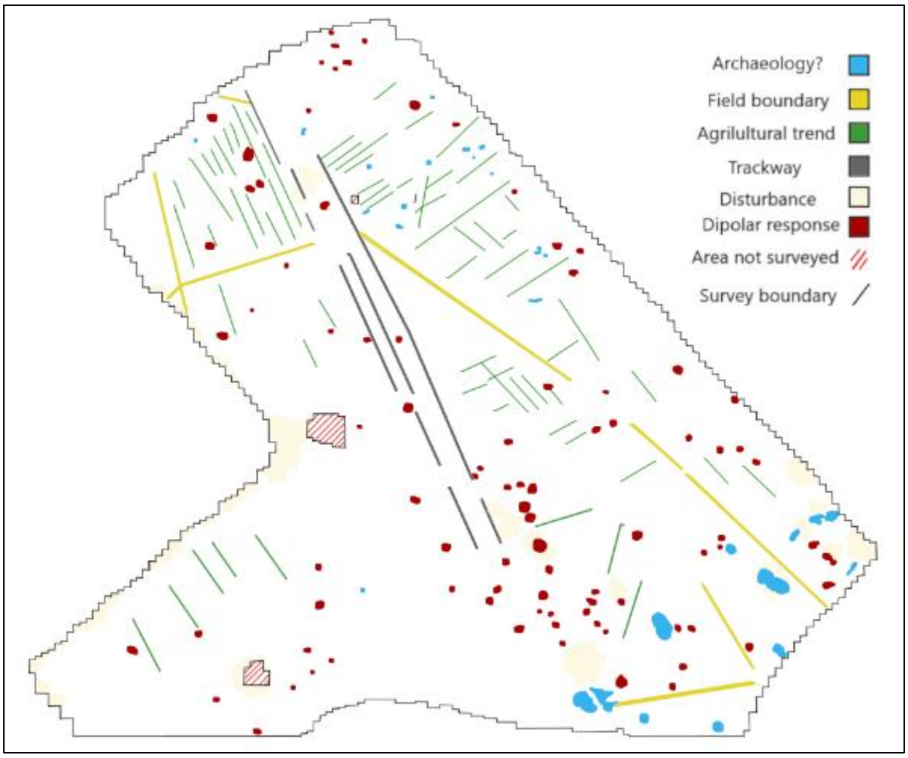

***Figure 7**: Interpretative image based on the results of geophysical survey (Looney 2023)*

3. Archaeological testing programme

Overview

Archaeological testing at the site at Castlelands, Mallow, County Cork was undertaken between Monday 29th and Wednesday 31st January 2024. The weather conditions were largely dry, though recent rains meant that the ground was quite saturated. Nineteen linear test trenches with a combined length of 830 linear metres were excavated across the site (**Table 2, Figure 8**). The trenches measured 20m to 100m in length and were excavated by a mechanical excavator, fitted with a 1.8m wide toothless grading bucket which operated under constant supervision by the licensee.

No difficulties were encountered during the testing and all trenches were excavated according to the method statement, except for Trench 14 which was modified slightly to minimise water ingress (see below). Trench 1 – 14 and Trench 19 were located within areas which had recently been ploughed. This did not affect the ability to excavate the trenches, but as a result of the ploughing, the soil was loose and inclined to fall into the freshly excavated trenches. While evidence of agricultural activity was revealed in a number of the excavated trenches, **nothing of archaeological significance was encountered during the testing programme**. Specifically, none of the geophysical anomalies targeted were archaeological in nature. In addition to the past agricultural activity, indicated by linear furrows and drainage ditches, many areas were disturbed by the earlier construction work and by root activity. Extracts from the photographic record are provided in the **Appendix** to this report, while each test trench is described in detail below.

Trench descriptions

Table 2: *Test trenches and targeted anomalies, see* ***Figure 8*** *for locations*

Trench No.	*Length*	*Orientation*	*Targeting geophysical anomaly – see Figures 6, 7*
1	25m	NE-SW	Linear
2	35m	NW-SE	Linear features including townland boundary
3	40m	NE-SW	Small anomalies
4	25m	E-W	Targeting area without anomalies
5	20m	N-S	Small anomalies
6	65m	NE-SW	Targeting area without anomalies
7	60m	N-S	Targeting area without anomalies
8	55m	E-W	Targeting area without anomalies
9	30m	NE-SW	Linear and unclear area
10	75m	E-W	Small anomalies
11	45m	ENE-WSW	Small anomalies
12	35m	NE-SW	Medium and small anomalies
13	40m	NNW-SSE	Medium and small anomalies and linear
14	20m	WNW-ESE	Medium anomaly
15	30m	NNW-SSE	Unsurveyed area, less disturbed than other areas
16	40m	NW-SE	Unsurveyed area, less disturbed than other areas in south
17	40m	ENE-WSW	Unsurveyed area, less disturbed than other areas in south
18	50m	ENE-WSW	Unsurveyed area, less disturbed than other areas in south
19	100m	NNW-SSE	Unsurveyed area, less disturbed than other areas in south
Total	**830m**		

Figure 8: *Trenches excavated for this programme of archaeological testing*

Trench ID	**Tr1**
Length	25m
Orientation	NE-SW
ITM co-ordinates	556976.2, 598955.2 556957.4, 598938.3
Description	Test trench 1 (Tr1) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.25 – 0.35m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. Two linear features, representing possible field boundaries were noted from the results of the geophysical survey. These were both identified within the trench and investigated with hand tools. They both had a gentle u-shaped profile and were filled with a stoney mid-brown clayey sand, similar to the topsoil. The western of these (orientated east to west) measured 1.45m across and 0.17m deep, while the eastern example (orientated NNW to SSE) measured 1.15m across and 0.14m deep. A series of more ephemeral linear features were also noted within the trench, these were orientation northeast to southwest and similar linear features were encountered in other test trenches. A spread of material that included charcoal was identified towards the northeast end of the trench, this was investigated with hand tools and deemed to relate to root activity. The linear features were the only cut features in the trench. Nothing of archaeological significance was identified within this test trench. **Plates 1 & 2**

Trench ID	**Tr2**
Length	35m
Orientation	NW-SE
ITM co-ordinates	556934.8, 598901.9 556967.3, 598889.3
Description	Test trench 2 (Tr2) was excavated to a maximum depth of 0.4m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.3 – 0.4m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A number of linear features were noted from the results of the geophysical survey. These were identified within the trench and investigated with hand tools. The most prominent linear with a NNW to SSE orientation was noted as being in the same location as a townland boundary depicted on the first edition 6-inch OS map, but not on the subsequent edition. This linear feature was investigated with hand tools. It measured 1.19m across and 0.29m deep, with a gentle u-shaped cut. It was filled with a mid-brown clayey sand; it was soft and included roots within the fill. No dateable artefacts were recovered from this feature. Other ephemeral linear features were also identified within this trench, in a similar orientation (NNW to SSE) to those found in other trenches. Another linear that crossed the trench (ENE to WSW) and was seen very prominently on the image of the geophysics results, contained a plastic pipe and a stone filled drain. Nothing of archaeological significance was identified within this test trench. **Plates 3, 4 & 5.**

Trench ID	**Tr3**
Length	40m
Orientation	NE-SW
ITM co-ordinates	557043.3, 598930.9 557011.2, 598907.9
Description	Test trench 3 (Tr3) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a 0.25 – 0.35m deep mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A range of linear features cut the upper part of the subsoil. These were all shallow and deemed to relate to drainage and agriculture. One particular linear, orientated NNE – SSW, noted on the geophysical survey, was identified as a subsoil-cut feature within the trench. It was *c.*0.5m wide, but very shallow, less than 0.05m deep. An area that included charcoal was identified towards the northeastern end of the trench; this was investigated but deemed to relate to burnt roots. Nothing of archaeological significance was identified within this test trench. **Plates 6 &7**

Trench ID	**Tr4**
Length	25m
Orientation	E-W
ITM co-ordinates	556978.5, 598869.1 556955.3, 598869.2
Description	Test trench 4 (Tr4) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.3 – 0.35m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. Four linear features, orientated NNW-SSE, extended across the trench. These correspond with linear trends noted from the geophysical survey and match similar linear features identified within other trenches. These were deemed to relate to agricultural activity. They were ephemeral and a selection investigated were cut less than 0.05m into the subsoil. No features were noted towards the western end of the trench where an anomaly had been noted from the geophysical survey, this was likely caused by waste material within the topsoil. Nothing of archaeological significance was identified within this test trench. **Plates 8 & 9**

Trench ID	**Tr5**
Length	20m
Orientation	N-S
ITM co-ordinates	557058.7, 598900.5 557057.6, 598879.0
Description	Test trench 5 (Tr5) was excavated to a maximum depth of 0.3m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.2 – 0.3m deep. It overlay a mottled light orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones.

	A number of parallel linear features crossed the trench in a northeast to southwest orientation, as had been identified from the results of the geophysical survey. The most prominent of these was investigated with hand tools and found to be 1m wide and 0.12m deep with a flat base and gently sloping sides. These linear cut features were interpreted as cultivation furrows. A stone drain was also noted within the trench. Nothing of archaeological significance was identified within this test trench. **Plates 10, 11 & 12**

Trench ID	**Tr6**
Length	65m
Orientation	NE-SW
ITM co-ordinates	556963.0, 598801.6 556910.7, 598761.1
Description	Test trench 6 (Tr6) was excavated to a maximum depth of 0.4m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.3 – 0.4m deep in this trench and overlay a mottled yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. This trench was crossed by agricultural linear features as well as by three modern stone drains. Nothing of archaeological significance was identified within this test trench. **Plates 13 & 14**

Trench ID	**Tr7**
Length	60m
Orientation	N-S
ITM co-ordinates	557005.6, 598834.5 557006.9, 598773.1
Description	Test trench 7 (Tr7) was excavated to a maximum depth of 0.4m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.15 – 0.4m deep in this trench, deepest in the centre and south of the trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A range of parallel linear features were noted within this trench, modern material was found within one of these that was investigated manually. Nothing of archaeological significance was identified within this test trench. **Plates 15 & 16**

Trench ID	**Tr8**
Length	55m
Orientation	E-W
ITM co-ordinates	557048.4, 598773.6 556993.8, 598773.1
Description	Test trench 8 (Tr8) was excavated to a maximum depth of 0.4m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.25 – 0.4m deep in this trench, deepest in

	the east. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. Linear features, cut into the subsoil, crossed the trench, these included stone filled examples which appeared to have been excavated with a machine, other linear features were similar in form to those seen in other trenches and deemed to relate to agriculture. One pit-like feature was identified and investigated but found to contain a plastic lid for a coffee cup. This confirmed recent disturbance in the area. Nothing of archaeological significance was identified within this test trench. **Plates 17 & 18**

Trench ID	**Tr9**
Length	30m
Orientation	NE-SW
ITM co-ordinates	557073.3, 598817.1 557049.2, 598800.2
Description	Test trench 9 (Tr9) was excavated to a maximum depth of 0.6m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and modern building waste material. The topsoil was 0.5 – 0.6m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A stone filled linear cut, deemed to be a drain, was identified to the southeast of the centre of the trench. Evidence of root activity was identified elsewhere. Nothing of archaeological significance was identified within this test trench. **Plates 19 & 20.**

Trench ID	**Tr10**
Length	75m
Orientation	E-W
ITM co-ordinates	557113.6, 598846.1 557039.7, 598846.1
Description	Test trench 10 (Tr10) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and modern waste material. The topsoil was 0.2 – 0.35m deep in this trench and overlay a mottled yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A number of parallel linear features were cut into the upper part of the natural subsoil. These were orientated northwest to southeast and had been identified from the geophysical survey. The most prominent of these was 0.6m wide and 0.08m deep and had a gentle u-shaped profile. Modern ceramic sherds and glass were noted within the fill. Nothing of archaeological significance was identified within this test trench. **Plates 21 & 22**

Trench ID	**Tr11**
Length	45m
Orientation	ENE-WSW
ITM co-ordinates	557158.9, 598811.9 557116.8, 598801.4

Description	Test trench 11 (Tr11) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.25 – 0.35m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. Three linear cuts containing plastic pipes and gravel were identified in the eastern part of the trench. A similar example was noted in Trench 12. Other linear features also crossed the trench, these ranged in width from 0.4m to 0.8m and those manually investigated were 0.1 to 0.2m deep. These were deemed to relate to cultivation. A possible feature was investigated close to the western end of the trench, however this was deemed to relate to root activity. Nothing of archaeological significance was identified within this test trench. **Plates 23 & 24**

Trench ID	**Tr12**
Length	35m
Orientation	NE-SW
ITM co-ordinates	557143.6, 598796.3 557113.0, 598778.4
Description	Test trench 12 (Tr12) was excavated to a maximum depth of 0.35m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.25 – 0.35m deep in this trench. It overlay a mottled yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. A linear feature containing a plastic pipe and filled with gravel was identified at the east of the trench, similar to those seen in Trench 11. Another linear cut was investigated by hand and found to include modern ceramics. This was deemed to relate to cultivation. Nothing of archaeological significance was identified within this test trench. **Plates 25 & 26**

Trench ID	**Tr13**
Length	40m
Orientation	NNW-SSE
ITM co-ordinates	557094.4, 598784.7 557112.6, 598752.4
Description	Test trench 13 (Tr13) was excavated to a maximum depth of 1.2m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.40 – 1.20m deep in this trench and overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. The topsoil (including introduced topsoil) was very deep towards the northern part of the trench, up to 1.2m from current ground surface. A subcircular anomaly had been noted in this area from the geophysics. This is likely to relate to modern infill that was moved during the post-2000 work. This may have been related to a trial pit from those works. A study of aerial images from before and after the post-2000 work showed that a circular marking in that area is visible only on images from *c.*2012 onwards.

	Two linear cut features were noted towards the south of the trench, these were investigated manually and deemed to relate to cultivation or drainage. Nothing of archaeological significance was identified within this test trench. **Plates 27 & 28**

Trench ID	**Tr14**
Length	20m
Orientation	WNW-ESE
ITM co-ordinates	557064.2, 598758.0 557084.5, 598753.7
Description	Test trench 14 (Tr14) was excavated to a maximum depth of 0.25m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and occasional modern waste material, the topsoil was limited to the eastern part of the trench, while the western part was contained hardcore stone material. The topsoil was 0.2 – 0.25m deep in this trench and overlay a mottled light orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. The western part of the trench was on the line of an access trackway that was part of the post-2000 development works. That side of the trench filled with water immediately after being excavated. A gap was left unexcavated so the eastern side could be excavated without water entering the trench. Natural subsoil was encountered in the eastern side where no features were identified. The geophysical anomaly that this trench was targeting could not be identified and was most likely related to the post-2000 development works for which the trackway was made. The anomaly may have been a response to waste metal material in the topsoil. Nothing of archaeological significance was identified within this test trench. **Plates 29 & 30**

Trench ID	**Tr15**
Length	30m
Orientation	NNW-SSE
ITM co-ordinates	557101.5, 598724.9 557112.6, 598698.0
Description	Test trench 15 (Tr15) was excavated to a maximum depth of 0.15m below the existing surface level. The topsoil in this trench was a mid-brown clayey sand with occasional small to medium subangular stones and frequent modern waste material. The topsoil was 0.05 – 0.15m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. This trench was outside the area that was suitable for geophysical survey but, based on aerial images and a site survey, was identified as an area of proportionally less disturbance. However, this area was indeed considerably disturbed. A patch of gravel was uncovered at the southern end of the site, this gravel was similar to that used above underground services so that area of the trench was not excavated deeper. Elsewhere a linear cut was seen to include plastic and polystyrene waste. Nothing of archaeological significance was identified within this test trench. **Plates 31 & 32**

Trench ID	**Tr16**
Length	40m
Orientation	NW-SE
ITM co-ordinates	556917.9, 598370.0 556942.3, 598338.7
Description	Test trench 16 (Tr16) was excavated to a maximum depth of 0.25m below the existing surface level. The topsoil in this trench was a dark orangey brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.15 – 0.25m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones, though the natural subsoil was not encountered in the entirety of the trench. This trench was outside the area that was suitable for geophysical survey but, based on aerial images and a site survey, was identified as one of the areas of proportionally less disturbance. This area was indeed considerably disturbed. There were manholes adjacent to the northern end of the trench and an area of gravel was exposed within the trench nearby. This was not excavated further as services related to the manholes may have been under this gravel. An area of compressed hardcore material was situated towards the south of the trench. Nothing of archaeological significance was identified within this test trench. **Plates 33 & 34**

Trench ID	**Tr17**
Length	40m
Orientation	ENE-WSW
ITM co-ordinates	557212.8, 598509.5 557175.7, 598495.8
Description	Test trench 17 (Tr17) was excavated to a maximum depth of 0.25m below the existing surface level. The topsoil in this trench was a dark orangey brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.15 – 0.25m deep in this trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized sub-angular stones. This trench was outside the area that was suitable for geophysical survey but, based on aerial images and a site survey, was identified as one of the areas of proportionally less disturbance. This was less disturbed than Trenches 16 and 18. A linear cut feature in the western side of the trench was manually investigated. This had a u-shaped profile and contained stones at the base, it was interpreted as a drainage ditch. Nothing of archaeological significance was identified within this test trench. **Plates 35 & 36**

Trench ID	**Tr18**
Length	50m
Orientation	ENE-WSW
ITM co-ordinates	557238.3, 598461.0 557191.8, 598444.0
Description	Test trench 18 (Tr18) was excavated to a maximum depth of 0.15m below the existing surface level. The topsoil in this trench was a dark orangey brown clayey sand with occasional small to medium subangular stones and frequent modern waste material. The topsoil was 0.05 – 0.15m deep in this trench, having previously been stripped of topsoil. It overlay a mottled light yellowish

	to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. This trench was outside the area that was suitable for geophysical survey but, based on aerial images and a site survey, was identified as one of the areas of proportionally less disturbance. This area was indeed very disturbed and contained mixed building waste material. Nothing of archaeological significance was identified within this test trench. **Plates 37 & 38**

Trench ID	**Tr19**
Length	100m
Orientation	NNW-SSE
ITM co-ordinates	557239.2, 598566.8 557270.8, 598475.3
Description	Test trench 19 (Tr19) was excavated to a maximum depth of 0.6m below the existing surface level. The topsoil in this trench was a dark orangey brown clayey sand with occasional small to medium subangular stones and occasional modern waste material. The topsoil was 0.15 – 0.60m deep in this trench, deepest towards the centre of the trench. It overlay a mottled light yellowish to orangey brown, clayey silt subsoil with occasional small to medium sized subangular stones. This trench was outside the area that was suitable for geophysical survey but, based on aerial images and a site survey, was identified as one of the areas of proportionally less disturbance, similar to the area in the north, this area has been in use for cultivation (but only post 2022). A series of linear cut features crossed this long trench in various orientations. A selection of these were manually investigated and none were deemed to relate to archaeology, rather they were deemed to relate to cultivation and drainage. The northern 90m of the trench was within an area that has recently been farmed, while the southern 10m had not been used for agriculture in recent times. This 10m long portion of the trench was very disturbed and contained mixed rubble and building waste. Nothing of archaeological significance was identified within this test trench. **Plates 39 & 40**

4. Conclusions and recommendations

Conclusions

A programme of archaeological test trenching was undertaken within the subject site at Castlelands, Mallow, County Cork between Monday 29th and Wednesday 31st January 2024. The testing programme was carried out as part of pre-planning archaeological mitigation measures relating to the proposed construction of a large-scale residential development.

Nineteen linear test trenches with a combined length of 830m were excavated across the subject site. Natural subsoil was identified at a depth of between 0.05m and 1.2m below the modern surface level.

Ten of the trenches targeted anomalies of archaeological potential identified during an earlier programme of geophysical survey in the northern portion of the site (**23R0470, Figures 6 & 7**), none of these anomalies were found to relate to archaeological features. Other test trenches were located to investigate the areas of least disturbance outside the area that was suitable for geophysical survey. These trenches confirmed the considerable disturbance that has taken place at the site.

Evidence of agricultural activity, root activity and recent construction works were encountered; however, **no artefacts, features or deposits of archaeological significance were revealed within the excavated test trenches.**

Recommendations

The absence of archaeological material from the excavated test trenches, along with the findings of the geophysical survey, the desktop review, and the disturbed nature of the majority of the site, together indicate that there is ***a low potential for archaeological activity within the remainder of the site***.

It is recommended, however, that archaeological monitoring of any topsoil stripping within 50m of the previously recorded archaeological sites ringfort – rath (CO033-012----) and the *fulacht fia* (CO033-090----) is undertaken.

It should be noted that the above recommendations are subject to the approval of the National Monuments Service and Cork County Council.

5. References/sources

Cork County Development Plan 2022: https://www.corkcoco.ie/en/resident/planning-and-development/cork-county-development-plan-2022-2028 [Accessed on 09/05/2023]

Database of Irish Archaeological Excavations: http://www.excavations.ie/ [Accessed on 09/05/2023]

Geohive Mapviewer Resource: http://www.geohive.ie/ [Accessed on 09/05/2023]

Government of Ireland's Historic Environment Viewer: http://webgis.archaeology.ie/historicenvironment/ [Accessed on 09/05/2023]

Heritage Map Viewer: https://heritagemaps.ie/WebApps/HeritageMaps/index.html [Accessed on 09/05/2023]

Looney, P. 2023. *Geophysical Survey at Castlelands, Mallow, County Cork*. Unpublished report prepared by John Cronin & Associates.

Trinity College Dublin. *Down Survey*. Available at: http://downsurvey.tcd.ie/ [Accessed on 09/05/2023]

Appendix: Extract from the photographic record

Plate 6: *Trench 1 facing northeast*

Plate 7: *Trench 1 facing southwest*

Plate 8: *Trench 2 facing northwest*

Plate 9: *Trench 2 facing southeast*

Plate 10: *Section excavated through linear, possible former townland boundary in Trench 2, facing north*

Plate 11: *Trench 3 facing northeast*

Plate 12: *Trench 3 facing southwest*

Plate 13: *Trench 4 facing west*

Plate 14: *Trench 4 facing east*

Plate 15: *Trench 5 facing north*

Plate 16: *Trench 5 facing south*

Plate 17: *Slot cut through linear in Trench 5, facing north*

Plate 18: *Trench 6 facing southwest*

Plate 19: *Trench 6 facing northeast*

Plate 20: *Trench 7 facing north*

Plate 21: *Trench 7 facing south*

Plate 22: *Trench 8 facing west*

Plate 23: *Trench 8 facing east*

Plate 24: *Trench 9 facing northeast*

Plate 25: *Trench 9 facing southwest*

Plate 26: *Trench 10 facing east*

Plate 27: *Trench 10 facing west*

Plate 28: *Trench 11 facing east-northeast*

Plate 29: *Trench 11 facing west-southwest*

Plate 30: *Trench 12 facing southwest*

Plate 31*: Trench 12 facing northeast*

Plate 32: *Trench 13 facing north-northwest*

Plate 33*: Trench 13 facing south-southeast*

***Plate 34**: Trench 14 facing east-southeast*

***Plate 35:** Trench 14 facing east-southeast*

Plate 36: *Trench 15 facing north-northwest*

Plate 37: *Trench 15 facing south-southeast*

Plate 38: *Trench 16 facing northwest*

Plate 39: *Trench 16 facing southeast*

***Plate 40**: Trench 17 facing east-northeast*

***Plate 41:** Trench 17 facing west-southwest*

***Plate 42**: Trench 18 facing east-northeast*

***Plate 43**: Trench 18 facing west-southwest*

Plate 44: *Trench 19 facing south-southeast*

Plate 45*: Trench 19 facing north-northwest*

Proposed residential development, Castlelands, Mallow, County Cork

Archaeological Assessment