Part 1 - General

1.1 Introduction

This Code of Practice outlines Irish Water's technical requirements for the design, construction and commissioning of Works (the Wastewater collection pipework element of the Water and Wastewater Services Infrastructure) for housing and industrial/commercial Developments, which is to be vested by Irish Water. This Code of Practice will be kept under review and the latest edition is available on the Irish Water website, at www.water.ie/connections/. The reader should ensure that they are using the most up to date version of this Code of Practice.

It is important that the Developer consults with Irish Water on all technical matters regarding the provision of the Works for proposed Developments as early as possible. This can be done by engaging in a Pre-Connection Enquiry process as outlined in the Irish Water Guide to Connect which is available on the Irish Water website, at www.water.ie/connections/.

Failure to conform to the Code of Practice may result in Irish Water declining to allow the Works to be connected to its Network and/or the refusal of Irish Water to vest or adopt the Works.

This Code of Practice covers the provision by the Developer of new Works which are to be connected to the Irish Water Network and should not be used as a guidance document for all Wastewater related construction. In these cases the appropriate Irish Water technical standards and guidance documents should be used.

The Developer shall obtain all necessary Requisite Consents and other permissions for the proposed Development, including the Works.

It should be noted that this Code of Practice relates to Works with Sewer sizes of 450mm diameter and below. Larger diameter Sewer sizes are outside the scope of this document.

1.2 Statutory Relevance

The Water Services Act 2007 is the primary legislation governing Water Services in Ireland. It is a broad ranging piece of legislation concerning the supply of water for both domestic and non-domestic use, and the collection and treatment of Wastewater.

The Water Services Act 2013 provided for the establishment of Irish Water in March 2013. It was established as a semi state company as a subsidiary of Bord Gais and subsequently under Ervia. The Water Services Act 2013 also gave Irish Water and the Commission for Regulation of Utilities (CRU) powers to prepare for the transition of Water Services from Local Authorities to Irish Water. Irish Water is responsible for the Water Services previously provided by 34 Local Authorities. The Water Services Act

2013 also provided for the commencement of the metering programme and the installation of meters on domestic connections.

The Water Services Act (No2) 2013 was enacted in December 2013 and provided for the transfer of Water Services functions from the Local Authorities to Irish Water from January 1st 2014. The Water Service Act also provided for the transfer of assets and certain liabilities related to Water Services from Local Authorities to Irish Water.

1.3 Options for Works Construction

Various options will be available to the Developer for the construction of the Works as follows:

1.3.1 Developer undertakes the design and construction of the Works (Self-Lay Works); or
1.3.2 Developer undertakes design of the Works and subsequently an Irish Water contractor undertakes its construction (Irish Water Lay),

This Code of Practice deals with the provision by the Developer of the Works which are to be connected to the Irish Water Network.

Note: The Developer shall provide separate Wastewater and Storm Water drainage systems for any new Developments in both greenfield and brownfield sites. Irish Water **does not** have responsibility for Storm Water Sewers. These Storm Water Sewers are the responsibility of the Local Authority. It is Irish Water's policy not to accept Surface Water or Storm Water runoff into its Network.

1.4 Connection Procedure

The steps that Irish Water will utilise for the Works comprises:

1.4.1 Pre-Connection Enquiry (Optional) (This is mandatory for Developments that avail of the Planning and Development (Strategic Housing Development) Regulations 2017 (SI 271 of 2017) process);
1.4.2 Design Submission;
1.4.3 Connection Application;
1.4.4 Connection Offer (followed by acceptance and payment);
1.4.5 Construction Stage (including Irish Water supervision, inspection, etc.);
1.4.6 Commissioning Stage (including infrastructure documentation inspection, etc.);
1.4.7 Connection of infrastructure to Irish Water asset (on issue of a Conformance Certificate);
1.4.8 Vesting;
1.4.9 Defects Liability Stage;
1.4.10 Completion (on issue of a Completion Certificate).

The Pre Connection Enquiry and Connection Application Stages are outlined in greater detail in the Irish Water Guides to Connect which are available on the Irish Water website, at www.water.ie/connections. Specific information is required in a Design Submission in advance of the submission of the Connection Application as outlined in **Section 2.3** and **Section 2.4** below. A Connection Agreement is required in all cases before Irish Water will provide a connection to its Networks.

1.5 Types of Sewage Collection Systems

Single Premises service connections extend from a Sewer to connect to the Premises Pipework and they collect the Wastewater discharges from Premises.

Drains provide for the collection of Wastewater from toilets, baths, wash-hand basins, showers, utility rooms including washing machines, dishwashers and from kitchens utilities in domestic properties. Drains also collect domestic quality wastewater and trade effluent from commercial properties. Drains are connected to the Works at the Boundary of the Premises.

In some instances, due to the topography of the area served, the Works may contain pumping stations(s). In these instances, the Wastewater is collected at these low points and it is lifted by pumping and conveyed through a Rising Main to Gravity Sewers discharging to the point of treatment.

It is Irish Water's policy to minimise Storm Water inputs to Combined Sewer and to restrict new Storm Water inputs to Sewers. Many Combined Sewers have Combined Sewer Overflows (CSO) that allow for the release of combined Storm Water and Wastewater in times of heavy rainfall.

Storm Water Sewers carry only runoff from roofs, paved surfaces, roadways, etc. These flows are discharged without treatment to watercourses or land drainage systems. It is not permitted to discharge Wastewater to a Sewer designated as a Storm Water Sewer Network. **Irish Water does not have responsibility for Storm Water Sewers**.

Storm Water Sewer systems are outside the scope of this document and should be constructed in accordance with the requirements of the relevant Local Authority or Roads Authority.

Watercourses or land drainage systems are not permitted to be directly or indirectly connected to the Irish Water Network. Satisfactory and separate arrangements should be agreed with the relevant Local Authority or Road Authority.

Note: The Developer shall provide separate Wastewater and Storm Water drainage systems for any new Developments in both greenfield and brownfield sites. Irish Water **does not** have responsibility for Storm Water drainage systems. Surface Water or Storm Water drainage systems are the responsibility of the Local Authority. It is Irish Water's policy not to accept Storm Water runoff into its Network.

The reduction of Storm Water runoff arising within new Developments and discharging to the storm water sewer network or to existing watercourses may be required by a Local Authority. This reduction can be achieved using Sustainable Urban Drainage Systems (SUDS). This will be a matter for the Developer to design and put in place in consultation with the relevant Local Authority. A suitable Sustainable Urban Drainage System (SUDS) may be required within the Development to the requirements of the Local Authority for the area. The SUDS can be undertaken to the requirements outlined in the Greater Dublin Region Strategic Drainage Study (GDSDS) Report or any other Design Guidance Document for SUDS considered appropriate for the location of the Development.

In very exceptional circumstances, where there is no other outlet for storm water and the Developer can prove to Irish Water that they have exhausted all other options, discharge of storm water to a combined sewer may be allowed, subject to the approval of Irish Water. Where wastewater and storm water sewer systems from the new Development area are allowed by Irish Water to be connected to an existing Irish Water combined sewer, the new wastewater sewer and storm sewer systems shall be separated within the Development and may only be connected together immediately prior to the Connection Point to the existing Irish Water Network. Irish Water, in this instance, shall also be consulted on the design of the Sustainable Urban Drainage System (SUDS) for the storm sewer network and its recommendations in relation to the acceptance levels of additional storm water to its sewer network shall be taken into account.

In these exceptional circumstances, storm water discharges are to be minimised and are to:

- be below or as near to greenfield storm runoff rate and discharge volumes as is practically possible, and
- be no greater than that which existed prior to the redevelopment of a brownfield development area that already discharged storm flows to a combined sewer, and
- be such as to ensure that there is no increased risk of causing environmental harm or increased flooding risk.

Storm water sewer systems are outside the scope of this document and should be constructed in accordance with the requirements of the adopting authority.

1.6 Specialist Works

Pressure pipe, vacuum pipe and other specialised systems are outside the scope of this document and should be discussed separately with Irish Water if such are being proposed. For specialist Wastewater systems the Developer will be asked to provide specific information to establish the whole life cost based on a 20-year operation, and durability of the fixed and buried components relative to a conventional system, to enable a decision on suitability.

The use of inverted siphons is also outside the scope of this document. Where proposed, specific Irish Water approval shall be sought and the siphon shall be designed to ensure that variation of flow is accommodated, self-cleansing velocities are achieved, and venting is incorporated to prevent air-locking, etc.

1.7 Private Pipework

Irish Water will not have responsibility for Drains located within the Boundary of Premises. Irish Water has wide-ranging powers pursuant to Section 43 of the Water Service Act 2007 to direct an owner of Premises to carry out relevant work, or, to undertake the work itself and recover costs from the owner of the pipework.

Private drainage systems shall:

1.7.1 Comply with the current Building Regulations and be constructed in accordance with procedures and requirements outline therein as well as other guidelines and legislation;
1.7.2 Be located within the final site boundary to ensure that the private Drains, gullies traps, Manholes, inspection chambers, Armstrong Junctions and similar private fittings are on the private property, with the exception of the private Drain connection to the public sewer;
1.7.3 Not pass through property they do not serve;
1.7.4 Serve only one unit whether domestic or non domestic;
1.7.5 Not provide a connection and/or use any other mechanism to provide Water Services onwards to another location or Premises other than the Premises as set out in the Connection Agreement;

The Developer shall provide and where necessary renew any Drain and shall take all reasonable and proper care of same. Irish Water shall accept no responsibility for the maintenance, renewal, adequacy, safety or other characteristics of any Drain. For clarity, this means that the householder/owner shall be responsible for the renewal, maintenance and repair of the Drains on the Premises.

The responsibility for the maintenance of the wastewater service connections from the Wastewater Works to Premises is outlined on the Irish Water website, www.water.ie and in the Pipe Maintenance Responsibility Diagrams included therein.

1.8 Application for a Conformance Certificate

The level of site inspection and auditing carried out by Irish Water during the installation of the Works will depend on whether the Developer uses his own contractors to carry out works (Self-Lay) or the Developer uses Irish Water's Regional Contractors to construct the Works (Irish Water Lay) (See **Section 1.3** above).

Irish Water's field engineers will undertake site inspections on the Works in line with the Quality Assurance Field Inspection Requirements attached to the Connection Agreement during and throughout the construction of the Works. The Developer's site staff shall retain on the site of the Works a **Quality Assurance Folder** to include information on, as well as on-site quality assurance records of the Works installation. The document shall be updated as required and made available on request to the Irish Water field engineer for inspection. This document shall be used to facilitate the collation of the **Final Documents** as referred to below. A CCTV survey of the pipework and a SUS25 survey of the Manhole chambers shall be undertaken by the Developer at the end of the construction phase and this is to be witnessed by the field engineer during a separate site visit. Final site inspections will be carried out after the submission by the Developer of an application for the issuing of a **Conformance Certificate**. The **Conformance Certificate** is a document that will be issued by Irish Water to the Developer indicating compliance of the Works with Irish Water's requirements following:

1.8.1 Inspection of the constructed infrastructure confirming that it is constructed in accordance with the Code of Practice and Standard Details. (If minor corrections are required to the infrastructure (snags) a '**Defects Report**' will be issued with the Conformance Certificate outlining these minor defects); and
1.8.2 The Developer's submission of **Final Documents**

The issuance of a Conformance Certificate marks the commencement of the Defects Liability Period.

The **Final Documents** shall comprise at least but not limited to the following suite of documentation:

1.8.3 Confirmation by a Chartered Engineer in writing that the Works has been installed in accordance with the design submitted in the Connection Application;
1.8.4 Confirmation by a Chartered Engineer in writing that the Works has been installed in accordance with the Codes of Practice and Standard Details;
1.8.5 Confirmation by a Chartered Engineer in writing indicating that the Works have undergone appropriate on-site testing, off-site testing and commissioning and provision of associated test result certificates. The requisite site tests for the Works include, but are not limited to, the following:
  1.8.5.1.1 Air tests and water tests of gravity sewers;
  1.8.5.1.2 Water retaining tests completion results for Manholes, chambers and pumping station structures;
  1.8.5.1.3 Testing completion results of pumping plant (if appropriate);
  1.8.5.1.4 Pressure testing completion results of Rising Mains complete with a hard copy print out from the logger (in the required format) of the relaxation curve as proof of the outcome of the test;
  1.8.5.1.5 A printout of the joint details, with a GPS location of each joint;
  1.8.5.1.6 Visual inspection completion results of Manholes;

1.8.5.1.7 CCTV report of the Works shall conform to Irish Water CCTV Survey requirements

1.8.5.1.8 Commissioning reports;

1.8.6 "As-Constructed" drawings and records of the constructed Works in hard and soft copy to the Irish Water field engineers in accordance with Sub-Section 1.18.4 below;

1.8.7 "As Constructed" record to be included in the drawings of service pipe installation completion (including link to House Numbers within the Development);

1.8.8 Safety File in accordance with the current Safety and Health Construction Regulations;

1.8.9 Operation and Maintenance Manuals for pumping plant (if such provided) in accordance with **Section 5.24** including full pump details, performance curves and power ratings, estimate of energy use, parts' replacement schedule, maintenance requirements (as well as estimated costs for these), etc., and all warranty documentation for the installed equipment as well as drawings of the pump station demonstrating the Area Classification of the pump station or otherwise the absence of zoning;

1.8.10 Deeds of Grant of Wayleave and Easement and associated PRA Compliant Map(s) in accordance with the Connection Agreement;

1.8.11 Proof of ownership of the Development in the form of Deed/Solicitor letter;

1.8.12 Confirmation by a Chartered Engineer of compliance with the Building Regulations and the Building Control (Amendment) Regulations, in particular evidence of compliance with the Building Regulations to ensure plumbing systems compliance and no risk of contamination;

1.8.13 A construction stage hydraulic model (if relevant);

1.8.14 "As Constructed" Record Drawings (provided in hard copy and digital format) shall show the location, layout plans, longitudinal sections and details of the Works and the Development in full. Plan scales should be in common use, i.e., 1:200, 1:500, 1:1000 or 1:2500 as appropriate. Drawings should be prepared using an electronic system and submitted in "CAD compatible (dwg/dxf)" file format. These drawings shall contain the following information:

1.8.14.1 Manhole, pipe, pump station, service connection and inspection chamber locations, (to Irish National Grid coordinates (ING)) to +/- 500mm accuracy in the horizontal plane, with dimensions relating to fixed Ordnance Survey co-ordinates;

1.8.14.2 Cover level and invert levels of Manholes relating to fixed Ordnance Survey Datum (Malin Head) to an accuracy of +/- 40mm as well as the level of all connecting pipework thereto;

1.8.14.3 Longitudinal sections, to an exaggerated vertical scale, (such as 1:1000 horizontal and 1:100 vertical) showing pipe installed levels, finished ground levels, pipe invert levels, pipe sizes, bedding type, haunch and surround details, backfill details, together with Manhole locations, fitting and inspection chamber locations, chainages, gradients, pipe materials, etc. All Manholes should be

identified and provided with a location to an Irish National Grid co-ordinate (Information in Tabular Format on a Schedule of Manholes);

1.8.14.4 Dwelling and building numbers;

1.8.14.5 Construction details of pump station as well as mechanical, electrical and instrumentation equipment details;

1.8.14.6 Details of any services and structures on the site, existing and proposed, especially those in close proximity to the Works including offset measurement to the Wastewater collection and water supply systems.

Necessary updates of the As-Built Record Drawings shall be provided on completion of the Development Works along with the Final Documents. Where Works are being carried out in a phased basis, a timeline schedule of submitting the “as built” records shall be agreed with Irish Water. As a minimum, updated drawings shall be submitted to Irish Water every 6 months or when new elements of a Works have been made live.

The Developer shall also provide details to Irish Water of the Storm Water collection system that is installed in the Development site along with the Final Documents in situations where the Storm Water collection system is connected to an Irish Water Network. This shall include details of Sustainable Urban Drainage System (SUDS) and associated control structures, if provided, to minimise the impact of Surface Water runoff from the Development. These details shall include layout plans and longitudinal sections of the Storm Water collection pipework showing pipe sizes, Manhole locations, etc. This level of information **shall** be provided in the Final Documents for Developments where the Storm Water collection system is allowed to connect to an Irish Water combined Sewer and it will be taken into account for the issuing of the Conformance Certificate.

However, where the Development’s Storm Water collection system is not connected to an Irish Water Wastewater Works, the provision of the details of the Storm Water collection system to Irish Water should be provided. However, its non-provision in these situations will not impact on the issuing of a Conformance Certificate.

1.9 CCTV and Manhole Surveys in Advance of Commencement of the Defects Liability Period

Irish Water requires a CCTV and Manhole survey to be carried out in advance of the commencement of the Defects Liability Period and the issue of the Conformance Certificate. The CCTV and Manhole surveys shall be carried out by the Developer and shall be accompanied by a report dealing with the condition of the Works. It is the responsibility of the Developer to notify Irish Water at least ten Business Days ahead of survey works commencing. Irish Water and its agents will conduct audit inspections of these survey works at their discretion.

1.9.1 Asset Naming

The Developer's node naming format will be accepted subject to the following conditions:

- Node references shall be Alphanumeric:
- the letter shall represent system type e.g. F for Foul, S for surface

It is the intention of Irish Water to apply standard Irish Water asset references following the receipt of the data and reports required in this section.

1.9.2 CCTV Surveys

The Developer must engage the services of a competent surveying contractor with suitably qualified personnel. CCTV and Manhole survey information should be submitted to Irish Water in accordance with current Water Research Centre (WRc) specifications and Irish Water requirements, which are set out as follows;

Sewer Condition Classification Format; sewer condition classification for each survey shall be undertaken in accordance with the Water Research centre (WRc) *Manual for Sewer Condition Classification (MSCC) 5th Edition*.

Sewer Condition Scoring Scheme; the sewer condition scoring scheme within the CCTV report shall be in accordance with the scoring scheme of the Sewerage Risk Management (SRM) Manual 5 produced by WRc.

Qualifications and Training Requirements; all personnel responsible for classifying wastewater infrastructure condition, including those undertaking quality control, shall have completed training and achieved successful accreditation in a sewer condition classification course, such as Pipe Sewer Condition Classification OS19x. Evidence of appropriate training and qualifications of personnel shall be provided to Irish Water by the Developer on request. The above course shall have been successfully completed to enable personnel to classify pipe conditions to the level of Manual of Sewer Condition Classification 5th Edition.

Calibration of Equipment; all plant and equipment used during surveys shall be maintained and calibrated in accordance with the manufacturer's requirements. Calibration certificates shall be made available when requested by the Irish Water Field Engineers/agents.

CCTV Recording; recordings shall show a continuous record of data displayed automatically on the monitor screen containing the following information:

- Automatic update of the camera's position (in metres) in the sewer line;
- Date of survey
- Direction of survey

- Pipe dimensions
- Manhole/pipe length reference
- Condition assessment
- Pipe material
- Connection details

***Camera Speed*;** the speed of the camera in the sewer shall be limited to 0.10 m/s for sewers of diameter less than 200mm, 0.15 m/s for diameters exceeding 200mm but not exceeding 300mm and 0.20 m/s for those exceeding 300mm, or such other speed as agreed with Irish Water as will enable all details to be extracted from the DVD recording.

CCTV Video Files; digital CCTV video files are required to have consistent naming convention to enable linkage of the footage to Irish Water's asset database of as-built records and GIS. The naming convention to be followed is:

> Start node reference _ Finish Node reference _ Direction of Survey (D or U) _ Date _ Time Survey Started

Date shall be in DDMMYYY format and Time shall be in HHMM format for 24 hour clock.

For example, a CCTV Survey started on 10th November 2012 at 12.23 from node F1 to node F2 in an upstream direction would have the name:

> F1_F2_U_10112012_1423

The intention of the above naming convention is that it is clear which asset the survey relates to and that multiple surveys relating to a single asset can be differentiated.

All video files must be housed within a digital folder named in accordance with the following format

> Development Name_Town

The intention of the above naming convention is that Irish Water will be conveniently able to file the CCTV video footage files on the Irish Water systems under the relevant agglomeration or catchment name.

***Digital colour photographs*;** digital colour photographs shall be taken at the following points in all sewer surveys;

- General condition of the sewer at 20m intervals or each Sewer section length whichever occurs most often
- Service connections(photograph taken a right angle to service connection to identifying unobstructed service connections)

- Protruding pipework
- Defective connections & junctions
- Debris
- Cracks
- Fractures
- Broken Pipes
- Deformation
- Open Joints
- Displaced Joints
- At the point where a survey is required to be abandoned

Photographs must show clear definition and accurately reflect what is shown on the monitor, which shall be in proper adjustment. Photographs shall be of sufficient quality to enable clear interpretation of defect on a personal computer screen, laptop screen or on A4 print out. The digital photographs shall clearly identify the following:

- Automatic update of the camera's position in metres along the sewer line from adjusted zero
- Sewer dimensions
- Upstream and downstream Manhole references
- Direction of the survey
- Photograph number within the survey report
- Date photograph taken
- Remark, identifying the reason for the photograph

1.9.3 Sewer Record Information

Manhole Surveys; a specific Manhole condition survey shall be completed in accordance with WRc Manual of Sewer Condition Classification 5th Edition and Irish Water Manhole survey requirements as set out below. Survey report cards or an Excel workbook should include the following data;

- Grid reference of Manhole, to Irish national grid coordinates;
- Cover Material
- Cover integrity
- Roof slab integrity
- Manhole wall/ring unit integrity
- Chamber material
- Chamber size
- Chamber integrity/ Confirmation that no infiltration exists
- Material and diameter of all incoming and outgoing pipes;
- Diagram showing incoming/outgoing pipes
- Benching, channel, invert quality, profile and orientation
- Step Material
- Step integrity

- Backdrop arrangement type and detail

Manhole Survey Photographs; photographs shall be submitted in digital '*.jpeg' or similar suitable format and shall be a resolution of 1024 X 768 pixels. Photographs are required to clearly identify the following;

- Cover condition
- Internal chamber condition
- Benching
- Backdrop details etc.
- Channel layout and orientation, direction of flow

Manhole Survey Format; it is a requirement of Irish Water that data collected during Manhole survey is delivered to Irish Water in a in a Microsoft Excel workbook format or in a format compatible with InfoNet.

Developer's Quality Control Responsibility; before submitting CCTV & Manhole survey information to Irish Water the following quality control regime should be implemented by the Developer;

Stage 1: The Developer is responsible for checking that the CCTV and Manhole surveys show no defects or debris. Any defects should be rectified followed by the generation of a final CCTV survey report(s).

Stage 2: The Developer's consulting engineer (Chartered Engineer) shall administer a quality checking system. The quality checking system should incorporate visual inspections of the wastewater network and desk top studies which effectively gauges the accuracy and consistency of the survey report produced by the surveying contractor. Any defects identified at this stage should be rectified by the contractor.

Note: Survey reports submitted to Irish Water shall meet Grade 1 Structural & Operational classification as set out Sewerage Risk Management (SRM) Manual 5 produced by WRc. Reports submitted to Irish Water which do not meet this classification will be returned to the Developer for resubmission in a format acceptable to Irish Water.

Reporting & Deliverable; The CCTV Final Reports and Deliverables to Irish Water shall include the following items:

a. ***CCTV Defect Coding files;*** files shall be in "xml" format submitted to Irish Water in accordance with MSCC, 5th Edition.
b. ***CCTV Video Files;*** Mpeg format.
c. ***CCTV Reports;*** pdf format to include header information and defect coding information (as per MSCC 5) and all photographs taken.
d. ***Manhole Survey Reports*****;** Reports submitted in "Excel" format on CD or DVD with a hard copy of the survey reports. Manhole referencing shall be consistent with the As Constructed Drawings (to Irish National Grid coordinates (ING)) to +/- 100mm accuracy in the horizontal plane, with dimensions relating to fixed Ordnance Survey co-ordinates).

e. ***Sewer Network Layout;*** PDF and AutoCAD version of Sewer Network layout (including surface water) which includes at a minimum the following details:-
   - Node references (as used during CCTV and Manhole surveys)
   - Pipe diametrs
   - Direction of flow (flow arrow)
   - IW Standard symbology for nodes, pipes etc.

f. ***Certification from the Developer's consultant engineer (Chartered Engineer;*** confirmation that a quality control regime has been implemented with the result that no defects exist in either the sewers or the Manholes.

All CCTV & Manhole reports will be reviewed by Irish Water which will include visual site inspection against the information submitted. It is the responsibility of the Developer to ensure that defects do not exist.

Irish Water will validate the data received using in-house validation rules and any anomalies will result in the data being returned to the Developer for rectification and cleansing. A charge will be levied by Irish Water for additional review of CCTV and Manhole reports should the Developer fail in their responsibility to adequately enforce quality checking ahead of submitting reports to Irish Water. This charge will be recovered from the Self-Lay Surety.

In the event of the existence of deficiencies in the Works, Irish Water will identify areas of deficiencies and a programme of remedial works to rectify these deficiencies shall be prepared by the Developer. Repairs of these deficiencies shall be carried out by the Developer and confirmation obtained that the repairs achieved an adequately watertight system by a re-run of the CCTV survey along the sewer at the defect location.

If the Developer does not carry out the CCTV and Manhole surveys or does not carry out repairs of any deficiencies, Irish Water retains the right not to connect the Works to the Irish Water Network(s).

1.10 Conformance Certificate

Following Irish Water's examination of the Final Documents and completion of all site inspections of the Works, the Developer will be made aware of the outcome of these inspections in writing and may be required to undertake remedial work and a further CCTV survey may be required to be submitted to Irish Water by the Developer. An additional inspection will be carried out if deemed necessary and, if accepted, Irish Water will issue a **Conformance Certificate** and complete the connection of the Works to the Network(s) within the timeframe outlined in the Connection Agreement. If minor corrections are required to the infrastructure (snags) a '**Defects Report**' will be issued with the Conformance Certificate outlining these minor defects. These minor corrections shall be addressed by the Developer within a reasonable timeframe in advance of the connection being made.

If the Developer does not attend to the listed remedial requirements outlined in the "Defects Report" or if these remedial works are not carried out or undertaken in a reasonable timeframe, Irish Water will have recourse to call upon the Self-Lay Surety of the Connection Agreement or may not connect the Works to the Network.

Irish Water reserves the position that Vesting of the Works in Irish Water or connection to the Network(s) will not take place until all Final Documents of the Works have been provided to Irish Water and are deemed to be acceptable.

1.11 Connection of Development to Irish Water's Network

Following the completion of the minor corrections outlined in the Defects Report, Irish Water or its agents will carry out the connection of the Works to Irish Water's Network. The **Defects Liability Period** commences on the date of the Conformance Certificate. Irish Water will vest the Works upon its connection to the Irish Water Network. However, the Developer will remain responsible under the Connection Agreement for the cost of remediation of any defective works that are deemed necessary during the Defects Liability Period. Irish Water will undertake inspections, surveys and investigations to assess the continued compliance of the Works during the Defects Liability Period.

The Developer shall not proceed with "step-by-step" extensions of the initial approved infrastructure beyond that which has received Irish Water's agreement/consent via the Connection Agreement without making a formal application for and receiving Irish Water approval of any extension(s) of the Works associated with the initial Development, i.e. the connection of subsequent phases of a development from the initial development's infrastructure, shall not proceed without a Connection Agreement being in place for the subsequent phase. This will also apply where another developer is seeking to connect into the infrastructure installed in the Development. Such extensions are regarded as additional new Connection Works and are subject to the same level of Irish Water compliance, governance, etc., as the initial connection. These extensions will require separate Connection Agreements, payment, inspection, auditing, etc.

1.12 Vesting

Under the Connection Agreement, the Developer agrees that the Works will become vested in the ownership of Irish Water immediately upon issuance of the Conformance Certificate by Irish Water.

If the Works is deemed adequate after final inspection and the completion of remediation of defects a Conformance Certificate will be issued and thereafter a connection will be made to the Network. Upon the issuance of the Conformance Certificate the new infrastructure (the Works) will be vested in Irish Water in accordance with the Connection Agreement.

Prior to Vesting, the Developer will be required to provide proof of title of the Development land as well as whatever formal Deeds of Grant of Easements and associated PRA Compliant Map(s) are required in accordance with the Connection Agreement for pipework routes for the benefit of Irish Water. Deeds of Grant of Easements and associated PRA Compliant Map(s) for the routes of pipework for Irish Water required extensions for new developments adjacent to the Development being advanced may also be required if Irish Water has required this as part of the Connection Agreement or has required the upsizing or extension of the Works to facilitate the adjacent future developments.

The Developer shall provide a Deed of Grant of Easement and PRA Compliant Map(s) for the benefit of Irish Water in a form as set out in the Connection Agreement over all the lands which are intended to be taken in charge by the Local Authority under Section 180 of the Planning and Development Act, 2000. These areas shall be highlighted on a Property Registration Authority (PRA) compliant map and approved by Irish Water prior to execution of the Deed.

The Developer shall provide, where part of the Works are located in private land and fall outside lands intended to be taken in charge by a Local Authority, a Deed of Grant of Easement and PRA Compliant Map(s) in a form as set out in the Connection Agreement for the benefit of Irish Water, by the applicable landowner, of a wayleave incorporating a protected strip of a specified width at either side of the Works in that particular area in respect of the full length of the infrastructure. This is to ensure the ability of Irish Water to access the Works in the private land which will be highlighted on a Property Registration Authority compliant map and approved by Irish Water prior to execution of the Deed.

As part of the Connection Agreement, the Developer shall agree to procure the completed registration of the Deeds of Grant of Easements outlined above by a Solicitor acting for the Developer as soon as possible and within all applicable time limits prescribed in the Connection Agreement.

Information relating to the assets will be uploaded to Irish Water Asset Information.

The Developer will be responsible for operation and maintenance of the Water and Wastewater Services Infrastructure until the end of the Defects Liability Period. At this point Irish Water's Operation & Maintenance will assume responsibility of the operation and maintenance of the Works and this will be undertaken in accordance with Irish Water procedures.

1.13 Defects Liability Period

A **Defects Liability Period** will apply to the Works. The Defects Liability Period will apply for a minimum of 12 months or such other period as may be specified by Irish Water in the Connection Agreement, between the issue of the Conformance Certificate and the issue of the Completion Certificate during which the Developer is responsible

under the Connection Agreement for the rectification of any defects in or connected to the Works. Any defects found during the Defects Liability Period are the responsibility of the Developer and shall be completed at his/her cost.

During the Defects Liability Period the Developer shall execute or procure the execution of all works of repair reconstruction rectification and making good of defects imperfections, shrinkages or other faults as may be required of the Developer in writing by Irish Water during the Defects Liability Period. Irish Water may undertake additional inspections, surveys, investigations to assess the continued adequacy of the Works during this period. Irish Water will notify the Developer in writing of the need for such repair reconstruction or rectification works. All such works shall be carried out at the Developer's expense.

In the event of the existence of deficiencies in the Works during the Defects liability Period, Irish Water will identify areas of deficiencies and a programme of remedial works to rectify these deficiencies. Repairs of these deficiencies shall be carried out by the Developer and confirmation obtained that the repairs have achieved an adequately watertight system by a re-run of the CCTV survey.

If the Developer fails to execute or procure the execution of repair works, Irish Water shall be entitled to carry out such works and shall be entitled to recover from the Developer the expenses reasonably incurred by way of deduction from the Security (Self-Lay Surety or Bond) provided under the Connection Agreement.

The Self-Lay Surety shall be returned to the Developer twenty eight (28) days after the completion of the Defects Liability Period subject to any deductions made pursuant to the Connection Agreement and subject to the Works being deemed adequate and satisfactory.

The Developer will remain responsible for the repair to the final road restoration of trenches. It is to be noted that the Developer will be responsible for the upkeep of roads, footpaths, etc. until such time as the Development is taken in charge by the Local Authority. The Developer shall alert Irish Water of the proposed Taking in Charge schedule for the Development by the Local Authority.

Following the installation of individual Premises service connections within the development during the Defects Liability Period, additional record documentation shall be provided by the Developer to Irish Water. This shall comprise updated "As Constructed" records of service pipe installation, location of inspection chamber, etc. This information may be provided on a phased basis as blocks of houses are made ready for occupation by the Developer.

1.14 Completion Certificate

Following The Defects Liability Period Irish Water will issue a **Completion Certificate** to the Developer. Irish Water may deduct from the Self-Lay Surety any costs which Irish Water may incur:

1.14.1 in undertaking any works of construction, reconstruction, maintenance, rectification or repair or making good of defects, imperfections, shrinkages or other faults by reason of the Developer or the Contractor failing to complete in a good and workmanlike manner and in accordance with the specification aforesaid the entirety of the Works or,

1.14.2 towards invoices or sums payable by virtue of any actions, claims or demands made against Irish Water by any third party as a result of any act or default by the Developer.

1.15 Final Inspection at Defects Liability Termination

Irish Water will carry out a final inspection of the Works nearing the end of the Defects Liability Period. This inspection will, amongst other things, establish if any additional work has been carried out by the Developer that might impact on the integrity of the Works since the issue of the Conformance Certificate and commencement of the Defects Liability Period. Such impacts may be associated with the installation of other utility services without proper horizontal and vertical separation, installation of structures closer to the Works than allowed, damage to the infrastructure by building works, etc.

If defects are observed, additional CCTV or dye surveys may be required to identify and locate such defects. The Developer shall, at their cost, undertake such surveys and, if not advanced by the Developer, will be undertaken by Irish Water and the cost shall be recovered through any Surety associated with the Connection Agreement. The undertaking of the CCTV surveys shall be as outlined in **Section 1.9** above.

Additional works may have to be carried out by the Developer to rectify these defects if deemed necessary by Irish Water. If this is not executed by the Developer, it will be carried out by Irish Water and its funding covered by the Security put in place via the Connection Agreement.

If the infrastructure is deemed adequate after the Defects Liability final inspections, Irish Water will release the Security to the Developer subject to any deductions that might arise due to monies owed for remedial works or other costs incurred by Irish Water.

1.16 Statutory and Other Consents

The Developer shall obtain all necessary Requisite Consents and other permissions for the proposed Development, including the Works.

1.17 Fire Authority Liaison

The Developer or his/her designer shall be responsible for all liaisons with the Local Fire Authority and for agreeing all arrangements for the advancement of the construction of the Development. Any approvals that the Developer obtained from the Fire Authority shall be provided to Irish Water in the Design Submission.

1.18 Regulations

The Developer shall comply with all relevant Irish legislation. The version of Acts and Regulations current at the time of the project shall be applicable.

1.19 Standards

All materials shall be in accordance with Relevant Standards as well as with the relevant European Standards (EN) covering the subject which is in force in the European Union. In Ireland ENs are published as IS EN and in the UK as BS EN. Where there is no relevant European Standard, materials shall be in accordance with an Irish Standard (IS) or a British Standard (BS). A UK Water Industry Specification (WIS) may be used where there is no relevant European Standard, Irish Standard, British Standard (BS) or European Union National Standard available.

In the case of recently developed or innovative products, there may be no European Standard, Irish Standard, British Standard or European Union National Standard available. This may not preclude the use of a product where its performance or properties can be determined to align with its intended duty and design life. Careful consideration should be given to any independent assessment of evidence of product performance.

Developers should discuss and agree the proposed use of newly developed products with Irish Water and seek derogation for the use of such products. Such products shall only be used only if approval of the derogation is received and shall not be used without the prior consent of Irish Water. Additional quality assurance requirements, including third party certification may be required (in Ireland this will be provided by or endorsed by the National Standards Authority of Ireland). The use of products which are not in accordance with the provision of a European Standard, an Irish Standard, British Standard or of a European Union National Standard could result in the material, product or unit being excluded from use or, if installed, being removed from the Works at the Developer’s cost.

1.20 Civil Engineering Specification for the Water Industry (CESWI)

The design and construction of Works shall conform to the current version of the Civil Engineering Specification for the Water Industry (CESWI), subject to the particular requirements applied to it by Irish Water, as outlined in this Code of Practice. CESWI is a base document and it is published by the Water Research Centre (WRc plc). Irish

Water has developed additional Amendments and Notes for Guidance to CESWI to reflect its own additional general specification requirements. This Code of Practice is based on CESWI and on the Irish Water Amendments thereto.

1.21 Standard Details

Irish Water has developed Standard Details describing typical infrastructure associated with the Works. These Standard Details shall be used as a minimum guide for the preparation of designs and provision of infrastructure. A full set of the Standard Details for Wastewater collection infrastructure is available on the Irish Water website, at www.water.ie/connections/.

1.22 Temporary Wastewater Connection for Construction Purposes

A Developer requiring a Wastewater connection during the Development construction period for collection of Wastewater from temporary construction site office accommodation shall apply to Irish Water for the provision of this temporary connection. This temporary Wastewater connection shall only be used for the collection of Wastewater arising during construction activities and the connection shall **not** be used as the permanent Works of the Development.

A Connection Application is required for a temporary Wastewater connection. This is outlined in the Irish Water Guide to Connect which is available on the Irish Water website, at www.water.ie/connections/. A Connection Agreement is required in all cases before Irish Water advances the provision of a temporary connection to its Wastewater collection Network.

On completion of the construction of the Development, the temporary Wastewater connection shall be disconnected by Irish Water or its agents and all of the infrastructure relating to it shall be removed by the Developer to ensure that it is not used as an unauthorised connection in the future. The cost of the disconnection work will be the responsibility of the Developer and will be obtained through the Connection Agreement payments.

1.23 Extensions to Undeveloped Contiguous Areas

Where it is identified by Irish Water that there is a strategic benefit in the possibility of connecting into or extending the Works to adjoining land that is not developed, the Developer shall provide for future connections to these areas by upsizing and/or extending the Works to the boundary of these contiguous properties, if required by Irish Water. This will be the subject of a separate Technical Requirements Agreement.

This upsized or extended pipe will terminate in a “blind” Manhole, i.e. a Manhole built at the end of the extension pipe without an invert benching or an inlet connection. A temporary bung shall be installed in the outlet pipe from this “blind” Manhole.

Irish Water will reimburse the Developer for the cost of this pipe upsizing or extensions at a unit rate commensurate with the average cost of providing the Sewer. Irish Water will also cover the cost increase due to the marginal increase in pipe size within the new Network within the Development to service the future Wastewater load of the adjoining Development area. The Connection Agreement and associated Technical Requirement Agreement shall outline how such reimbursement is applied.

Part 2 – Design Requirements and Submissions

2.1 Introduction

A Developer intending to seek a new connection from Irish Water should refer to the Irish Water Guide to Connect which is available on the Irish Water website, at www.water.ie.

The Developer shall carry out or procure the design of the Works. The Developer's designer shall be competent and the design shall be carried out strictly in accordance with this Code of Practice. Irish Water shall nominate the location of the Connection Point to the Irish Water Network(s).

The provisions of the Safety, Health and Welfare at Work Act 2005 and associated Safety, Health and Welfare at Work (Construction) Regulations shall apply in relation to the design and construction of all Works.

2.2 General Design Requirements

The design shall incorporate a risk assessment to ensure that risks to both the local community and operators of the Works are minimised. The provisions of the Safety, Health and Welfare at Work Act 2005 and associated Safety, Health and Welfare at Work (Construction) Regulations shall apply in respect of the appointment of competent designers, Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS).

The Developer or his/her designer shall certify that the design complies with the Code of Practice and Standard Details and accepts liability for compliance through their professional indemnity insurance, which shall be kept in place for a period of 6 years after the issue of the Completion Certificate. The Developer shall ensure that this professional indemnity insurance is retained and that evidence of this is made available to Irish Water in accordance with the Connection Agreement. The design responsibilities and liabilities shall not be discharged by Irish Water after the design passes a satisfactory inspection and issue of a Statement of Design Acceptance, if a design submission is provided in advance of a Connection Application, or by a de-facto Statement of Design Acceptance via the Connection Agreement if the design submission is submitted as part of the Connection Application**.**

The design of the Wastewater infrastructure shall be such that a minimum design life is achieved of 50 years for pipework and structures, 25 years for mechanical and electrical plant and 15 years for information, communication and telemetry equipment (ICT).

The Developer shall also provide separate Wastewater and Storm Water drainage systems for redevelopment proposals of brownfield developments. If infill development is proposed on brownfield sites and the Storm Water Sewer system already discharges to a Irish Water Combined Sewer, the Storm Water drainage system shall be designed

to ensure that Storm Water discharge from the infill development area is at or less than that which existed prior to the Development and ideally is as near to a greenfield storm runoff rate as practicably possible based on a SUDS assessment. The Developer can reduce discharges of Storm Water from a Development by the application of appropriate Storm Water controls systems, such as SUDS.

If these requirements, Standards Details and Code of Practice guidelines, are not met, Irish Water is under no obligation to provide a connection to its Network or vest the Works.

2.3 Design Submissions

Before the submission of a Connection Application for a new Connection or an additional Connection can be considered, appropriate information is required from the Applicant to allow Irish Water to assess the Developer's Works proposal. This should be provided in a design submission in advance of a Connection Application for Developments. Design submissions are to be submitted to Irish Water using cdsdesignqa@water.ie. Irish Water will engage with the Developer to vet the design of the Works ahead of the Developer finalising a planning application (for housing and mixed use developments to ensure compliance with the Codes of Practice and Standard Details). The design submission shall comprise the following information as a minimum:

2.3.1 The applicant's details, including name, address (Developer's or Agent's details are also required if different from the Applicant);
2.3.2 Location of the Development with grid reference to the Irish National Grid;
2.3.3 Type of Development proposed that requires the Connection, along with details of domestic and non-domestic properties that will be connected to the Works;
2.3.4 Servicing details, including the required Wastewater discharge volume, Wastewater quality parameters, Wastewater discharge profile;
2.3.5 Drawings outlining details of the Development as outlined in **Section 2.4** below,
2.3.6 Design calculations as outlined in **Section 2.4** below;
2.3.7 Site Investigation Report;
2.3.8 Contaminated Ground Report (if relevant);
2.3.9 Mechanical and Electrical plant information (if relevant);
2.3.10 Surge analysis report and proposals for surge protection plant, if required;
2.3.11 An Environmental Impact Assessment (EIS) or Appropriate Assessment (AA) Report (if relevant);
2.3.12 An integrated utility layout plan showing the layout of all utility pipes, ducts, etc. and indicating the relative separation distances between the various utility infrastructure;
2.3.13 Details of the Planning Permission and other statutory requirements relating to the Development, including Fire Authority approvals, etc.;

2.3.14 A document outlining impact risks of the new infrastructure to existing Irish Water's Wastewater collection and water supply infrastructure to ensure that risks to both the local community and operators of the Works are minimised;
2.3.15 Preliminary Health and Safety Plan;
2.3.16 Construction Method Statements;
2.3.17 The identity of the manufacturer for pipeline and accessories material, particularly if PE material is proposed;
2.3.18 Manufacturers data sheets and certification for fittings and materials used in the Works;
2.3.19 Specific information in relation to Specialist Works (See **Section 1.6** above) to establish the whole life cost based on a 20-year operation, and durability of the fixed and buried components relative to a conventional system, to enable an Irish Water assessment of suitability;
2.3.20 Where wastewater pumping stations or pumped systems are being proposed, an assessment of the whole life cost of the system indicating that it's capital and operating costs are less than the cost of conventional gravity systems over a period of 40 years, based on a Net Present Value (NPV) assessment;
2.3.21 Where wastewater pumping stations are proposed, drawings and specifications of the pump station should demonstrate the Area Classification of the pump station or otherwise the absence of zoning;
2.3.22 A report on specialist advice on separation distances between landscape works and the Works as obtained from a competent landscaping architect and/or arboriculturist to ensure that the required separations distances are achieved;
2.3.23 The specific location for any scour valve chamber on rising mains requiring the approval of Irish Water and the relevant Local Authority;
2.3.24 A design stage hydraulic model of the Works (if deemed relevant by Irish Water);
2.3.25 If applicable, a written statement from the Roads Authority in whose functional area the Development is located allowing the use of alternative acceptable Backfill material in lieu of Irish Water's requirement for the use of Clause 804/808 granular material;
2.3.26 If the proposal includes installing Works which are to be constructed on made ground, engineered ground or within fill zones, this should be clearly stated in the Design Submission with such areas/locations or zones clearly identified and indicated on a plan layout attached to the submission. Geotechnical reports shall be provided for the particular areas/locations or zones outlining the design for the pipe support system as well as construction details at and along transitionary interfaces between made ground, engineered ground and fill zones and surrounding original or virgin ground. A method statement for the construction of the Works shall also be provided;
2.3.27 A Floor Risk Assessment, together with flood mapping layout, shall be provided confirming compliance with Section 5.5 of this Code of Practice

dealing with flood risk analysis, if applicable, complete with topographical survey and flood mapping;

2.3.28 Where pump stations are proposed a site specific anti-floatation set of calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete).

Irish Water will require the provision of appropriate design parameters, calculations, drawings, details, etc. from the Developer. The Developer's design will be vetted by Irish Water to ensure that it is in compliance with the Code of Practice, Standard Details, specifications and good practice. Any deficiencies that are identified in the proposals will be advised to the Applicant during the design vetting assessment and these deficiencies shall be remedied to the satisfaction of IW. A revision of the design proposed shall be submitted and Irish Water will assess this revised design proposal. Irish Water will issue a Statement of Design Acceptance if the design of the Works is deemed satisfactory. A Connection Agreement will not be issued unless the Developer's design proposal is acceptable to Irish Water.

If a Developer intends to proceed with a variation of the design proposal or construction standards which has already been assessed as being satisfactory by Irish Water, then he/she must apply to Irish Water for approval of the revised design proposal. This application for the variation must include all necessary data and information to prove that the proposed revised design meets the requirements of this Code of Practice. Irish Water is not obliged to accept the alternative design. If Irish Water accepts and agrees with the alternative proposals, written confirmation of acceptance of the waiver from the original design standards in whole or in part will be provided.

Irish Water will not provide retrospective approval of a variation of the design of the Works and is not obliged to provide a connection or complete Vesting of the Works based on an unapproved design.

2.4 Drawings, Calculations and Design Information

Drawings and calculations shall be supplied for the Works, including elements that are not to be vested in Irish Water i.e. Pipes that are not within the Attendant Grounds of the Development.

Layout plans shall be prepared with standard legends and symbols as required by Irish Water's Drawing Standard and at least with water services industry norms. The drawings submitted by the Developer shall show the precise layout as dictated by the local topography and all necessary detailed information required for guidance. The layout plans shall show the site boundary, existing utility apparatus, North point, Ordnance Grid reference for the centre of the site, Ordnance Grid Reference for the Connection Point(s), etc.

Location and layout plans, longitudinal sections and details should show the drainage system and the Development in full. Plan scales are required to be shown at either

1:200, 1:250, 1:500, as appropriate, for A1 sheet size. Drawings shall be prepared in a digital format using “CAD (dwg/dxf)” file format and also submitted in PDF. Details to larger scales should be provided where necessary. The drawings submitted shall also show the following:

2.4.1 The location of the Development site on an Ordnance Survey Map with the site outlined in red,

2.4.2 Layout roads and properties including plot numbers, phasing of the Development (if relevant) to include the overall development plan layout intended to be constructed and delivered in phases indicating phase lines and control breaks;

2.4.3 Layouts of Sewer, outfalls, Manholes, Storm Water Sewer, details of all associated features and external property drainage details, including details of existing services in the case of infill or brownfield sites;

2.4.4 Details of all over ground or underground structures within the Attendant Grounds and especially those that are to be vested by Irish Water;

2.4.5 Contours of existing ground levels, proposed Development ground levels and property floor levels relative to Ordnance Datum (Malin Head);

2.4.6 Longitudinal sections, to an exaggerated vertical scale, showing proposed levels, existing ground levels, existing or proposed buried service crossings, invert levels, pipe sizes, bedding, haunch and surround details, thrust blocks associated with pressure mains, backfill details, together with Manhole locations, chainages, gradients, pipe sizes, pipe materials, etc. All Manholes should be given unique, sequential numbers/letters for identification;

2.4.7 Locations of all natural features, such as trees, streams, rivers, springs, etc., which are in the vicinity of the Works;

2.4.8 Location of manmade features, such as existing structures, buildings, roads, bridges, made ground, engineered ground or fill zones, etc., which are in close proximity to the proposed Works;

2.4.9 An integrated utility layout plan showing the layout of all utility infrastructure (ESB Networks, Gas Networks Ireland, telecommunication provider ducting, etc.) and indicating the relative separation distances between the various utility infrastructure, which shall be in accordance with Irish Water’s separation distance requirements;

2.4.10 Layout taking into account possible future developments;

2.4.11 Location of Ordnance Survey (OS) Benchmarks and their value to Malin Head Datum.

The design shall be clear and unambiguous outlining the Wastewater flows based on the type and number of units served, occupancy rate of the units, per-capita Wastewater organic loads, etc. The design shall outline the dry weather flow, peak flow, etc. The Works shall be designed using an approved software package, which generates a Network model or spread-sheet, Sewer flow, etc. in its output.

The design shall be deemed to cover all associated and ancillary works such as pipe supports, beds, surrounds, backfill, surface restoration, access requirements, etc.

The submission shall include a soil investigation report including details of soil analysis, results of the soil analysis in tabular format, plans showing the locations where site investigations were carried out and the location of samples taken, details of known contaminants, details of possible contamination, mitigation proposals/measures to address soil contamination, details of standing water tables, made ground, engineered ground or fill zones, etc. Irish Water reserves the right to have its own independent site investigation work carried out to verify the results of the submitted site investigation data and reports. The cost of this will be recovered by Irish Water from the Developer under the Connection Agreement or under a separate Project Works Service Agreement.

The submission shall include a schedule of materials along with manufacturer's data sheets and certificates for the materials required for the proposed Works, including the size and lengths of pipes, fittings, etc.

The design submission shall provide specific information of any business (non-domestic) customers that are to be served, including information on Wastewater arising from such developments, any special characteristics associated with the Wastewater, organic loads, etc., and Section 16 (Water Pollution Act) Licences (existing and future) associated with these developments as well as any other pertinent information on such discharges.

The submission shall also provide any relevant reports and information pertaining to the Development, such as Flood Risk Reports, Habitat Directive Reports, Appropriate Assessments, Sub-Threshold Environmental Impact Assessments, etc.

Irish Water will nominate a suitable location for the Wastewater Connection Point(s) for connection of the Works to the Irish Water Network to provide adequate discharge capacity to meet the level of service, bearing in mind proposals for future Development.

2.5 Hydraulic Modelling

Irish Water may require the Developer to provide a hydraulic model of the Works within the new Development to confirm that the proposed Works provides the best engineering solution and value proposal. This is a mandatory requirement for all Works associated with developments containing more than 330 units.

Hydraulic models shall be provided for all Storm Sewers which are connected to the Irish Water combined sewer system.

The 'design stage' hydraulic model of the proposed Works for the Development (as well as the Storm Sewer system, if connected to the combined sewer system) shall be constructed using appropriate data and all flow assumptions shall be comprehensively explained in accompanying documentation. At the discretion of Irish Water, the

Developer may be required to assist in the determination of the impact of the additional Wastewater flows on the existing Works using the ‘design stage’ model inputs.

Upon completion of the proposed Development, or at a designated stage of the Development as required by Irish Water, the Developer shall upgrade the ‘design stage’ hydraulic model to a ‘constructed stage’ hydraulic model. The ‘construction stage’ hydraulic model shall include information from as-built surveys and shall be verified in accordance with Irish Water’s latest model specifications.

The Developer shall demonstrate to Irish Water (i.e. using the ‘constructed stage’ hydraulic model) that the constructed Works is performing to the hydraulic standards for which it was designed with results comprehensively demonstrated in accompanying documentation. On site flow verification of the hydraulic model results shall be used to confirm this and Irish Water shall be provided with an opportunity to observe these verifications.

Part 3 – Works Design

3.1 Compliance

The Works shall comply with this Code of Practice and with the associated Standard Details for Wastewater Infrastructure as a minimum unless otherwise agreed in writing with Irish Water in advance. The Works shall also comply with:

3.1.1 The Standards set out in **Appendix A**;
3.1.2 The Civil Engineering Specification for the Water Industry, 7th Edition (CESWI), published by the Water Research Centre (WRc plc). This document is subject to amendments set out by Irish Water appropriate to Ireland's Water Services sector and this Code of Practice takes account of these amendments;
3.1.3 The Environmental Protection Agency Guidance Document for Small Wastewater Treatment Plants in terms of the expected Wastewater loadings from various types of facilities, subject to any amendments arising from **Appendix C**.

Proposed Developments shall be drained on the basis of a completely **separate Wastewater Sewer system** and **Storm Water Collection system** as outlined in **Section 1.5**.

3.2 Reliability and Design Objectives

Pipes shall be free from defects or other features that might cause blockage or otherwise impede the design flow. Gravity Drains, Service Connections and Sewers shall have adequate gradient to maintain self-cleansing conditions (full pipe velocity generally greater than 0.6 m/sec). Rising Mains shall be sized to achieve self-cleansing velocities and excessive velocities in the Rising Main should be avoided. The range of flow velocity within the Rising Main shall be between 0.75 m/sec and 1.8m/sec.

3.3 Materials – General Requirements

The Developer is responsible for the provision of materials and shall have an auditable system in place to trace materials from manufacture, specification, purchase and through to delivery and their use in the permanent Works on site.

Materials including products, components, fittings or naturally occurring materials used in the construction of the Works shall comply with this Code of Practice and be of suitable nature and quality for their intended use. In addition, materials used in the Works design and construction shall achieve the following:

3.3.1 pollution of surface receiving waters and groundwater is prevented;
3.3.2 for all practicable purposes, they are watertight in accordance with relevant test requirements outlined in this Code of Practice;

3.3.3 odour nuisance or creation of toxic explosive or corrosive substances is avoided;
3.3.4 noise and vibration is minimised and
3.3.5 any other negative impacts on the environment are avoided.

The suitability of materials and products can be demonstrated by appropriate use of a product bearing CE marking in accordance with the EU Construction Products Regulations (No. 305/2011 –CPR) and any other relevant Directives which require:

3.3.6 a product complying with an appropriate technical specification (as defined in appropriate Directives and Regulations);
3.3.7 compliance with an appropriate harmonised Standard or European Technical Assessment in accordance with the provisions of the Construction Products Regulations (No. 305/2011 –CPR);
3.3.8 Compliance with an appropriate Irish Standard or Agreement Certificate or with an alternative national technical specification of the European Union;
3.3.9 a product bearing a CE Marking in accordance with the Construction Products Regulations (No. 305/2011 –CPR).

From 1st July 2013, CE MARKING of construction products covered by harmonised European Standards is mandatory.

Pipes should have sufficient ring stiffness to prevent deformation during storage, embedment and backfilling. Materials and components should comply with the following:

3.3.10 the manufacturing process should minimise the use of solvent-based substances that emit volatile organic compounds or ozone-depleting substances;
3.3.11 products should be made from recycled material, where reasonably practicable.

In the event that ground conditions in any part of the site prove to be anything other than inert material, the Developer shall inform Irish Water accordingly and shall take whatever precautions are deemed necessary by Irish Water to deal with the situation. These precautions may include, but are not limited to, the laying of the Sewers which are specially designed for use in contaminated ground. Such Sewers shall also be installed in specifically designed trenches as approved by Irish Water or other necessary requirements.

3.4 Structural Design and Integrity – Specific Requirements

The Works shall be designed and constructed to ensure structural integrity over their design life. The design shall ensure that:

3.4.1 all connections to existing Sewers are carried out in a manner that do not compromise the structural integrity of the existing Sewer and that the connection to the Sewer does not damage the structural integrity of the pipe;
3.4.2 buried pipes have sufficient depth of cover, as set out in **Section 3.9** below, to afford adequate protection from anticipated imposed loading, including loading from the passage of construction plant as well a normal design loading, low temperatures and damage from normal use of the land and where this cannot be achieved, there should be suitable alternative protection measures provided;
3.4.3 Manholes and branch pipework are built into the Works for planned future connections, to the requirements of Irish Water, if requested;
3.4.4 if the depth of cover to the crown of the pipe is less than the values required herein, protection measures are required by, in order of precedence, either the provision of a reinforced concrete slab of C30/35 concrete to IS EN 206, the provision of full concrete surround of C16/20 concrete with flexible joints or the use of a ductile iron pipe for the distance where the depth is below requirements or a combination of these requirements, all details of the protection measures shall be to be agreed with Irish Water;
3.4.5 all pipes have the structural ability to resist the possible incidence of punching shear;
3.4.6 no vertical load is imposed by structures such as shafts onto non-load bearing components such as the pipes;
3.4.7 the Works is resistant to tree root ingress where there is a risk of such intrusion, (e.g. by use of appropriate barriers or pipelines constructed from polyethylene with welded joints, see also **Section 3.21** below);
3.4.8 the Works shall be watertight in accordance with test requirements to prevent ingress to and egress, especially at connection locations;
3.4.9 trees and large shrubs shall not be planted over the Works.

3.5 Layout of Works and Manholes

The layout of Gravity Sewers, Rising Mains, Manholes and chambers in the Works shall:

3.5.1 be as simple as possible;
3.5.2 ensure infrastructure is located so that if there is a structural failure an excavation may be carried out to repair the failure without impairing the integrity of adjacent buildings, other infrastructures or trees/shrub landscaping (See **Section 3.5.9** below);
3.5.3 ensure infrastructure is located in pavements, roads or in open spaces (Rising Mains may be located in either roads/areas or in private property, subject to the provision of an Easement giving Irish Water access for maintenance, operational, renewal, replacement and upgrading activities);
3.5.4 ensure infrastructure is designed and constructed in order to provide access for any reasonably foreseeable maintenance, renewal, replacement and upgrading activities

3.5.5 ensure infrastructure is located so that it is safely accessible and apparent to Irish Water or its Agents and that covers are located at finished ground level;
3.5.6 ensure infrastructure is laid on the side of the street/road where the housing density is greatest so that the number of service pipes road crossings are minimised and the lengths of the service connections are minimised;
3.5.7 ensure that a single collection network, as opposed to dual networks, is provided; and
3.5.8 ensure that the maximum distance between Manholes does not exceed 90m for 225mm diameter pipes and above and does not exceed 75m for 150mm diameter pipes (as outlined in **Section 3.12.1.3**).

Alternative routes shall be considered to identify the best achievable route that takes account of whole-life cost arising from a combination of the construction, maintenance, operation and eventual decommissioning of the asset (See also **Section 5.2**, Pumping Station General Requirements).

Sewers shall be located to ensure acceptable clearances between the line of the new Sewer and the proposed property construction and any existing structures and features on the site. **Under no circumstances will Irish Water accept Sewer installations under structures, existing or proposed, or in close proximity to existing structures or features that will inhibit access for post installation maintenance and access or future works**.

The following general requirements shall apply to the locations of the Works in new Developments that are covered by this Code of Practice:

3.5.9 The external face of any new Sewer shall be at least **3.0 m** or a distance equivalent to the depth of the Sewer below the foundation, whichever is greater, from the external face of any building or Development structure. Modified foundation arrangements do not obviate the need for this separation distance. This is to allow future access for maintenance, operation, future renewal, replacement, upgrading work, etc. of the pipeline. Foundations and basements of adjacent buildings should be designed to ensure that no extra loads are transferred to the pipeline, i.e. the pipe should be located outside the zone of influence of the building foundation. The minimum clear distance shall be increased if the Sewer is greater than 3m deep or if the diameter is greater than 375mm. The minimum clear distances for pipe diameters of 450mm diameter and greater (outside the diameter size covered by this Code of Practice) or depths exceeding 4.0m shall be based on specific consultation with Irish Water. These separation distances also apply to separation from other existing structures, including attenuation structures and swales;
3.5.10 Sewers and service connections shall not be constructed under any building or structure. No building may be constructed over the line of a Sewer, service connection or Drain. This approach is in accordance with Section 29 of the Public Health Act 1878 and the Water Services Act;

3.5.11 Sewers and Rising Main locations shall be agreed with Irish Water and, where practicable, shall be located in areas that are or will in future be maintained by the Local Authority, i.e., road verges, roads and public open space or a space where they are reasonably accessible and visible. Wayleaves and Deeds of Easement shall be provided for all Sewer routes. Sewers shall not be laid in enclosed private land, where there is a practicable alternative route;

3.5.12 Between Manholes, Sewers shall be laid in straight lines in both the vertical alignment (profile) and horizontal alignment (plan). However, long radius bends up to 45 degrees may be laid on 100mm wastewater service connections downstream of the private side inspection chambers to facilitate the transition from horizontal to vertical at the point where the service connection drops into the trench to connect to branch connection on the Network Sewer;

3.5.13 The angle between any inlet pipe to a Manhole and the outlet pipe from the Manhole shall not be less than 90 degrees, i.e., the inlet flow from any inlet pipe should not run counter to the outlet flow direction and suitably profiled benching shall be provided to ensure smooth flow conditions;

3.5.14 Where Wastewater and Storm Water Manholes are adjacent, their positions shall be staggered to allow for crossing over of Sewers. Staggered positioning of Wastewater and Storm Water Manholes is required with a full separation between the Wastewater and Storm Water Sewer systems (Note that Irish Water does not have responsibility for Storm Water Sewer systems.). The external walls of the staggered manholes shall be separated by at least 500mm to allow compaction of backfill material between the structures;

3.5.15 The design of landscaping shall be undertaken at the same time as the design of the Drains and Sewers so that the impact of tree roots on the Works can be considered (see **Section 3.21** below). Trees/bushes/shrubs shall not be located closer to the Sewer or Drain than the canopy width at mature height, except where special protection measures are provided. A tree should not be planted directly over Sewers or where excavation onto the Sewer would require removal of the tree;

3.5.16 When in a road or highway (and in addition to **Section 3.5.9**), the outside of the Sewer to which this Code of Practice applies should be in the vehicle carriageway (not footway) and shall be at least 1.0 m from the kerb line. The external faces of Manholes and chambers should be at least 0.5 m from the kerb line;

3.5.17 A Storm Water sewer or a Wastewater Sewer should generally not be installed to cross over a Water Main. When the surface water or Wastewater Sewer is being installed under a Water Main, adequate structural supports shall be provided to maintain the structural integrity of the Water Main. A method statement for the proposed crossing shall be provided. Where crossing over a Water Main is unavoidable, the surface water or Wastewater Sewer crossings shall not be located directly above

the joints in the Water Main. No other utility service should be laid longitudinally directly above the line of the Wastewater Sewer;

3.5.18 Any Sewer crossing of a Water Main shall do so at right angles, or as near to as possible, to avoid prolonged envelopes of influence between the services. Crossings shall be located midway between the Water Main joints with a minimum vertical clear distance of at least 300mm and up to 500mm or more in some instances between the Sewer pipe and the Water Main. All such crossings shall be to Irish Water approval and shall not be undertaken until Irish Water or its agents has examined the work at the crossing point and deemed it fit for backfilling;

3.5.19 Specific vertical separation distances for wastewater service connections and Sewers to other pipework, including utility service pipes and ducts, shall be in accordance with the Table at the end of this Section;

3.5.20 There should be a minimum clear horizontal distance of at least 900mm between the external face of a Gravity Sewer/Rising Main and other pipe/duct utilities running parallel to it, with a clear local horizontal distance of 300mm between the external face of a Gravity Sewer/Rising Main and cabinets, poles, junction boxes, Manholes or chambers;

3.5.21 Specific separation clearance distances in excess of those outlined above shall be provided for services such as gas, electricity, fibre-optic or oil filled cables as the case may be. The particular utility providers shall be consulted to determine these minimum separation distances and evidence of this consultation, with the specified separation distances, shall be provided to Irish Water at design submission stage. For example, the minimum separation distances for Gas Networks Ireland infrastructure shall be in accordance with IS329 ‘Gas Distribution Mains’ and IS328 ‘Code of Practice for Gas Transmission Mains’ as amended/updated;

3.5.22 A Deed of Grant of Easement shall be provided for all Sewers and Rising Mains prior to their construction. Connections to the Irish Water Network will not be permitted without such Easements having been submitted and accepted by Irish Water. Construction and permanent Deed of Grant of Easement, comprising a conditional Burden on the Title, are to be provided complying with particular widths requirements outlined in the Connection Agreement and such Easement should be to the benefit of and registered with Irish Water as the owner following Vesting. The Easement shall not be built upon after the installation of the Sewer or Rising Main. The construction techniques should be selected to ensure that the maximum settlement is within the agreed limits;

3.5.23 Rising Mains shall be laid in straight lines or in gentle curves, to manufacturer’s requirements, or using long radius bends. Where bends are used, they should be formed with proprietary bends of suitable material allowing for a fully integrated joint, and securely anchored with thrust blocks, if deemed necessary;

3.5.24 The provision of access points, comprising rodding points and chambers, for pigging, rodding or cleaning of the Rising Main is required along its entire length, especially along long Rising Mains;

3.5.25 Where possible, Rising Mains shall be evenly graded between the intake point and the discharge point. If a continuous rise cannot be achieved, the Rising Main should be fitted with sewage air valves and scour valves as per the hydraulic design of the system. Both of these should be suitable for use with raw Wastewater. The valve locations shall be clearly marked by the provision of indicator plates and posts.

3.5.26 The design of the Rising Main shall take account of the containment of the Wastewater volume during pigging, rodding and cleaning operations at the scouring point and provisions shall be made for ease of collection of the Rising Main contents by vacuum tanker and transportation of this to a suitable point for treatment or reintroduction into the Wastewater collection Network;

3.5.27 The route of Rising Mains should be marked at every field boundary and, where practicable, at every change of direction by marker posts. The marker plates shall be labelled “RM” and the depth to the top of the Rising Main as well as the distance to the main shall also be provided;

3.5.28 Non-degradable marker tape, red or orange in colour, shall be installed 300mm above the crown of the Rising Main. In the case of non-metal pipe material, the marker tape should incorporate a trace wire which is linked to the marker posts and terminating at the Wastewater pumping station and the discharge Manhole. The trace wire shall be tested to ensure that it is continuous and capable of transmitting locating signals;

In the case of installations to be constructed in close proximity to **existing Sewers**, specific approval of Irish Water shall be obtained. In the case of existing Network pipework, alternative minimum horizontal distances shall be maintained between pipes/ducts, cabinets, poles, Manholes, junction boxes, chambers, etc., as outlined in **Section 3.20** below.

Further to **Section 3.5.19** above, the separation distances outlined in the Table below shall apply for wastewater service connections at crossings of Irish Water’s Water Mains and Sewers. For other utility pipework, specific advice shall be sought from the Utility Provider in respect of their separation distance requirements. .

Scenarios where the network sewers cross or traverse one another within a development footprint should be minimised and should be clearly identified by the Developer’s designer and indicated in their respective design submission to Irish Water. On that basis Irish Water will have clarity on the separation distances at crossing points. In all instances the separation distance that is required by the utility service provided should be observed as outlined in **Section 3.5.21** above.

In relation to the domestic service connections, the applicable IW design pipe gradient shall apply. This shall take account of excluding the likelihood of excessive gradients if a Developer were to apply only the minimum separation distance criteria at a crossing as governing design criteria and assuming a straight line grade between the crossing and the inspection chambers, while ignoring the need to comply with the pipe gradient rules.

	Separation distance between Service Connection above and pipe below.	Separation distance between Service Connection below and pipe above if pipe is 100mm or less	Separation distance between Service Connection below and pipe above if pipe above exceeds 100mm diameter.	Separation distance between sewer above and pipe below	Separation distance between sewer below and pipe above
Non Trafficked Areas	100mm	100mm	150mm	Pipe bedding depth of the upper pipe	Pipe bedding depth of the pipe below
Trafficked Areas	150mm	150mm	150mm	300mm	300mm

Note: The separation distances relate to that between the service connection pipe and other Irish Water asset pipework. The separation distance requirements of other Utility Providers shall apply in respect of their utility pipes/ducts.

3.6 Hydraulic Design for Gravity Sewers

The hydraulic design of the Works shall include an allowance for envisaged flows as well as increased flows that might be reasonably foreseeable within the Development, based on Local Authority Development Plans or as advised by Irish Water.

Gravity Sewers should be designed to convey the projected flows together with an allowance for:

3.6.1 variations in Wastewater flows resulting from increased occupancy or intensification of the Development commensurate with the introduction of water saving measures;
3.6.2 increased trade effluent flows resulting from reasonable changes in use or intensification of an industrial or commercial Development, including mixed use Developments;
3.6.3 levels of groundwater infiltration that might reasonably be expected over the life of the Drain or Sewer system;
3.6.4 inflow of surface water that might reasonably be expected due to leakage or accidental connection, giving rise to partially separate flows.

The Irish Water requirements for the design of wastewater gravity sewers are set out in **Appendix B** of this Code of Practice.

However, for Works in residential Developments, the sewer capacity criteria for a development are considered to be satisfied, without the need for a full **Appendix B** design assessment, where the pipe size and gradient requirements for the full potential development population corresponds to those in the Table below for the number of dwellings shown. For small numbers of housing units, the use of higher peak flow multipliers may be used for design purposes to reflect the proximity to source and the attenuation that naturally occurs in the Sewerage system.

Table: Sewer Size/Gradient for Multiple Properties

Number of Dwellings	Pipe Diameter	Minimum Gradient
2 to 9	150mm (or 225mm)	1:60
10 to 20		1:150
21 to 210	225mm	1:200
211 to 250		1:150
251 to 330		1:100
331 – 450	300mm	1:300
451 to 565		1:200
566 to 655		1:150
656 to 830		1:100

For developments which do not comply with the above Table, sewers shall be designed fully in accordance with Appendix B so as to convey the following flows:

- Works which carry domestic Wastewater shall be designed to carry a Wastewater volume of between 6 times and 2.5 times the dry weather flow depending on the size of the Development, as outlined in **Section 2.2.5** of **Appendix B**. Dry weather flows (DWF) should be taken as 446 litres per dwelling (2.7 persons per house and a per capita Wastewater flow of 150 litres per head per day along with a 10% unit consumption allowance in line with **Section 3.6.3** above and **Section 2.2.4 of Appendix B**) (rounded up to 450 litres).

- Where the Works carry industrial or commercial Trade Effluent and Wastewater, the Sewer collection system shall be designed to carry the flows outlined **Section 2.2.6 to 2.2.9** of **Appendix B**.

- Allowances for flows associated with **Section 3.6.4** above and for Urban Creep, as outlined in **Section 2.2.10** of **Appendix B**, shall also be incorporated into the design of the wastewater collection system.

The Works shall be watertight in accordance with the test criteria outlined in **Section 4.10** to minimise the ingress of groundwater and Surface Water and the egress of Wastewater.

When calculating emergency storage requirements in accordance with **Section 5.2**, **Section 5.7** and **Section 5.11** of this Code of Practice**,** average trade wastewater flows should be used towards the calculation of the storage capacity requirement. The storage capacity requirement shall be between 6 and 24 hours, depending on the size of the Development. Where the trade wastewater flow, as outlined in **Section 2.2.8** of **Appendix B** are used to estimate the maximum trade wastewater flow, these can be converted to an average trade wastewater flow by dividing by a factor of 3.

Storage facilities may be required at the Premises site to balance the discharge from the site if requested by Irish Water to limit the effluent discharge so that the allocated capacity of the Irish Water Network is not exceeded. Details of such storage should be provided in the design provided at Connection Application Stage.

As a general rule, it is preferable to aim to achieve self-cleansing velocity in the pipe system at least once per day. This varies for pipe sizes with self cleansing velocity of 0.75m/sec for pipes less than 300mm diameter and 0.77m/sec for pipes 375mm and 450mm diameter. The designer should aim to achieve a flow velocity at the design flow (i.e. peak flow) of between the required self cleansing velocity (using 0.75m/sec) and a velocity of 2.0m/s, with an absolute velocity of 2.5m/s as an upper limit.

Subject to the limitations imposed by the foregoing, pipe sizes and gradients shall be selected from approved pipe design tables, based on an approved design approach, such as the use of the Colebrook White equation. It may not be possible to provide a self-cleansing velocity within small diameter pipe sizes, while meeting the minimum flow velocity requirement of 0.75m/sec design flow. Where this requirement cannot be met, the criterion would be considered to be satisfied by the following:

3.6.5 a 150 mm nominal internal diameter Gravity Sewer is laid to a gradient not flatter than 1:150 where there are at least ten dwelling units connected or 1:60 for up to nine connected dwelling units; or

3.6.6 a service connection with a nominal internal diameter of 100 mm laid to a gradient not flatter than 1:80, where there is at least one WC connected and 1:40 if there is no WC connected.

These parameters should not be taken as a norm when the topography permits steeper gradients. Hydraulic studies indicate that these requirements may not necessarily achieve a self-cleansing regime. When a choice has to be made between a Gravity

Sewer system and pumped pipe system, these criteria should not be regarded as inflexible. The roughness value (ks) for Gravity Sewer design should be chosen to suit the material being proposed and the “long term roughness value” should be chosen.

In general, pipes of **100mm** diameter should be laid at minimum gradients of between 1:60 and 1:100. Pipes of **150mm** diameter should be laid at a minimum gradient of 1:150. Pipes of 225mm diameter should have a minimum gradient of 1:200 and pipes of greater diameter should comply with self cleansing and maximum velocity requirements. Pipe gradients for private side drainage should be constructed in accordance with that indicated above as a minimum, or with Building Regulations requirements.

The maximum allowable gradient for gravity sewers should be chosen so as to achieve a full bore velocity of no greater than 2.5m/s. Typically, this can be achieved with the maximum gradients outlined in the Table below:

Table: Maximum sewer gradients

Pipe Diameter	Maximum Pipe Gradient
150 mm	1:13
225 mm	1:22
300 mm	1:31

Steeper gradients than those in the above table may be considered in cases where it can be proven that the pipe will not be flowing at full bore at any stage in its design life. In these cases maximum gradients can be determined based on achieving a velocity of no greater than 2.5m/s while the pipe is conveying the maximum design flow as outlined in **Appendix B**.

In either case, Gravity Sewer Pipes should not be laid with a gradient steeper than 1:12. Where ground profiles dictate steep gravity sewer gradients, backdrop Manholes shall be incorporated into the Works to ensure that the steep gradient limits set out above are not exceeded.

3.7 Hydraulic Design for Rising Mains

Rising Mains shall comply with the following:

3.7.1 The hydraulic design shall include an allowance for envisaged flows that might be reasonably foreseeable within the Development;

3.7.2 The diameter should be such that the velocity of discharge is in the range 0.75m – 1.8m per second and that any blockages of the pipeline are avoided;

3.7.3 Diameters of less than 80mm shall not be provided and the typical minimum diameter should be 100mm diameter (Rising Mains of a lower diameter might not be taken over by Irish Water);

3.7.4 Pipes less than 80mm will only be considered with the use of appropriately sized/type pumps. Such systems are only appropriate for taking low flow volumes and shall be provided with suitable anti-septicity systems;

3.7.5 The roughness value **(k_s)** should be chosen to suit the material being proposed and the "long term roughness value" should be chosen as being suitable for mean velocities between 1.1 and 1.8m/sec;

3.7.6 The installed minimum gradient shall be **1:500** rising and **1:300** falling with Wastewater type air release valves at the high point to facilitate air removal;

3.7.7 The gradient shall be a continuous rise without air valves, where possible;

3.7.8 Where it is proposed to install rising mains with gradients that are steeper than 1:10, the Developer shall advise and seek review by Irish Water's Connection and Developer Services. Alternative gradient proposals may be required in such instances;

3.7.9 Rising Mains longer than 500m shall have provision for in-line rodding, access and cleaning by the provision of in-line proprietary rodding chambers at centres not exceeding 200m;

3.7.10 Drain and washout facilities at low points should be provided with infrastructure for collection and appropriate treatment of the drained contents in order to ensure protection of the environment during such operations;

3.7.11 Wastewater type air release valves should be provided at high points to counteract air coming into solution;

3.7.12 Rising Mains should be designed to avoid septicity (twin pipe systems if necessary);

3.7.13 Surge analysis, subject to Irish Water approval, should be carried out for all Rising Mains and surge protection should be provided, where deemed necessary, for Rising Mains to protect the pipe from shock. Cyclic fatigue of pressure pipe systems should also be taken into account in the design of the pipeline;

3.7.14 Rising Mains should not discharge directly to a Sewer. In all cases, a separate discharge Manhole or header/stand off chamber shall be provided (see **Section 3.15**). This Manhole/chamber will be linked to the receiving Sewer by a short section of Gravity Sewer (minimum of 100mm diameter and sized to carry the peak pumped flow) connected to the receiving Sewer at a Manhole location. A Y branch connection between the gravity discharge pipe and the Sewer shall be used for single house pumped discharges. The discharge Manhole or header chamber shall be sized and designed to avoid turbulence and to achieve a smooth discharge to the Gravity Sewer system. Venting of the header Manhole to a vent-column shall be provided, complete with passive odour control. A pressure sealed Manhole shall also be provided.

3.7.15 Scouring arrangement of the Rising Main shall be incorporated in accordance with **Section 3.5.25** above.

3.8 Pipe Sizes

The minimum size for a Gravity Sewer, subject to the criteria outlined in **Section 3.6** above, should be:

3.8.1 150mm nominal internal diameter for carrying Wastewater from 20 properties or less;
3.8.2 At least 225mm nominal internal diameter carrying Wastewater from more than 20 properties.

The minimum size for a Service Connection shall be 100 mm. The minimum size for Gravity Sewer serving less than 20 properties shall be 150 mm diameter. The minimum pipe size for Gravity Sewer where more than 20 housing units are connected shall be 225mm diameter subject to hydraulic design capacity assessment requirement. A pipe size greater 225mm diameter shall be provided where the design flow exceeds the capacity of the 225mm diameter pipe.

The minimum size for a Rising Main should not be less than 80mm internal diameter. Rising Mains less than 80mm will only be considered with the use of appropriately sized/type pumps. Such systems are only appropriate for taking low flow volumes and shall be provided with suitable anti-septicity systems.

3.9 Depth of Cover

Gravity Sewers and Rising Mains shall be designed in accordance with the requirements of BS 9295. As a general guide the, minimum depth of cover from the finished surface to the crown of pipework **without protection** should be as follows:

3.9.1 Areas without any possibility of vehicular access - depth not less than 0.5 m;
3.9.2 Driveways, footways, parking areas and yards with height restrictions to prevent entry by vehicles with a gross vehicle weight in excess of 7.5 tonnes - depth not less than 0.75 m;
3.9.3 Driveways, footways, parking areas and narrow streets without footways (e.g. mews developments) with access for vehicles with a gross vehicle weight in excess of 7.5 tonnes - depth not less than 0.9 m;
3.9.4 Depths of pipes in gated estates shall be as outlined above points 3.9.1-3.9.3;
3.9.5 Agricultural land and public open space - depth not less than 0.9 m;
3.9.6 Other roadways, highways and parking areas with unrestricted access to vehicles with a gross vehicle weight in excess of 7.5 tonnes – depth not less than 1.2 m.

The depth of cover to pipework can be reduced by the installation of protection measures, but an absolute minimum depth of cover of 500mm in un-trafficked areas and 750mm in trafficked areas shall apply when protection measures are used. Appropriate protection measures are discussed in greater detail below. The depth of

cover is also dependent on whether the pipework installation is a rigid or a flexible construction.

If the depth of cover to the crown of the pipe is less than the values set out above in **Section 3.9.1 to 3.9.6**, protection measures shall be provided. Consultation with Irish Water is required in relation to the provision of these measures. In order of precedence, the protection measures may comprise either the provision of a reinforced concrete slab designed to spread the imposed traffic load away from the pipe, slab to be a minimum of 150mm thickness of reinforced concrete of C30/35 concrete to IS EN 206, or the provision of full concrete surround of C16/20 concrete to the pipe, as described in **Section 4.7**, complete with flexible joints, where required, or the use of a ductile iron pipe in lieu of the original pipe material, provided there are no service connection in this length of pipe. These alternative protection measures shall extend for the distance where the depth is below the limits outlined above. A combination or a mix of all of these additional protection measures may be required and are to be agreed with Irish Water. However, the primary approach should be to provide the pipe with the required depth of cover as outlined above in **Section 3.9.1 to 3.9.6**.

3.10 Roadway/Footway Surface Reinstatement

Roadway's/footway's surface finishes above the trench backfill and pipe granular surround material in new Developments shall be to the requirements of the Roads Authority in whose functional area the Development is located and/or as outlined in the Planning Permission for the Development.

Reinstatement of trench surfaces in existing Public Roads shall be to the requirements of the relevant Local Authority Roads Department's Road Opening Licence, unless otherwise specified by Irish Water. This will require compliance with the "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads", 2nd Edition, or subsequent amendments published by the Department of Transport, Tourism and Sport.

The reinstatement of trenches on National Roads shall be in accordance with the TII "Specification for the Reinstatement of Openings in National Roads" or subsequent amendments published by Transport Infrastructure Ireland, unless otherwise specified.

3.11 Access to the Works

Access structures to Works shall be located to minimise the risk of damage to buildings or other infrastructures. Such access points are generally provided by way of Manholes or inspection chambers. Inspection chambers (minimum 900mm X 900mm plan area or 900mm diameter) may be provided as access points in the Works to be Vested in Irish Water in the case of small diameter Sewers that are located at shallow depths (less than 900mm cover) subject to Irish Water agreement. Private side inspection chambers on wastewater service connections are described separately in **Section 3.11.14** below.

Manholes and inspection chambers shall be designed to:

3.11.1 Provide reasonable access for equipment to carry out maintenance activities;
3.11.2 Provide safe access and egress in accordance with Health and Safety Authority requirements and in accordance with Health and Safety Legislation;
3.11.3 Have a minimum clear access opening of 600 mm x 600 mm. (However, designers must have regard to safe access/egress requirements to Works by operatives with breathing apparatus in accordance with the Preliminary Safety and Health Plan as prepared by the Project Supervisor Design Process (PSDP) which must include requirements for a safe means of access and egress);
3.11.4 Incorporate an access shaft in situations where the Manhole is of deep construction, with a minimum clear access opening of 600mm x 600mm and minimum internal dimension of 1,200mm x 1,200mm, or 1,200mm diameter;.
3.11.5 Incorporate a smooth flow invert/channel directing the wastewater from the inlet sewer(s) to the outlet sewer with the change in flow direction between the inflow in any of the inlet sewers and the outflow in the outlet sewer not exceeding 90^{o} when measured from a straight through line, i.e. the inlet flow in any inlet sewer should not run counter to the main flow direction in the channel.

Access points to the Works shall be located with due regard to public utility services, safety, security and the provision of safe working areas. Access to shallow Sewers via inspection chambers should be provided at maximum intervals of **45m**. Access to Sewers via Manholes should be provided at maximum intervals of **90m** for Sewers of 225mm diameter and above, and at maximum intervals of **75m** where the Sewer size is 150mm diameter, and shall be located in the following positions

3.11.6 At all changes of pipe direction;
3.11.7 At all changes of pipe gradient;
3.11.8 At all changes of pipe material along the Sewer length;
3.11.9 At all changes of pipe diameter;
3.11.10 At the head of all Sewers;
3.11.11 At all Sewer junctions of two or more pipes;
3.11.12 At every junction of a Wastewater Sewer with another Sewer serving three or more properties where the access point is a Manhole;
3.11.13 At the point of connection of the Works to the Network.

In addition to the above, the following shall also be adhered to:

3.11.14 An inspection chamber of precast concrete or blockwork construction (600mmX600mm plan area) or proprietary approved plastic units in accordance with EN 13598-2 shall be installed on the Drain on the

private side of the boundary of a Premises at or within 1.0m upstream of the Premise Boundary to allow access to the private Drain and the downstream service connection (see additional provisions below) ,

3.11.15 The renewal, maintenance and repair of Drains and associated Accessories upstream of the boundary of the Premises is the responsibility of the property owner and shall be constructed in accordance with the Building Regulations subject to the provision of an inspection chamber as above.

Access points (Manholes and chambers) shall be located so that they are accessible and apparent to the maintainer at all times for use. They shall avoid rear gardens or enclosed locations and they shall never be overlain with surface dressing, topsoil, etc. Additional access points may be provided in other locations, as long as access is provided to the system from other access points. A safe working space shall be provided and maintained at all times around the Sewer access points.

With respect to the private side inspection chamber referred to in **Section 3.11.14** above the following additional provisions will apply:

- Inspection chambers, where possible, shall be located within 1m on the private side of property boundary. The maximum depth at this location shall be 1.20m.
- Irish Water may facilitate or accommodate a relocation of the inspection chamber where the anticipated or design depth at that location is greater that 1.20 meters. In these instances the chamber may be relocated or moved back towards the dwelling until a depth of 1.20m is achieved, provided the distance of the inspection chamber from the boundary of the Premises does not exceed 2.0m (achieving the 1.20m depth determines the final location for the inspection chamber). This will be subject to Irish Water approval in all instances and shall only apply to specific locations within a Development. It should not be assumed that once approval for the relocation is granted that it applies to all dwellings within the respective Self Lay Development. Where it is envisaged that there is a justifiable engineering reason for re-locating the inspection chambers to achieve the maximum depth of 1.2, Developers shall indicate on a layout plan the location and applicable house numbers within the development where this applies. Relaxation reviews will be assessed on the basis of this submission.
- If the depth of the service connection exceeds 1.2m a Manhole (minimum 900mm X 900mm plan area or 900mm diameter) shall be provided.
- A proprietary inspection chamber may be used provided the minimum internal chamber dimension is either 600mm x 600mm or 600mm diameter irrespective of depth (up to 1.20 meters). The use of proprietary units is subject to Irish Water's requirements in all instances.
- Where there is a justifiable engineering reason such as a physical space restriction or constraint, Irish Water may allow the installation of smaller inspection chambers than the 600mm square or circular units for depths up to 1.0 meters. The dimension of these smaller units shall not be less than 450mm (square or circular). These are subject to specific Irish Water approval in all

instances and shall only apply to specific locations within a Development. It should not be assumed that once approval is granted for the smaller sized units that this applies to all dwellings within the respective Self Lay Development. Were it is envisaged that there is a justifiable engineering reason such as a physical restriction or constraint for downsizing the foul inspection chambers, Developers shall indicate on a layout plan, the location and applicable house numbers within the development where this applies. Relaxation reviews will be assessed on the basis of this submission.

- In high density developments i.e. Duplex or Terraced housing, wastewater drains from a maximum of two units can be combined into one inspection chamber in instances where there are space constraints.
- In high density developments, an inspection chamber shall be located within 1.0m of the private boundary where possible. However, in instances where the property does not have a garden or private parking space (within the curtilage of the property), the inspection chamber should be located in the footway, or, in parking area immediately outside the property subject to approval by Irish Water. In these instances, the inspection chamber should be positioned so as to avoid frequent wheel loading from vehicles.
- Covers and frames shall be suitable for the relevant road and traffic conditions and provided in accordance with IS EN 124.
- Long radius bends, up to 45 degrees, may be installed on the 100mm service connection downstream of the private side inspection chambers to facilitate the transition from horizontal to vertical to allow the service connection to connect to the branch connection on the Network, in accordance with the requirements of **Section 3.5.12**.

3.12 Manholes

3.12.1 General

Manholes should generally be provided as the means of access to the Works and particularly where;

3.12.1.1 the depth from the surface to the crown of the pipe is greater than 900mm;
3.12.1.2 there are two or more upstream pipes each serving more than one property; or
3.12.1.3 the distance between Manholes would otherwise be greater than **90** m for Sewers of 225mm diameter and above, and **75m** where the Sewer size is 150mm diameter.

At the head of sewer lengths, inspection chamber access, of 900mm diameter or of 900mm by 900mm plan area, may be acceptable where the pipe is of small diameter, the depth to invert of this pipe is less than 900mm and no part of the pipe is more than 22.5 m from the adjacent access point.

Manhole covers and frames to IS EN 124, with D400 load capacity, should be used where Manholes and inspection chambers are located on roads. If the Manhole location is on a carriageway, a cover with a higher load bearing capacity than the standard IS EN 124, D400 cover, should be used. Covers with E600 rating should be used in heavily trafficked roads, as required on a case by case assessment basis.

A Manhole, in general, shall not be located in carriageway situations where traffic frequency and loading is anticipated to be high (e.g., in industrial developments where large numbers of HGV vehicles with a gross vehicle weight in excess of 7.5 tonnes are expected) than would occur on a typical residential estate distributor road.

Manholes are to be fitted with step rungs or fixed ladders as required depending on the depth of the Manhole and to allow safe self egress. Step rungs are to be provided in Manholes where the depth from ground to the soffit of the pipe is up to 3.0m. Fixed ladders are required in Manholes where the depth from ground to the soffit of the pipe exceeds a depth of 3.0m and up to 6.0m. A site specific engineering solution shall be provided to Irish Water for review and approval for access arrangements in Manholes where the depth between ground and the soffit of the pipe exceeds 6.0m.

Site specific risks are to be assessed relating to access to and egress from Manholes during construction as well as during the operational phase and design mitigation measures implemented as required. Adequate safe working space shall be provided and maintained around all Manholes and inspection chambers. All Manhole entry and egress is to be carried out using a safety access plan incorporating the use of safety equipment, tri-pod and winch. The designer must ensure that the general principles of prevention, as well as relevant Health and Safety legislation, are taken into account when selecting Manhole covers and frames in respect of manual handling, opening size for access, egress and rescue, etc. Proprietary lifting equipment for covers should be provided to allow safe lifting of covers and this should be consistent to avoid risk of accident due to misuse.

Backdrop Manholes shall be provided where there is a differential in depth between the incoming and outgoing Sewer inverts of 600mm or more. These backdrop Manholes shall be provided with a horizontal rodding eye internally. Where the back drop from the Sewer is constructed at right angles to the vertical plane or where the drop exceeds 900mm, a vertical rodding pipe from ground level, complete with a surface cover and frame to IS 261, etc., shall be provided. Where there is a differential in depth between the incoming and outgoing Sewer inverts of less than 600mm, a cascade Manhole shall be provided to Irish Water's requirements or the benching shall be profiled to ensure a smooth flow from the inlet to the outlet pipe.

Manholes shall be constructed of the following materials:

3.12.1.4 In situ concrete, C30/37, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum wall and floor thickness of 225mm for Manhole depths up to 3.0m and 300mm or more

when the Manhole depth exceeds 3.0m, complete with a cast in situ concrete roof slab, minimum thickness of 225mm, depending on Manhole dimensions, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover.

3.12.1.5 Precast concrete Manholes shall only be provided where the water table is low. They shall not be used where there is a perched water table, where the Sewer is located next to a river, lake or other water body and within areas that are identified by the Office of Public Works Catchment Flood Risk Assessment and Management (CFRAM) with a flood risk of 1 in 10 years. The precast wall units shall be provided with rubber sealing ring gaskets between units, complying with the requirements of IS EN 1917 and IS 420, subject to specific approval of Irish Water, complete with a 150mm minimum thickness cast in situ formed concrete surround, C20/25, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620. The precast concrete Manhole shall have either a pre-cast concrete (150mm minimum thickness beneath channel) or a cast in-situ concrete base (225mm minimum thickness beneath channel). It shall be also provided with either a pre-cast (160mm minimum thickness) or cast in-situ concrete roof slab (225mm minimum thickness). Both the base and roof slab shall be constructed of C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover. The concrete surround to the precast concrete wall units shall only be omitted if the Manhole ring has a wall thickness of 125mm or more and where a proprietary watertight sealing system is provided as an integral part of the Manhole wall system up to a maximum depth of 4.0m. The omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised.

3.12.1.6 High density, high strength (20N/mm^2), solid concrete block work walls only in circumstances where the depth of the Sewer is less than 1,200mm (the use of block work in deeper Manholes will be considered but such use will require detailed structural design and agreement with Irish Water). The blocks shall be bedded in mortar, minimum M20 strength to IS EN 998-Part 2. Block work, complying with the requirements of IS EN 771 – Part 3, shall be flush pointed and not plastered internally, with internal lining of solid engineering brick to IS EN 771 – Part 3 to a height of 1.0m above the benching, bonded to the concrete block work. The block walls to be supported on a 225mm thick concrete floor with a reinforced concrete roof of 225mm minimum thickness, both cast with in-situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover.

3.12.2 Manhole Dimensions

Manhole Dimensions depend on the size of the main Sewer and the number of pipes accommodated in the Manhole. The design size shall permit safe access and egress without unduly restricting operating space. All Manholes shall have a minimum internal clear dimension of 1,200mm on Manholes up to 3m depth. The internal dimensions of Manholes will vary with the pipe size, the number of pipes entering the Manhole, the direction of entry of the pipes relative to the outlet pipe, the variation in depth between the inlet and outlet pipes and the depth of the Manhole itself. Manholes shall have an open channel(s) allowing smooth flow between the inlet pipe(s) and the exit pipe. A safety chain shall be fitted on the downstream pipe where it exceeds 450mm diameter, subject to health and safety requirements. Manhole dimensions shall be in accordance with IS EN 752.

As a guide, the following nominal internal dimensions of Manholes will apply

Nominal diameter of largest pipe in Manhole (mm)	**Minimum nominal internal dimension of Manhole (mm)**
Less than 375	1200
375 - 450	1350

The internal dimensions shown above of the Manholes are minimum dimensions and shall be increased to accommodate bends and multiple inlet layouts to ensure safe working area. It should be noted that this Code of Practice relates to pipe sizes of 450mm diameter and below. Larger diameter Sewer sizes are outside the scope of this document.

3.12.3 Manhole Bases

Manhole bases shall be constructed of cast in situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm. Thicker Manhole bases are required for Sewers in excess of 3m deep or where the Manhole size is greater than the standard minimum size outlined above. Alternatively, precast concrete bases may be used, incorporating invert channels, benching, etc. in compliance with IS EN 1917 and IS 420, with the base thickness beneath the channel shall be at lease 150mm. Where precast concrete rings are used with cast-in-situ concrete bases, the bottom ring unit shall be cast into the base slab to ensure adequate sealing of the wall/base junction. The Manhole base shall be founded on a 75mm layer of C12/15 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620.

3.12.4 Manhole Walls

Manhole Walls shall be constructed of cast in situ concrete, C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm. Thicker Manhole walls are required for Sewers in

excess of 3m deep where the size is greater than the standard minimum size. Cast in situ concrete Manholes shall be used in all locations where there is a perched water table, where the Sewer is located next to a river, lake or other water body and within areas that are identified by the Office of Public Works Catchment Flood Risk Assessment and Management (CFRAM) with a flood risk of 1 in 10 years. Alternatively, precast concrete ring units shall only be used where the water table is low. The precast concrete units shall comply with the requirements of IS EN 1917 and IS 420, complete with a cast in situ formed concrete surround of 150mm minimum thickness of C20/25, 20mm aggregate size. The concrete surround to the precast concrete wall units shall only be omitted if the Manhole ring has a wall thickness of 125mm or more and where a proprietary watertight sealing system is provided as an integral part of the Manhole wall system, up to a maximum depth of 4.0m. The omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised. In shallow Manholes, less than 1.2m deep, high density, high strength (20N/mm^2), solid concrete block work walls may be used. The blocks shall be bedded in mortar, minimum M20 strength to IS EN 998-Part 2.

3.12.5 Manhole Roofs

Manhole roofs should consist of a reinforced concrete slab of in situ C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 225mm, designed to carry all live and dead loads. Alternatively, precast concrete roof slabs, with a minimum thickness of 160mm, may be used in compliance with IS EN 1917 and IS 420. This approach would be the preferable option where pre-cast concrete ring units are used as Manhole walls. An access opening shall be formed in the Manhole roof slabs. The minimum dimensions of the roof opening shall be 600mm by 600mm or 600mm diameter. Circular Manhole openings of 600mm diameter may be used if the Manhole cover is circular. The opening in the roof slab shall be formed over the benching with the widest width at invert level.

3.12.6 Manhole Inverts and Benching

Manhole inverts should be fitted with smooth flow channels to accommodate the flow from the inlet pipe(s) to the outlet pipe. For straight through Manholes, with similar size inlet and outlet Sewers, an open channel or half round pipe section, bedded in cement sand mortar, may be used. Otherwise, the Manhole invert should be formed with cast in situ concrete, C25/30 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, finished with a 1:3 cement sand mortar. Alternatively, pre-cast concrete bases, incorporating pre-formed channels and benching, may be used. Such units shall be in accordance with the provisions of IS EN 1917 and IS 420. Where pre-cast concrete Manhole inverts units, with multiple channels, are used, any redundant channels shall be blanked by scabbling the channel surfaces, filling with C25/30 concrete and finishing the surface to match the existing invert. Where there is more than one incoming Sewer discharging to the Manhole, the benching shall be so shaped as to guide the flow in the direction of the outgoing Sewer. The benching shall

be brought up vertically at the flow channel to the level of the crown of the incoming Sewer. The benching shall slope away from the vertical edge at a slope of 1:30. The soffit crowns of the incoming and outgoing Sewers shall be kept at the same level. The flow channel shall be sloped gradually and evenly between the incoming and outgoing Sewer. Staggered toe-hole rebates, 200mm wide x 150mm high x 150mm deep, shall be provided in vertical invert benching at 300mm centres in channels of sewers of 450mm and greater to allow access from the benching to the channel invert.

3.12.7 Manhole Shafts

Manhole shafts are required in deep Manholes where the Manhole plan dimensions are in excess of 1,200mm x 1,200mm plan area or 1,200mm diameter. The distance between the top of the benching and the soffit of the main roof slab supporting the shaft structure should be not less than 2.1m. The minimum internal dimensions of the access shaft shall be 1,200m by 1,200mm, or 1,200mm diameter. The corresponding opening in the main chamber roof slab shall be at least 1,200m by 1,200mm, or 1,200mm diameter. The walls shall be formed in reinforced C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, cast monolithic with the main chamber roof slab. The minimum thickness of the shaft walls shall be 225mm. The supporting roof slab shall be formed in reinforced C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, and shall be 225mm thick. Alternatively, approved precast concrete ring units complying with the requirements of IS EN 1917 and IS 420, may be used as Manhole shafts, complete with a cast in situ concrete formed surround of 150mm minimum thickness of C20/25 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620.

3.12.8 Rocker Pipes

Rocker pipes shall be provided for rigid pipe at the entry to and exit from Manholes to form a flexible joint upstream and downstream of the Manhole structure. The length of rigid pipe stub that is built into the Manhole wall shall extend no further than 600mm from the inner face of the Manhole wall. The length of the next pipe, the rocker pipe, shall be varied in relation to the pipe diameter with lengths of 600mm for pipes of 150mm to 600mm diameter. This Code of Practice relates to pipe size up to 450mm. Where the pipeline is installed in ground which is varied or unstable, multiple rocker pipes may be required. If flexible pipes are being used, rocker pipes are not required.

3.12.9 Manhole Covers and Frames

Manhole covers and frames shall comply with IS EN 124 and BS 7903 and be of suitable load grade, Class D400 (or E600 for heavy trafficked roads, as required on a case by case assessment basis) with a clear access opening of 600mm (square or circular). Covers shall be selected and designed to prevent the cover unit(s) falling into the chamber. Covers and frames shall be designed to be safely lifted with minimal risk of manual handling injury, suitable for use with lifting equipment and arranged to ensure

rescue procedures are not impeded. Frames should be square or circular with a square or circular insert with a minimum clear opening of 600mm diameter/dimension. Class D400 shall either have a 100mm or a 150mm deep frame and Class E600 covers on heavily trafficked roads shall have a 150mm deep frame. All covers shall be of non-rock design and closed keyways shall be provided in each cover. Manhole covers may be single units or double triangular, the double triangular units shall incorporate a closed key in each unit. Hinged Manhole covers shall incorporate a locking mechanism to keep the unit upright when open. Third Party Certification shall be provided for all Manhole covers and frames.

Manhole covers shall be set in position flush with the finished ground surface, whether road, pavement or open ground and shall have clear working space around the opening. The frame cover should be supported on Class B solid engineering brick, 215mm in width, to IS EN 771 – Part 2, one course minimum and no more than a maximum of three courses in height, set in mortar, minimum M30 strength to IS EN 998-Part 2:2010. Alternatively, pre-cast reinforced concrete seating rings set in mortar as above and of similar depth to brick courses and of similar concrete strength as the Manhole units may be used instead of brick where precast Manhole units and roof slabs are used. The Manhole cover frame shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing. Standard concrete blocks or bricks shall not be permitted. The cover frame should be installed and set to the manufacturer's instructions. The finish of the road surface around the Chamber cover and frame shall be to the requirements of the relevant Roads Authority for the area.

3.12.10 Manhole Steps

Manhole steps shall be provided in Manholes where the depth from ground to soffit of the sewer does not exceed 3.0m and in shallow chambers. Manhole steps shall comply with the requirements of IS EN 13101, Type D, Class 1. Galvanised mild steel step rungs, 20mm diameter, shall be provided with plastic encapsulated finish. Steps rungs shall be 300mm wide and located 300mm apart vertically. The vertical distance between the top of the Manhole cover and the first step in the Manhole shall not exceed 675mm. The distance between the bottom step and the benching shall not exceed 300mm. All step irons shall be centred under the access opening in the Manhole roof slab. The centre face of the step rung shall be 120mm from the wall face within the Manhole to align it with the roof slab opening.

3.12.11 Ladders

Ladders are to be provided in Manholes where the depth from ground level to soffit of the sewer pipe exceeds of 3.0m. Such fixed ladders within Manholes shall comply with IS EN 14396. The vertical distance between the top of the Manhole cover and the first step in the Manhole shall not exceed 675mm. The distance between the bottom ladder rung and the benching shall not exceed 300mm. All ladders shall be centred under the

access opening in the Manhole roof slab. Ladders, where provided, shall be manufactured of low carbon steel complying with IS EN 10025 with hot dipped galvanised finish to IS EN ISO 1461, with at lease 100 micron galvanise thickness. Ladder stringers shall be 65mm x 12mm, 300mm apart with 20mm diameter solid rungs at 300mm centres. Ladder stringers should be adequately supported from the Manhole walls at intervals of not more than 1.5m. Stringers should be bolted to the support cleats to facilitate renewal. Alternatively, stainless steel fixed ladders may be required in accordance with Irish Water's requirements. These shall be fabricated from Grade X5CrNiMo 17-12-2 steel complying with IS EN 10088-3. Aluminium ladders shall not be provided. The base of all ladders shall be positioned on a horizontal landing platform. The tops of ladders shall be provided with proprietary fixings to extend the ladder above ground level, if deemed necessary. The centre line of the ladder rung shall be 150mm from the wall face within the Manhole to align it with the roof slab opening. Manholes in excess of 6m depth shall be the subject of a detailed design submission for agreement with Irish Water in advance of construction. The Manholes shall be provided with intermediate landing platform(s) as part of an engineered access solution and full details of the landing platform shall also be provided for agreement with Irish Water. Access to Manholes is regarded as confined space access and shall be subject to a safety access plan.

3.13 Gravity Sewer Pipe Material Types

The types and fittings outlined herein shall be used in the construction of the Gravity Sewers. Pipe material shall not change between Manholes. The list below does not apply to pipes installed by pipe jacking or micro tunnelling.

3.13.1 ***Concrete;*** Concrete Sewer pipes with spigot and socket joints and rubber ring fittings shall comply with IS EN 1916 (2002), BS 5911, Part 1 (2002 – 2010) and IS 6 (2004) or equivalent standard, strength Class 120 with minimum crushing loads in accordance with Table 8 of BS 5911-1 (2002-2010). All pipes and fittings shall have gasket type joints of spigot and socket or rebated form. (Pipe diameters 225mm and above)

3.13.2 ***Thermoplastic Structured Wall Pipes;*** Thermoplastic structured wall pipes shall comply with the provisions of IS EN 13476 (2007/2009). Pipes shall be of Stiffness Class 8kN/m^2 (SN8) and to be capable of demonstrating a jetting resistance of 2,600 psi (180 Bar) without damage when tested in accordance with Section 3.3 of WIS 4-35-01 (2008). (Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter). Pipe fittings of Stiffness Class 4kN/m^2 (SN4) stiffness class, complying to IS EN 13476, will be acceptable if SN8 stiffness class fittings are not manufactured by the pipe manufacturer;

3.13.3 ***Unplasticised PVC;*** Unplasticised PVC pipes shall comply with the provisions IS EN 1401 2009/2012. Pipes to be application area code "UD", Stiffness Class 8kN/m^2 (SN8). Provision for jetting shall be based on the WRc Sewer Jetting Code of Practice, June 1997. Pipes to be capable of resisting a maximum jetting pump pressure of 2,600psi (180 Bar) without

damage. (Sewer diameters 150mm up to 450mm, Service Connections of 100mm diameter). Pipe fittings of SN4 stiffness class, complying to IS EN 1401, will be acceptable if SN8 stiffness class fittings are not manufactured by the pipe manufacturer;

3.13.4 ***Other;*** The use of alternative pipe types and materials will require the prior written agreement of Irish Water.

3.14 Rising Main Pipe Material Types

The pipes types and fittings outlined herein shall be used in the construction of Rising Mains. Pipe material shall not change along the Rising Main length.

3.14.1 ***Ductile Iron;*** Ductile iron pipes and fittings for Wastewater shall comply with the requirements of IS EN 598. The pipes and fittings shall be cement lined internally and zinc coated with an approved bituminous coating externally. Ductile iron pipes may require plastic sheeting protection in adverse ground conditions in accordance with BS 6076;

3.14.2 ***Polyethylene;*** Polyethylene pipe and fittings for Wastewater shall comply with the requirements of IS EN 12201. Polyethylene fittings, including fusion joints and electro-fusion fittings, shall comply with the provisions of IS EN 12201 – Part 3

Polyethylene pipes shall also conform to the following UK Water Industry Specification documents

- WIS 4-32-08 – Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 materials;
- IGN 4-32-18 – The Choice of Pressure Rating for Polyethylene Pipe Systems for Water Supply and Sewerage Duties;
- IGN 4-01-03 – Pressure Testing of Pressure Pipes and Fittings for use by Public Water Supplies.

3.15 Rising Main Discharge (Header) Manhole

A Rising Main discharge Manhole, or a header Manhole, shall be provided at the discharge point of a Rising Main. This Manhole shall be set off from the Network and it shall be linked to the Network by a length of Gravity Sewer of appropriate size to carry the Rising Main maximum pumped flow. The Gravity Sewer shall be connected into the Network at a Manhole when the Rising Main flow is from a Type 1, 2 or 3 Pumping Station (See Part 5). In the case of low flow discharge volumes, the connection of the Gravity Sewer to the Network may be provided by a branch connection.

The header Manhole shall be constructed in either cast in-situ concrete or pre-cast concrete rings, both as described above in **Section 3.12** above. The header Manhole shall be provided complete with base, roof slab, roof access opening and cover/frame. The rising main pipe shall terminate outside the wall of the header Manhole with a

stub/rocker pipe arrangement, a straight length of pipe and a flexible coupling. The straight length of rocker pipe shall be connected by a flexible coupling to a length of plain/flanged ductile iron pipe, which shall be built into the wall of the Manhole, complete with a puddle flange. The flanged end of this flanged/plain pipe, located within the Manhole, shall be fitted with a 90 degree all flanged bend and a flanged bell-mouth to allow the rising main to discharge vertically within the Manhole.

The invert of the Manhole shall be provided with internal benching formed to allow the Rising Main discharge volume to be directed to the outlet gravity discharge Sewer. The benching shall be formed to ensure a smooth flow transition between the Rising Main bell-mouth discharge and the outlet Sewer. The Manhole invert shall be formed with cast in situ concrete, C25/30, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, and finished with a 1:3 cement sand mortar, perfectly smooth. The benching shall slope at a gradient of 1:10 from the bell-mouth.

In all areas, the header Manhole shall be provided with a 100mm diameter vent pipe linked to a vent stack and it shall be fitted with a sealed manhole cover and frame. The vent pipe shall be built into the wall of the Manhole at a high level and sealed watertight within the wall. It shall be connected to a free-standing vent column or vent stack. A passive activated carbon filter shall be provided to the vent column/stack. The activated carbon filter shall be of robust proprietary manufacture and sized to have a minimum retention time of 3 seconds at maximum flow-rate.

3.16 Pipe Joints

3.16.1 General

Pipe joints shall be in accordance with the manufacturer's requirements for the pipe material. Pipe joints will generally be one of the following:

- Push in rubber ring joint;
- Bolted flanged joint;
- Flexible mechanical coupling with protective coating;
- Fusion welded joints where the site fusion jointing shall be strictly in accordance with UK WIS 4-32-08, 2016 (Specification for Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 Materials) and with BS ISO 21307:2017 (Plastic Pipes and Fittings – Butt Fusion Jointing Procedures for Polyethylene (PE) Piping Systems.
- Equipment used for butt fusion and electrofusion welding shall be in accordance with BS ISO 12176 (Plastic Pipe Fittings – Equipment for Fusion Jointing Polyethylene Pipe Systems – Part 1 Butt Fusion, Part 2 Electro Fusion).
- Equipment used for butt fusion and electrofusion welding shall have CE Certification and shall be calibrated on a 6-monthly basis.

Bolted flanged joints shall have raised face flanges complete with nuts and bolts to IS EN ISO 898 and double metal washers to BS 4320. Nuts, bolts and washers to be protected against corrosion in accordance with WIS 4-52-03. Flange assemblies, including nuts, bolts, washers and gaskets to be designed to meet a working and test pressure of 16 bar and 24 bar respectively.

All pipes and joints will be subjected to appropriate pressure tests as outlined in **Section 4.10** and **Section 4.11** below.

3.16.2 Jointing of Polyethylene Pipes

In advance of commencing pipe installation on site, the Developer shall provide a specific method statement to the Irish Water field engineer for review/assessment outlining the butt fusion and electrofusion jointing processes for polyethylene pipes that will be carried out on site. This shall be additional to the requirements for Method Related Statements as set out in Section 2.3.16 above. .

The Developer shall adopt and follow any and all applicable quality control procedures for all joints on polyethylene pipes for both butt fusion and electrofusion as well as for mechanical jointing systems. In addition, the Developer shall also follow the manufacturer's requirements but these shall not take precedence over good site practices.

Butt fusion and electro fusion jointing of polyethylene pipes shall only be carried out by appropriately trained and experienced operatives in possession of a current relevant Training Certificate. Training should be certified and equivalent to City and Guilds qualifications. Jointing personnel shall have, and be able to confirm, a minimum of one year's experience in successfully completing pipe welding under "live" construction conditions. Jointing shall be completed using fully automatic or pre-approved jointing machine/rigs in accordance with the manufacturer's instructions. In relation to electro fusion jointing, the jointing machine shall incorporate a remote inspection/monitoring system, which allows for real time inspection of the weld integrity or a data download facility. The identity of the polyethylene (PE80, PE100) pipeline manufacturer shall be made known to Irish Water prior to commencement of the installation. Certification and testing (including independent third party certification) shall be provided to confirm quality assurance compliance. Each joint shall be clearly marked with the joint logged automatically on the jointing machine in a format to the satisfaction of the Irish Water field engineer.. A printout of the joint details, with an as-built drawing complete with GPS location and geo-located photograph of each joint, shall be provided and retained for quality assurance purposes. In addition to the data log report, the welders own record / ledger must also be maintained and provided as part of the quality assurance documentation. All fusion welds shall be undertaken in an enclosure (e.g. tent) to minimise the effects of wind and rain on the jointing process and to prevent contamination from wind borne dust. All personnel carrying out pipe jointing shall have appropriate training in health and safety and shall follow all safety procedures laid down for welding.

3.16.3 Auditing and Testing of Polyethylene Pipe Joints

Each installation team and welding equipment unit will be audited by the Irish Water field engineer prior to commencement of welding on site and on a regular basis thereafter. Where it is deemed necessary by the field engineer, Irish Water may require or instruct the Developer to procure an audit from an independent accredited auditor. The audit reports from this independent auditor shall be provided to the Irish Water field engineer on a regular basis. Each installation and welding team shall also be audited by the Developer's Construction Engineer on a weekly basis or more frequently if required by the Irish Water field engineer. All of these audits will use a standard checklist to ensure that all the correct equipment and working practices are being utilised.

Weekly equipment checks and regular supervision of the welding equipment shall be carried out by the Developer and reports on these checks will be inspected by the Irish Water field engineer.

The destructive weld testing and analysis shall be carried out by a specialist and accredited testing organisation who will take the samples, deliver the sample for testing, test the joint and report on the result, thus ensuring that a chain of custody is maintained on all test samples. The Developer's contractor shall provide details of his proposed testing organisation to the Irish Water field engineer for review and approval prior to any testing being undertaken.

Joint tests complying with WIS 4-32-08, (2016) shall be carried out for each pipe diameter containing electro fusion welds used by the Developer's contractor's personnel and welded by the equipment to be used for Works. These shall be in accordance with ISO 13954 for assembly socket fittings > 90mm, in accordance with ISO 13955 for assembly socket fittings < 90mm and in accordance with ISO 13956 for saddle assemblies. Where possible, at least 6 strips should be taken from a welded coupler for testing with a lower number of strips taken for smaller diameter units. Samples shall be cut from each end of the joint spaced at equidistant intervals around the joint circumference. Similarly, joint tests complying with WIS 4-32-08, (2016) (in accordance with ISO 13953) shall be carried out for each pipe diameter containing butt fusion welds used by the Contractor's personnel and welded by the equipment to be used for Works. The tests shall be undertaken by an independent laboratory accredited by the Irish National Accreditation Board or equivalent. Reports, in a format acceptable to Irish Water, on these tests shall be provided to the Irish Water field engineer for review.

Prior to the commencement of polyethylene pipe laying works, pipe joint sample testing shall be carried out for all pipe sizes to be used in the Works. One initial sample test butt-fusion weld per designated butt-fusion crew and one initial sample test electro-fusion weld per designated electro-fusion crew shall be cut and taken for testing. These shall be taken for each pipe size per designated crew on pipes that are to form part of the Works.

During the installation of pipework, butt fusion welds and electro-fusion welds shall be cut out from the polyethylene pipes associated with the Works completed and shall be subjected to a destructive test, in accordance with the test procedures in WIS 4-32-08 (2016), as outlined above. The weld joint chosen for testing will be as indicated by the Irish Water field engineer. All weld samples shall be clearly labelled and referenced. The rate of testing of the joints shall be as follows:

- A minimum of one butt-fusion weld per designated butt-fusion crew per week and one electrofusion weld per designated electrofusion crew per week shall be cut out from the polyethylene pipes associated with the Works and tested. This minimum frequency of destructive testing shall be increased as directed by the field engineer if recurrent failure rates occur or if issues arise from auditing of welding crews and equipment. The sample test frequency is additional to the works test frequency outlined above.
- In addition to the initial and weekly weld joint testing outlined above, testing of the installed pipe joints shall be undertaken on joints as selected by the Irish Water field engineer. The frequency of joints testing on the polyethylene pressure main that has been installed in the Works shall be at least one test per 30 joints made on site, with a minimum of five tests in smaller developments, or as directed by the field engineer. The test joint shall be chosen at random by the Irish Water field engineer.

All tests shall be carried out at the expense of the Developer and this shall include for all costs associated with the taking of, testing, analysis of and transportation of samples as well as the required reporting of the test results. All costs associated with auditing shall also be at the expense of the Developer.

The Contractor shall arrange for the selected installed joint samples to be tested in accordance with WIS 4-32-08, IS EN 12201 – Part 5, and with ISO 13953, ISO 13954, ISO 13955 and ISO 13956 (as appropriate and listed above) by an accredited laboratory (accreditation by the Irish National Accreditation Board or equivalent) and a test report, in a format required by Irish Water, shall be provided to Irish Water's field inspectors within 1 week of the sample joint being taken. The report should indicate the test result, the failure mode of samples (Wasted Specimens), the specific joint identification data (Welders Name, Joint Number, Weld Date, Machine I.D, Date that the sample joint was received by Testing Facility) on the test report and results, along with clear photos of the joints prior to sampling with the Irish Water field engineer's signature present on the pipe, photos of the tested wasted specimens and in addition particular photos of any individual wasted specimens that were classified as a failure.

Where welds have failed, the Contractor shall excavate, cut out, and provide the welds carried out immediately before and immediately after the failed joint for additional testing.

The Contractor shall note that if the results of any of these two additional weld tests indicate that a weld is not in compliance with WIS 4-32-08, i.e. a weld failure, then the

Developer shall be required, at his/her own expense, to remove and replace all welds from the date of the last verifiable weld test found to be in compliance with WIS 4-32-08, performed by the particular welding machine and designated crew who completed the weld that failed. The welding machine and designated crew shall be prohibited from performing further welds until they have undertaken and passed a second site audit. If any additional work undertaken by designated crew is persistently at fault, they shall be prohibited from undertaking further welds until re-training shall be carried out.

All butt fusion joints shall be de-beaded and the bead referenced and kept for inspection. Beads shall be examined upon removal for signs of defects or splitting along the length of the bead joint. For butt fusion welding, completed welds shall be de-beaded and the weld bead shall be inspected on site by the welding crew. Beads shall be labelled, bagged and stored by the Developer's contractor and access shall be provided to the Irish Water field engineer to inspect the weld beads when requested.

The provision of the sample and all costs associated with their provision including restoring the pipe to service and reinstatement will be borne by the Developer. Untested sample welds shall be properly catalogued and stored by the Developer until the end of the Defect Liability Period. The sample welds thus stored shall remain the property of Irish Water and shall be made available to the Irish Water's field inspectors at any time for testing should it be so directed.

Pipe coils will only be permitted to be used for pipe diameters of 125mm OD and below. Pipe ovality on coiled pipes can have a detrimental effect on the integrity of electrofusion joints on both socket and saddle type fittings. Hydraulic re-rounding clamps and steel re-rounding inserts must be used to permit a straight length of pipe to be electrofusion jointed to the ends of the coil. The pipe profile within the area of the coil to be jointed shall be re-rounded to within the limits of ovality prescribed by BS EN 1201-3.

A coil of PE pipe length with a diameter greater than 100mm OD shall require the use three electrofusion couplers to joint any additional PE coil length to it. Two lengths of straight stick PE pipe (min length 500mm) shall be used to join the coils together. A coupler shall join the straight sticks to the ends of each coil, a third coupler shall then be used to electro fuse the straight sticks sections together.

Coils of PE pipe lengths with diameter less than 100mm OD shall be joined by using two electrofusion couplers to joint one length of straight stick PE pipe (min length of 500mm) between them.

All pipe joints, fittings and accessories shall be free from lead.

3.17 Rising Main Fittings

3.17.1 General

All fittings to Wastewater Rising Mains, including sluice valves, scour valves, air valves and meters shall be operable without the need to enter Chambers or other confined spaces. The fittings shall be suitable for use with untreated Wastewater flows.

3.17.2 Sluice Valves

Sluice valves shall be double flanged ductile iron resilient seated valves, suitable for use in Wastewater pipework and Rising Mains. They shall comply with the requirements of BS 5163 - Parts 1 and 2, IS EN 1074, Parts 1 and 2, and they shall have the CE marking in accordance with the EU Construction Products Regulations (No. 305/2011 – CPR). Sluice valves shall be suitable to be buried in the ground and shall have a minimum design life of 50 years. All flanges shall be drilled to PN 16 and shall have ductile iron flanges in accordance with IS EN 1092 Parts 1 and 2. Sluice valves shall be capable of accommodating a maximum differential pressure during operation of 16bar. Telescopic spindles shall be fitted with a cast iron false cap (complete with grub screw). Valves in pumping station valve chambers shall be fixed to flanged pipework and shall be wheel operated.

The fittings associated with the sluice valve will be dependent on the pipe material of the Rising Main. In ductile iron mains, the valve shall be fitted with an appropriate dismantling joint and a flanged to plain ended pipe with a flexible coupling at one end, a flanged to plain ended pipe and a flexible coupling at the other end to allow the valve's disconnection from the Rising Main pipework for maintenance if desired. Puddle flanges shall be fixed to the flanged to plain ended pipe, as appropriate, to allow it to be secured to a thrust block. One of the proprietary flexible couplers may not be required on spigot/socket ductile iron pipes. In polyethylene pipes the valve shall be fitted to an appropriate dismantling joint and a stub flange with backing ring at one end and a stub flange with backing ring at the other end to allow the valve's disconnection from the Rising Main pipework for maintenance if desired. The stub flanges shall be fusion welded to the polyethylene main at both sides of the valve arrangement. Alternative pipe fitting pieces will be required for other pipe material types.

The depth of the sluice valve stem cap, or the top of an extension spindle, shall not be less 250mm below the finished ground level and no valve stem cap or spindle cap shall be greater than 350mm below ground level, while observing the requirements for depth of cover of the pipe as outlined in **Section 3.9** above.

All sluice valves shall be CLOCKWISE CLOSING. The direction of closing shall be imprinted on the valve casing and on the associated marker plate. The number of turns (n) to open/close the valve shall be: n = 2N+1 where N is diameter in inches. The operating torque must not exceed the max allowed in BS 5163-1, Type B. Valves in

deep chambers shall be provided with extended spindles, completed with associated tube, adequately fixed/braced within the chamber.

The sluice valve shall be protected from corrosion by a coating in accordance with

A) WIS 4-52-01; or
B) IS EN 14901

For coatings in accordance with WIS 4-52-01, the internal water-wetted surface shall be coated to Class A standard while all other surfaces shall be coated to Class B standard.

3.17.3 Scour Valve Arrangements

Scour valves shall be double flanged ductile iron resilient seated valves as outlined in **Section 3.17.2** above. Sluice valves shall be provided on the Rising Main at either side of the take-off point of the scour pipe, complete with dismantling joint arrangement as outlined above. The scour pipe and scour valve shall have the following minimum diameters:

Diameter of Rising Main (mm)	Diameter of Scour (mm)
80	80
100 to 200	100
200 to 300	100 to 200

Scour valves and outlet pipes shall be sized for gradual emptying time and based on the capacity of the scour chamber and the vacuum tanker used for emptying the chamber. Each specific location will require the approval of Irish Water and the relevant Local Authority.

The scour valve should be located off of the line of the Rising Main in a separate scour chamber. The scour take-off from the Rising Main shall be provided by a flanged tee piece fitting with a level invert outlet of appropriate size. The connection pipe between tee piece at the take-off point on the Rising Main and the scour chamber shall be of ductile iron material. A scour chamber, as described below in **Section 3.18.2**, shall be provided downstream of the take-off point and the discharge point to balance the scour discharge and to allow collection and pumping out of scour discharge and debris.

Pipe fittings for the tee piece at the take-off point will be dependent on the pipe material of the Rising Main. In ductile iron mains, the tee piece shall be fitted with a flange to plain ended pipe, dismantling joints and flexible coupling at both ends. One of the proprietary flexible couplers may not be required on spigot/socket ductile iron pipes. In polyethylene pipes the tee piece shall be fitted to a stub flange with backing ring at both ends. The stub flanges shall be fusion welded to the polyethylene main at both sides of the tee piece arrangement. Alternative pipe fitting pieces will be required for other pipe material types.

3.17.4 Wastewater Air Valves

Air valves shall be of Wastewater air valve type with isolating valve in accordance with the requirements of BS ISO 7121. The Air valves shall have bodies and covers of cast iron to BS EN 1561 with flanges drilled to PN 16 in accordance with IS EN 1092. Each valve shall have a large and a small air escape orifice with an isolating valve. The isolating valve shall be either a resilient seated gate valve to BS 5163 and BS EN 1074, Part 2 and shall be of a boltless bonnet design, or a butterfly valve to IS EN 1074 Part 2. The inlet diameter shall be 80mm for Rising Mains of 250mm and below.

The location of the air valve shall be the subject of particular agreement with Irish Water to ensure that the risk of odour is eliminated. The valve shall be generally located at the high points of a Rising Main. The air valve shall have a flanged inlet and it shall be fitted on a flanged tee-piece branch off of the Rising Main. The tee piece shall be supported on a concrete cradle supported on the floor of the valve chamber.

The flanged tee piece shall be fitted at one end with a flange to plain ended connection piece of ductile iron material. This fitting shall be built into the wall of the air valve chamber and fitted with a puddle flange. It shall extend outside the wall by 400mm to allow its connection to the Rising Main pipework. The other flanged end of the tee piece shall be fitted to a dismantling joint, which in turn shall be attached to a flanged to plain ended pipe. This flanged to plain ended fitting shall be built into the wall of the air valve chamber and fitted with a puddle flange. It shall extend outside the wall by 400mm to allow its connection to the Rising Main pipework. The omission of the dismantling joint and flanged to plain ended pipe and its replacement with a longer flanged to plain ended pipe, complete with puddle flange, will be allowed if written confirmation from the air valve manufacturer is provided to warrant that the air valve and isolation valve assembly can be replaced without the need to take the rising main out of operation.

Rocker pipe arrangements shall be provided at either side of the air valve chamber in the case of ductile iron Rising Mains. The rising main pipe shall terminate outside the wall at either side of the chamber with a stub/rocker pipe arrangement, a straight length of pipe and a flexible coupling. The straight length of rocker pipe shall be connected by a flexible coupling to a length of plain/flanged ductile iron pipe, which shall be built into the wall of the chamber, complete with a puddle flange. In the case of polyethylene Rising Mains, the built in pipe fitting in the walls of the chamber shall be double flanged ductile iron. Stub flange with backing ring shall be fitted at either end of the Rising Main pipework.

3.17.5 Other Fitting Materials

Joint gaskets for flexible and flanged joints shall be Ethylene Propylene Diene Monomer (EPDM). Gasket material shall comply with the requirements of EN 681-1, Type WA with a hardness range of 76 – 84. Gaskets shall be tested in accordance with BS 7874. Gaskets for flanged joints shall be full face type. Gaskets shall be designed to meet a

working and test pressure of 16 bar and 24 bar respectively, when installed as intended in flanged and flexible joints.

All lubricants to be used in joints shall be provided by and recommended by the pipe and fitting manufacturer and shall have no deleterious effects on either the joint rings or pipes and shall be unaffected by the liquid to be conveyed.

Nuts and bolts used in flanges joints shall be provided by the pipes and fittings manufacturer and shall be made of steel in accordance with IS EN ISI 898. Metal washers shall comply with BS 4320. All nuts, bolts and washers shall be protected against corrosion in accordance with WIS 4-52-03 for a barrier and galvanic coating system. Flange assemblies, including nuts, bolts, washers and gaskets shall be designed to a working and test pressure of 16 bar and 24 bar respectively, when installed.

Manufacturers shall supply tape wrapping to be used for wrapping joints where required. The wrapping required shall be a high performance polyethylene wrap with a minimum thickness of 6mm.

Flange adopters shall comply with IS EN 14525 and shall have an allowable operating pressure of 16 bar. Flanges shall be PN16 rated and shall be drilled in accordance with IS EN 1092. The body of the end ring shall be ductile iron in accordance with IS EN 1563. Flange adaptors shall be suitable for use with ductile iron, cast iron, steel, PVC, asbestos cement and polyethylene. Flange adaptors for polyethylene pipes shall be designed for Type 1 end restraint to IS EN 12842 and IS EN 14525. The manufacturer shall supply any liners required to stiffen polyethylene or other pipe material types in accordance with his/her recommendations.

Couplings shall comply with IS EN 14525. Couplings shall have an allowable operating pressure of 16 Bar. The body and end ring shall be either, stainless steel minimum Grade 304 or ductile iron in accordance with IS EN 1563. Couplings shall be suitable for use with ductile iron, cast iron, steel, PVC, asbestos cement, polyethylene. Flange adaptors for polyethylene pipes shall be designed for Type 1 end restraint to IS EN 12842 and IS EN 14525. The manufacturer shall supply any liners required to stiffen polyethylene or other pipe types in accordance with his recommendations.

Dismantling joints shall be designed for a working pressure of 16 bar and be tested to comply with the performance requirements of WIS 4-21-02. The body shall be either, ductile iron in accordance with IS EN 1563 with a minimum tensile strength of 420 N/mm^2 or steel in accordance with BS EN 10025 with minimum grade S275. Dismantling joint flanges shall be minimum PN16 rated and flanges shall be drilled in accordance with IS EN 1092. All bolts shall be a minimum, either steel Property Class 4.6 in accordance with BS EN ISO 898-1 or stainless steel, with a minimum chromium content of 13%, in accordance with BS EN ISO 3506-1. All nuts shall be minimum, either steel Property Class 4 in accordance with BS EN ISO 898-2 or stainless steel, with a minimum chromium content of 13%, in accordance with BS EN ISO 3506-2.

Couplings shall be suitable for use with ductile iron, cast iron, steel or PVC pipe material:

3.18 Sluice Valve, Scour Valve and Air Valve Chambers

3.18.1 Sluice Valve Chamber

Sluice valve chamber for Rising Mains shall have a minimum plan area of 600mm by 600mm for pipes up to 350mm in diameter. Alternative dimensions for sluice valve chambers of 450mm by 600mm or 450mm by 450mm may be allowed subject to Irish Water review. Valve chambers for pipe diameters in excess of 350mm shall be varied to suit the size of the appliance being housed. Chambers can be constructed of pre-cast concrete or of high density blockwork. Alternatively, proprietary prefabricated chamber units may also be used, but only subject to the approval of Irish Water.

The walls of blockwork chambers shall be constructed with 215mm, 20N/mm² high density solid concrete block work, complying with the requirements of IS EN 771 – Part 3, laid on flat, bedded in M20 mortar, complying with the requirements of IS EN 998 – Part 2, and flush pointed, without internal plaster.. The walls of the chamber can alternatively be formed with reinforced pre-cast concrete units formed with C28/35 concrete, 20mm aggregate size, with mild steel reinforcement. The units shall be square, composite units, with a minimum wall thickness of 100mm, thickened at each corner. Single height precast units will be acceptable. If modular units are proposed, the pre-cast concrete units shall be bedded in M30 mortar, complying with the requirements of IS EN 998 – Part 2, and flush pointed.

The valve chamber floors shall be formed with C25/30 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 100mm complete with mild steel reinforcement. Alternatively, pre-cast reinforced concrete bearing slabs of similar depth and concrete strength may also be used. The floor slab shall be founded on the granular pipe surround material or on Clause 804 backfill material above the granular surround. The floor slab of valve chambers shall not be cast against the body of the sluice valve. A Drain hole shall be allowed in the base slab to allow free drainage of liquid from the chamber to free draining granular material below.

The chamber shall be complete with a reinforced concrete roof formed with C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, of minimum thickness of 150mm, reinforced with high tensile reinforcement to BS 4449.

The sluice valve chambers shall be surrounded with Clause 804 granular backfill material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works, compacted in 150mm layers, to the underside of the road/footpath structure.

Sluice valve chambers shall be covered with approved heavy duty cast iron surface box covers and frames, 445mm by 280mm plan area, to IS 261 or BS 5834, subject to the minimum mass of the cover per m^2 for Grade A being 250kg/m^2 and Grade B being 200kg/m^2. The covers and frames shall be suitable for road and traffic conditions. Third Party Certification shall be provided for all cast iron surface box covers and frames.

The sluice valve cover frames shall be supported on Class B engineering brick to IS EN 771 – Part 2, minimum of one course with a maximum of three courses. The brickwork shall be bedded in mortar, minimum M30 strength to IS EN 998-Part 2:2010. The frame and cover shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing. The covers shall be set on the brick to finish in alignment with the final road or footway surface. The finish of the road surface around the Chamber cover and frame shall be to the requirements of the relevant Roads Authority for the area.

The metal covers shall have appropriate identification marks on the cover. Covers for surface boxes on Rising Mains shall have either the word “WASTEWATER” or the letters “WW” cast on the top surface in 75mm letters. Covers shall have “SV” (sluice valve) imprinted on them. Covers shall be level with the finished ground level after permanent restoration.

The valve covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, bedded in Clause 804 material. The plinth shall be complete with bull-nose finish to its perimeter and shall be provided with a mild steel reinforcement link.

Proprietary prefabricated spindle tube units with surface box may be used only in special situations. Their use shall be subject to specific Irish Water requirements and written approval.

Concrete in all chambers, etc., shall comply with the requirements of IS EN 206, and granular material in the concrete shall comply with the requirements of IS EN 12620 (See also SR 16). (This provision shall apply to all situations within this Code of Practice Document where in-situ and structural concrete is required.)

3.18.2 Scour Chamber

The scour chamber shall be constructed off the line of the rising main with suitable access for a vacuum tanker. Scour chambers shall be provided to balance the scour discharge from the Rising Main and to collect the contents of the Rising Main during the scouring operation for separate disposal. Where possible, scour chambers should be located off carriageways and generally in areas only subject to foot traffic.

The scour chamber shall be constructed with precast concrete Manhole wall units completed with rubber sealing ring gasket between units, complying with the requirements of IS EN 1917 and IS 420, complete with a 150mm minimum thickness of cast in situ concrete formed surround, C20/25, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with either pre-cast or cast in-situ concrete base of C30/37 concrete, in accordance with IS EN 206, 20mm aggregate, in accordance with IS EN 12620, (300mm minimum thick) with a 400mm x 400mm x 200mm deep floor sump located beneath the roof opening.

The scour chamber shall have cast in-situ concrete roof slab (225mm minimum thickness), constructed of C30/37, 20mm aggregate size, reinforced with high tensile steel bar reinforcement, with a minimum 40mm concrete cover. Alternatively, precast concrete roof slabs (160mm minimum thickness) may be used subject to Irish Water approval and compliance with IS EN 1917 and IS 420. This approach would be the preferable option where pre-cast concrete ring units are used as scour chamber walls. An access opening shall be formed in the Manhole roof slabs. The minimum dimensions of the roof opening shall be 600mm by 600mm. Circular Manhole openings of 600mm diameter may be used if the scour chamber cover is circular.

The scour chamber shall have a minimum internal clear dimension of 1,350mm. Confined space access requirements will apply with planned safe access procedures.

The roof slab opening shall be provided with a cover and frame to comply with IS EN 124, Class D400, and BS 7903. Frames should be square with a square or circular insert with a minimum clear diameter/dimension of 600mm and a minimum depth of 100mm, if located in light traffic roads. Class D400 and Class E600 covers on heavily trafficked roads will require a 150mm deep frame. All covers shall be of non-rock design. Two closed keyways shall be provided in each cover. Where square covers are provided, they shall be double leafed covers and secured to prevent the cover section from falling into the chamber. Circular covers shall be single leafed. The covers shall be set in position flush with the finished ground surface, whether, road, pavement or open ground. Covers shall be level with the finished ground level after permanent restoration. The frame cover should be supported on solid engineering brick, 215mm wide, to IS EN 771 – Part 2, one course minimum and no more than a maximum of three courses in height, bedded and pointed in mortar, minimum M30 strength to IS EN 998-Part 2:2010. Alternatively, pre-cast reinforced concrete seating rings of similar depth to brick courses and of similar concrete strength may be used instead of brick where pre-cast rings are being used. The frame and cover shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing. Standard concrete blocks or bricks shall not be permitted. The cover frame should be installed and bedded to the manufacturer’s instructions. The finish of the road surface around the Chamber cover and frame shall be to the requirements of the relevant Roads Authority for the area.

The metal covers shall have appropriate identification marks on the cover. Covers for surface boxes on Rising Mains shall have either the word “WASTEWATER” or the letters “WW” cast on the top surface in 75mm letters. The cover shall also have “ScV” (scour valve) imprinted on it.

The scour chamber shall be provided with ductile iron inlet pipework, built into the walls of the chamber and fully sealed, complete with puddle flanges. The inlet pipe shall be fitted with a Wastewater sluice valve, complete with extended spindle to allow its opening from ground level. A surface box to IS 261 or BS 5834, subject to the minimum mass of the cover per m^2 for Grade A being 250kg/m^2 and Grade B being 200kg/m^2, shall be provided to over a roof opening to allow access to the extended spindle for the chamber sluice valve.

Scour valves, scour chambers and outlet pipes for large diameter mains shall be sized for an emptying time appropriate for a vacuum tanker identified by Irish Water. Each specific location for the scour valve chamber will require the approval of Irish Water and the relevant Local Authority.

The chamber shall be fitted with Manhole steps to comply with IS EN 13101, Type D, Class 1, galvanised mild steel and plastic encapsulated. Access to the confined space within the chamber shall not generally be required but when needed this access shall be by way of a safe access plan.

3.18.3 Air Valve Chamber

Air valves shall be installed in chambers and these shall be suitably sized to accommodate the air valve and allow access for maintenance/replacement. The chamber should be located to allow ease of access and maintenance of the air valve. The base and walls of the chamber shall be constructed in C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, with a minimum thickness of 300mm and 250mm respectively. The chamber shall be complete with a reinforced concrete roof of minimum thickness of 225mm, formed with C30/37 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, reinforced with high tensile reinforcement to BS 4449.

The roof slab shall incorporate a 900mm x 900mm opening to allow the visual inspection of the air valve and to allow access to the associated isolating valve. Cast-in recessed lifting lugs shall be provided in each corner of the concrete roof slab to allow its positioning in place. In addition, these lifting lugs shall be used to remove the roof slab for access to the chamber to allow maintenance of the air valve and its removal and replacement if necessary. Access to the air valve chamber will be by way of an approved safety plan during the operational life of the unit.

The internal dimensions of the chamber shall be sufficient to contain the air valve and any associated pipework. The bolts and joints shall be visible and accessible in order to allow for maintenance and for the possible future replacement of the air valve without

the need for excavation. The depth of the meter chamber shall provide a minimum of 300mm clearance beneath the air valve fitting. Sufficient clearance shall be provided between the walls and the air valve equipment to allow maintenance activities to be carried out.

The air valve chambers roof slab opening shall be provided with approved ventilated heavy duty metal surface covers to IS EN 124 & BS 7903, rating D400, if located on roadways or footways. Lower load capacity rated covers may be used if the chamber is located off road in green areas.

The cover frames shall be supported on Class B engineering brick, 215mm wide, to IS EN 771 – Part 2. The brickwork shall be bedded in mortar, minimum M30 strength to IS EN 998-Part 2:2010. Alternatively, pre-cast reinforced concrete seating rings of similar depth to brick courses and of similar concrete strength may also be used instead of brick where pre-cast concrete units are used. The frame and cover shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing. The covers shall be set on the brick to finish in alignment with the road or footway surface. The finish of the road surface around the Chamber cover and frame shall be to the requirements of the relevant Roads Authority for the area. Air valve chamber covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, bedded in Clause 804 material. The plinth shall incorporate mild steel reinforcement links and shall have a bull-nose finish around its external perimeter.

The metal covers shall have appropriate identification marks on the cover. The covers for surface boxes on Rising Mains shall have either the word “WASTEWATER” or the letters “WW” cast on the top surface in 75mm letters. The cover shall also have “AV” (air valve) imprinted on it. Covers shall be level with the finished ground level after permanent restoration.

Access to the air valve chamber confined space shall be subject to a safety access plan. Access to the air valve chamber for maintenance of the air valve shall be achieved by removal of the roof slab unit.

3.19 Existing Utilities

It is the responsibility of the Developer and/or designer to obtain all current information on the location of other existing utility providers’ apparatus prior to the design being carried out. During installation, due diligence should be used when making excavations for Sewers and services and care shall be taken to protect and support all existing services (water, gas, telecommunications, drainage, electricity, etc.) and other works so as not to interfere with the working arrangements and integrity of such utilities.

3.20 Working near Existing Pipes (Notifications and Separation Distances)

Detailed proposals, including work method statements, insurance confirmation and details of work completed of a similar nature must be submitted to Irish Water for its consideration before approval will be issued prior to undertaking work in close proximity to Irish Water assets. All such works in the vicinity of Water Mains or Sewers of 400mm diameter and greater shall be subject to written agreement with Irish Water **before construction commences on site**. This agreement shall also include any necessary protection for Water Mains and Sewers. The placing of concrete over or around Water Mains is expressly forbidden.

In the case of installations in close proximity to **existing** Water Mains and Sewers, the following minimum horizontal distances shall be maintained between pipes/ducts, cabinets, poles, Manholes, junction boxes, chambers, etc. where depth to the existing infrastructure does not exceed 1.5m:

3.20.1 600mm at either side of pressure mains up to and including 150mm diameter;
3.20.2 1m at either side of pressure mains of 200mm to 250mm diameter;
3.20.3 2m at either side of pressure mains of 300mm and 375mm diameter;
3.20.4 5m at either side of pressure mains of 400mm and 450mm diameter;
3.20.5 Specific Irish Water advised distances for pressure mains in excess of 475mm;
3.20.6 600mm at either side of gravity sewer up to and including 225mm diameter;
3.20.7 1m at either side of gravity sewer of 300mm and up to 450 mm diameter;
3.20.8 1.5m at either side of gravity sewers of 600mm diameter and greater.

Specific written permission shall be required from Irish Water for installing infrastructure closer to existing Irish Water asset than the limits outlined above or where the depth of the existing service exceeds 1.5m. For strategic fibre optic or oil filled cables, the separation distance requirements of the service provider shall apply. Irish Water may require increased clearance separation distances in excess of the specific utility providers requirements.

The separation distances between new pipework associated with the Works and between the pipework associated with the Works and other utility pipework are set out in **Section 3.5.18** and **Section 3.5.19** above.

Where pipes or ducts are to be laid close to an existing Water Main or Sewer in the ownership of Irish Water, notification in writing shall be provided a minimum of 15 working days ahead of the commencement of the work. This requirement shall also apply to the carrying out of trial holes or slit trenches to locate the main or to gather ground investigation data. In the case of large diameter (350mm or greater) distribution and trunk Water Mains and Sewers, Irish Water must be notified at least one month before the work is commenced. This notification is in addition to any formal procedures

detailed elsewhere in this document. The notifications shall apply where work is proposed within the following proximities of Irish Water infrastructure:

3.20.9 1m at either side of existing pipes less than 200mm diameter;
3.20.10 2m at either side of existing pipes of 200mm to 350mm diameter; and
3.20.11 5m at either side of existing pipes of 350mm or greater.

Developer' s shall also comply with any notification requirements associated with other utility providers' infrastructure (ESB Networks, Gas Networks Ireland, telecommunications providers, etc.) that these Utility Companies might have.

Any costs arising from the Developer work associated with locating pipework or any costs due to work undertaken by Irish Water or its agents to assist the Developer in identifying and locating the infrastructure shall be fully covered by the Developer. The Developer will be notified of these costs in advance.

Irish Water reserves the right to revert to the Developer with specific requirements in relation to protection of its Water Mains and/or Sewer. Care shall be taken while laying pipes so as not to damage any Water Main or Sewer or any accessories. Any damage shall be notified immediately to Irish Water on the Irish Water website, www.water.ie. The person who causes the damage to a Water Main or Sewer or any accessories will be deemed to have committed an offence under Section 45 of the Water Services Act 2007.

3.21 Environmental Considerations

The design should take into account the impact of the Works on the environment and the impact of the environment on the Works. Cognisance should be taken of amenity conservation, preservation of access to the public and facilitation of recreation when designing infrastructure. Consideration should also be taken of areas of specific ecological interest such as Special Area of Conservation (SACs), National Heritage Area (NHAs), etc.

The design of landscaping works shall be undertaken concurrently and in conjunction with the design of the Works. The collaborative design process shall incorporate and take account of any likely assessed negative impact(s) on the root zones and root protection areas of trees and/or large shrubs on the Works. The design process shall seek to minimise risk to roots and the risk of root ingress to the Works by appropriate separation distances or by the provision of root protection barriers.

The design, procurement and supervision of the landscaping works next to and over the Works shall be undertaken by the Developer using a fully qualified and competent landscape architect, working in collaboration with a fully qualified and competent arboriculturist, both in consultation with Irish Water. Any part of Works which does not have special tree root protection measures shall be positioned with adequate separation from new trees/shrubs to ensure that their root systems will not cause damage to the

infrastructure. These separation distances will vary from (tree and shrub) species to species and specialist advice shall be obtained by the Developer from his/her landscape architect and arboriculture advisers in this regard, as outlined above, and provided in the Design Submission.

Special tree root protection measures may be provided to reduce the separation distances between the Works and the new planting. The design of the tree planting and species selection will need to be decided in relation to the depth of the pipe and the distance from the Works. Where tree planting is proposed within the distances where tree roots could directly damage the Works, as referenced in Table A1 of BS 5837, special protection measures shall be provided. These measures might be achieved in the pipe system by the provision of high performance joints or the use of polyethylene pipes with welded joints. Alternatively, proprietary protection systems, such as vertical barriers, geotextile pipe wrap, tree planting pits, etc. may be used to prevent the tree roots systems from reaching the Works.

Tree planting will not normally be allowed directly over the Works or within the distances referred to in Table A1 of BS 5837, but this may be increased depending on the species type or relaxed where it can be shown that appropriate species selection and protection measures can be provided to prevent root ingress damage to the satisfaction of Irish Water. Such protection measures may include root barriers, root directors and by avoiding planting next to joints, valves or other sensitive parts of the pipe system.

Where such planting is carried out directly over the Works and where excavation is required to subsequently access the infrastructure, there may be a requirement to remove the trees/shrubs, but this will be assessed on a case by case basis and any possible mitigation measures to reduce impact on tree vegetation should be investigated before a final decision to remove the tree vegetation is taken. Only shallow rooting shrubs shall be planted close to or over the Works.

Where new pipe installation works are to be carried out near existing tree vegetation, these shall be in accordance with the provisions of BS 5837 (Trees in Relation to Design, Demolition and Construction – Recommendations) and the National Joint Utilities Group (NJUG), Guidelines for Planting, Installation and Maintenance of Utility Apparatus in Proximity to Trees, Volume 4, which outline the following zones:

Prohibited Zone (1m from tree trunk): Excavation of any kind shall not be undertaken within this zone unless, after full consultation with an arboriculturist or landscape consultant, it is deemed acceptable. No material, plant and spoil shall be stored within this area.

Precaution Zone (defined as a radius of four times the circumference of the tree at 1.5m above ground level): Where excavation is carried out within this zone, the use of mechanical excavation plant shall be prohibited. All such excavation works shall be carried out manually or with the aid of an air-spade or vacuum and precautions shall be undertaken to protect any exposed roots from damage. All such excavation

works shall be supervised by a qualified arborist. No material, plant and spoil shall be stored within this area.

Permitted Zone (outside the Precaution Zone): Excavation works may be undertaken within this zone, but caution must be applied and the use of mechanical plant limited. Any exposed roots should be protected.

:

The installation of any new pipework or the planting of new tree vegetation within the vicinity of existing pipe systems will need to take account of the provisions of BS 5837 and BS 8545. Irish Water does not favour planting over its Networks.

3.22 Food Service Establishments

A Grease Recovery Unit (GRU) must be fitted on the outlet from all kitchen sinks within Food Service Establishments (FSE) and commercial buildings with food preparation or canteen facilities subject to the requirements of Irish Water. Cognisance shall be taken of the guidance provided in the Water Services Training Group Guidance Document for Control of Fat, Oil and Grease or any updated guidance as may be issued by Irish Water. Grease traps and/or GRUs must also be fitted on any commercial scale food preparation locations to achieve the discharge limits set out in the Trade Effluent Licence. The use of degreasing agents and enzymes for the breakdown of grease is not permitted, except with the agreement of Irish Water.

3.23 Grease Traps

Trade Effluent from commercial food preparation areas is subject to Trade Effluent Licensing, in accordance with the provisions of the Local Government (Water Pollution) Act (1977 – 1990). Such discharges shall discharge to a suitably sized and manufactured grease trap, designed in accordance with IS EN 1825, prior to discharge of the Wastewater to the Works. Full details of the grease trap, including details of the proposed maintenance regime, shall be submitted to and agreed with Irish Water's Wastewater Source Control and Licencing (WWSCL) unit. These details shall include design loading of the grease trap, grease trap capacity, etc. Compliance with guidance as set out in the Water Services Training Group Fat, Oil and Grease (FOG) Guidance Document and Irish Water's policy is required in respect of FOG control.

3.24 Macerators

No under-sink or other type of food macerator/grinder for the processing, discharging or disposal of food waste to the drainage system shall be installed in developments.

3.25 Basements

Special provision shall be provided by the Developer where Works are required to collect Wastewater from basement areas. All Wastewater from basements shall be pumped to ground level to discharge by gravity to the Irish Water Network. The pumped

Wastewater shall discharge initially to a standoff (Rising Main discharge (header)) Manhole before discharging to a Gravity Sewer connection to a Manhole on the public Sewer (See **Section 3.7.14** and **Section 3.15**). Direct pumping to the Network shall not be permitted.

Storm Water from basement car parks shall not be discharged to the Network. Such discharge shall be directed to the existing Storm Water Sewer in accordance with the requirements of the Local Authority for the area. Specific requirements may be required by the Local Authority for the prevention of Storm Water flows from basements via access points, provision of petrol/oil interceptors on Storm Drains, etc.

3.26 Marker Tape

All sewers and rising main pipework shall have non-degradable marker tape, red or orange in colour, installed 300mm above the crown of the pipework or above the granular surround material and directly above the centreline of the Pipe. The marker tape shall be laid around Manholes in the case of sewers to ensure continuity. It shall be tied to rising main fittings (valves) at a depth of 350mm and terminated at the pumping station. The tape shall be 400mm wide brown polyethylene material, in accordance with IS EN 12613 – Plastic Warning Devices for Underground Cables and Pipelines with Visual Characteristics. Plastic pipes and concrete pipes shall have a warning mesh incorporating a polypropylene reinforced band of stainless steel tracer wire. The correct operation of the tracing wire shall be tested.

Service Connections shall have a 200mm wide tape laid at the same depths as outlined above (300mm).

3.27 Indicator Marker Plates and Posts

Indicator plates shall clearly identify scour valve, wastewater air valves, meter and sluice valve locations. They shall be located to the approval of both Irish Water and the Roads Authority for the area. The plates shall be mounted on marker posts at the back of footpaths or on the boundary wall of the public thoroughfare nearest to the hydrant or valve.

The indicator plates and baseboard plates shall comply with BS 3251. The plate shall show the diameter of the Rising Main in “mm” and the distance from the marker to the fitting in “m”. Indicator plates shall have fixed black letters (AV, SV, ScV and Me respectively) on a brown background. The plate shall show the diameter of the Main in “mm” and the distance from the marker to the fitting shall be indicated in “m”. Marker plates shall be metal and shall be fixed with stainless steel non-retractable screws.

Marker posts shall be of concrete construction, complying with IS EN 206, to conform to IS 162. They shall be set 450mm deep in a 0.06 m3 support base of C25/30 concrete, 20 mm aggregate size.

Plastic marker posts shall not be provided under any circumstance. Plastic indicator plates shall not be provided.

Part 4 – Construction Related Issues

4.1 Construction – General Requirements

The Developer shall be responsible for ensuring that the Works are properly constructed in accordance with this Code of Practice. The Developer shall give notice to Irish Water before construction of the Works commences and shall meet with the Irish Water Field Engineers to agree procedures and a programme of inspections for quality assurance of the infrastructure installation.

The Developer shall keep accurate site records of the installations during construction to allow for the preparation of accurate record drawings of the installed infrastructure. The Works shall be constructed strictly in accordance with a design which has been submitted by the Developer to Irish Water and which has been assessed and accepted by Irish Water.

Sewers, service connections, Rising Mains, pumping stations and ancillary works shall be constructed taking due cognisance of the requirements of this Code of Practice in a manner such that:

a) where relevant, materials are:
   i) adequately selected, mixed or prepared; and
   ii) installed, used, or fixed to perform adequately the functions for which they are intended;
b) no part of the Works is damaged or its function impaired by:
   i) the method of construction; or
   ii) runoff from the construction site entering the Sewer system;
c) damage to existing ecosystems and major trees in the Development site is prevented;
d) soil erosion is minimised;
e) infrastructure installation is carried out in a safe, healthy and efficient manner;
f) the environment is protected.

All necessary precautions shall be undertaken to avoid causing damage to or interference with flow in existing water supply systems, public Sewers, etc., and such precautions shall ensure that debris, silt and mud, etc. do not enter the existing Sewer system or any new Sewer system being installed as part of the new Development.

All necessary precautions shall be taken to avoid misconnection of the new Works or service connections to other utilities, to existing Sewer systems or to water bodies that are not proposed as the disposal route for which the connection is approved. For clarity, Wastewater service connections shall only be connected to Wastewater collection infrastructure. Storm Water pipework shall not be connected to Wastewater collection infrastructure.

Surface Water from the construction site should not be allowed to enter the Works.

Construction operations shall be carried out in such a manner as to avoid damage to or deterioration of the integrity of adjacent buildings or other infrastructure. Excavations in roads and streets shall be carried out in accordance with the relevant Roads Authority and the Road Opening Licence requirements. The construction operations shall be carried out in accordance with the provisions outlined in the Guidance for Control and Management of Traffic at Road Works, as published by the Department of Transport, Tourism and Sport. All necessary precautions shall be taken to avoid

- causing damage to, or interference with flow in, existing public Sewers, and shall ensure that debris, silt and mud etc. do not enter the Sewer.
- misconnection of Wastewater drainage systems to Storm Water Drains or Sewers, or Storm Water drainage to Wastewater Drains or Sewers.
- misconnection of Wastewater collection Network to watercourses or other water bodies.

On completion of construction all internal surfaces of the Works and access points shall be thoroughly cleansed of all deleterious matter to prevent it passing into the Network. The Works shall be tested and inspected to ensure that:

- It is fit for all practical purpose, leak-tight based on the test requirements outlined in Section 4.10;
- It has been properly cleaned, scoured, swabbed and disinfected and that water quality testing has been carried out and found satisfactory;
- Pipes have not been damaged, deformed or subject to settlements during construction;

Specific on-site surveys shall be carried out to confirm that misconnection of services to Wastewater and to Storm Water Sewers has not occurred. This shall be achieved by the use of dye-testing of pipework in advance of putting these connections into service. These tests shall be carried out in the presence of the Irish Water Field Engineers.

Gravity Sewers, pressure pipelines, Manholes and inspection chambers shall be leak tight when tested after backfilling based on test requirements outlined in **Section 4.10**.

4.2 Transportation, Storage, Handling and Use of Materials

Precautions shall be taken to prevent damage to pipes and fittings during transportation, storage, handling and use of materials.

Suitable pipe supports shall be used on vehicles transporting pipes to prevent damage to both internal and external coatings by impact, scratching, abrasion, etc.

Purpose made wide fabric slings or suitably designed machines for lifting pipes shall be used during offloading and/or laying of pipes (particularly flexible pipes with concrete or

cement-mortar linings) to avoid damage and scratches to coatings as well as damage to pipe ends. Damaged pipes shall not be used in the Works.

All pipes and fittings shall be stored off the ground in a clean environment to prevent any contamination of the material prior to its use. Timber supports shall be used during transportation and stacking on site. Pressure pipes shall be capped at either end until they are used in the Works to prevent vermin and debris entering them and contaminating the material before their use. All fittings shall be supplied in sealed bags and they shall remain in these bags until immediately prior to installation. All pipes and fittings (and in particular plastic pipes) should be kept clear of fuel oils, and any material which becomes contaminated should be discarded.

Materials and components shall be handled in such a manner as to avoid any damage or contamination and in accordance with the applicable recommendations of the manufacturers. Pipes and fittings, including coatings and linings, shall be examined for damage prior to installation in the works. Plastic pipes shall be carefully examined for flaws, in particular for signs of impact damage and scoring. No polyethylene pipe shall be installed with scores or cuts penetrating more than 10% of the wall section thickness. If, after installation, scores or cuts penetrating more than 10% of the wall section thickness are found, the affected pipe length(s) shall be removed and replaced with an undamaged pipe length.

4.3 Location of Other Utilities

All available records shall be used to identify the location of utility ducts, cables, pipes, etc. Proprietary cable locators shall be used prior to excavation taking place to locate and mark these utilities. Trial hole to locate existing services shall be carried out where required. Precautions shall be taken when carrying out trial holes and making excavations for pipes and services to ensure no damage is caused to existing services. Care shall also be taken to protect and support all existing services and other works so as not to interfere with the working arrangements of the services.

4.4 Trench Widths

The trench width shall be kept as narrow as possible but the width must allow adequate room for pipe jointing as well as placing and compaction of pipe bedding, haunch, surround material and backfill material. Trench widths at the level of the top of the pipe should generally be as narrow as safe working conditions will allow, with a desirable minimum width of 300mm plus the external diameter of the pipe barrel, or a minimum trench width of 500mm. The trench width should not exceed the pipe diameter by more than 500mm.

Trench widths for pipe sizes up to 80mm diameter may be less than 500mm subject to consideration being given to the trench depth, health and safety consideration and access requirements.

In ground that contains ashes, chemicals or material that could accelerate corrosion or deterioration of the pipe, contact shall be made with the Environmental Protection Agency in relation to contaminated soil disposal requirements.

Edges of trenches in bituminous or concrete roads, footpaths and hard surfaces shall be cut using a concrete saw or other equivalent mechanical means in advance of breaking through the paved surface above the trench position. This shall be carried out in all instances to reduce damage to the remaining hard surface and to restrict over-break of the trench.

4.5 Trench Base

The trench base shall be free of hard objects such as stones, rock projections, tree roots, etc. Where the trench base is through rock or shows recurrence of hard objects, the material shall be excavated and allowance should be made for an additional thickness of bedding of at least 150mm and the void backfilled with Clause 808 granular material in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works. Soft spots in the trench base shall be excavated out and replaced with Clause 808 material as outlined in **Section 4.7** below.

4.6 Cleaning Pipes

Before installation, all pipes for inclusion in the Works shall be examined internally for dirt, stones or any foreign matter and shall be thoroughly cleaned before installation in the final position. To prevent foreign matter or vermin from entering the Works, all open ends of laid pipes shall be plugged, if work is suspended, until the next pipe is ready for jointing. If proprietary pipe stops/plugs are supplied, they shall be left in place until just before jointing.

4.7 Pipe Bedding, Haunch and Surrounds

Pipe bedding, haunch side fill and surround material for buried pipelines shall comply with WIS 4-08-02 and its associated Guidance Note, IGN 4-08-01, UK Water Industry Specifications, both updated in 2008. Granular material shall be 14mm to 5mm (designation d/D 2/14) graded aggregate or 10mm (designation d/D 4/10) single sized aggregate, complying with the requirements of IS EN 13242 and should have a compaction factor value not greater than 0.2 when measured in accordance with IS EN 752. Both the 14mm to 5mm (designation d/D 2/14) graded aggregate and the 10mm (designation d/D 4/10) single sized aggregate may be used for pipe diameters greater than 100mm and up to 300mm. The 10mm (designation d/D 4/10) single sized aggregate shall be used with 100mm pipes or less. The 14mm to 5mm (designation d/D 2/14) graded aggregate shall be used for pipe diameters of 350mm and above.

Pipes shall not be supported on stones or rock at any point along the pipe trench. Rock shall be excavated to a depth of 150mm below the pipe invert of the trench required and the void backfilled with Clause 804 granular material in accordance with the Transport

Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works. The granular bedding material shall be laid above this void backfill material.

All Sewer pipes and Rising Mains, either rigid or flexible, shall be laid on a bed of granular material. A minimum bed thickness of 100mm shall be provided for pipes up to 100mm diameter. A minimum bed thickness of 200mm shall be provided for pipe diameters between 150mm and 450mm. Rigid pipes, as a minimum, will be provided with a haunch of granular material to half the pipe diameter height. Flexible pipes shall have a haunch of granular material and an additional surround of granular material from the top of the granular haunch to a minimum depth of 150mm above the crown of the pipe.

Bedding and haunch side fill of granular material shall be placed uniformly underneath and on either side of the pipe, in layers not exceeding 100mm, each layer being compacted by non-mechanical tamping until the required depth of bedding and side fill has been achieved. Where a full granular pipe surround is required, it shall be placed above the side fill material in a similar fashion to bedding and side fill. Surround material shall be installed to the required depth above the pipe crown. The minimum depth of pipe surround material above the external crown of the pipe shall be 150mm at least. This depth shall be increased to 300mm where pipes are located adjacent to trafficked areas or where they are installed along roads and footpaths. Care shall be taken that the process of placing of the bedding, side fill and surround material does not displace the pipe from its correct line and level.

Where the Sewer or Rising Main is installed along roads and footpaths the minimum cover of granular surround material shall be 300mm above the crown of the pipe, irrespective of the pipe being either rigid or flexible. The pipe trench above the granular surround in this instance shall be backfilled in accordance with the requirements of **Section 4.8** below for road and footpath areas. If a Sewer or Rising Main is installed in a green field area the minimum cover of granular surround material shall be 200mm above the crown of the pipe and the Backfill shall be in accordance with **Section 4.8** below for green field areas.

Pipe protection measures may be required to address impact from loading in heavily trafficked areas and to address minimum pipe cover situations. The detail shall be subject to submission to and assessment by Irish Water before advancing with the work.

If the depth of cover to the crown of the pipe is less than the values set out **Section 3.9**, protection measures shall be provided. Consultation with Irish Water is required in relation to the provision of these measures. In order of precedence, the protection measures may comprise either the provision of a reinforced concrete slab designed to spread the imposed traffic load away from the pipe, or the provision of full concrete surround, complete with flexible joints, where required, or the use of a ductile iron pipe in lieu of the original pipe material, provided there are no service connection in this length of pipe. These alternative protection measures shall extend for the distance where the depth is below the depth limits outlined above. A combination or a mix of all

of these additional protection measures may be required and are to be agreed with Irish Water. However, the primary approach should be to provide the pipe with the required depth of cover as outlined above in **Section 3.9.1 to 3.9.6**.

The protection slab shall be a minimum of 150mm thick and constructed of C30/35 concrete to IS EN 206 and reinforced with high tensile reinforcement to BS 4449.

Concrete bed, haunch and surrounds of pipes shall be a minimum thickness of 150mm away from the external wall of the pipe with an absolute minimum depth of cover above the external crown of the pipe of 750mm. The concrete should be C16/20, in accordance with IS EN 206, 20mm aggregate, in accordance with IS EN 12620, with a vertical haunch to the mid-point of the pipe, in the case of bed and haunch and vertical faces to the full surround. The haunch and surrounds shall be formed using formwork to provide a rough cast finish. Expansion joints in the concrete surround shall be provided at all joints to allow for pipe flexibility.

The use of a ductile iron pipe in lieu of the original pipe material for the distance where the depth is below limits outlined may also be acceptable, provided the depth above the crown is not less than 750mm.

Where soft ground conditions (situations where a California Bearing Ratio (CBR) less than 5 exists) are anticipated or encountered, the soft material shall be excavated and disposed to an approved disposal area, in accordance with the Waste Management Act. Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works, shall replace the entire extent of the excavated material. Approved geo-textile wrapping shall be provided to this additional backfill. Alternatively, special pipe support arrangements, including piling, beam supports, etc., may be required where the depth of soft material is excessive. Such arrangements relating to soft fill material replacement and/or pipe supports shall be subject to submission to Irish Water of detailed proposals for review and a response from Irish Water indicating agreement is required before advancing with the work.

4.8 Backfill

Backfill material shall be placed above the granular surround material described in **Clause 4.7** up as far as the underside of the road construction.

The Backfill material shall comprise Clause 804 granular material, in accordance the TII “Specification for Road Works”, and it shall be used where the Water Main is installed along proposed roadways and footpaths in the Development. If the backfill material is within 500mm of a concrete pipe of structure, Clause 808 material shall be used instead of Clause 804 material. The use of Clause 804/808 Backfill material shall also apply where the trench is in green areas running within 500mm of roadways and footways. The Backfill material shall be placed in layers not exceeding 200mm, each layer being compacted to the requirements of the TII Specification for Road Works. The first layer of

backfill above the granular surround shall be compacted in 150mm layers. Mechanical compaction equipment shall not be used until there is a minimum of 450mm of compacted material above the crown of the pipe.

Alternative Backfill material to that described above (Clause 804 or Clause 808) of the pipe trench will only be allowed by Irish Water where the Roads Authority in whose functional area the Development is located provides **written approval** to the Developer for the use of such alternative acceptable material. Evidence of this written approval to use alternative acceptable Backfill material shall be provided to Irish Water in advance of the commencement of construction on site or in advance of the issue of the Connection Agreement, provided construction has not commenced on site. The relevant Roads Authority should specify this alternative acceptable Backfill material and this should require compliance with the definition of "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, with the specific Class of "acceptable material" clearly nominated by the relevant Roads Authority in the written approval.

Backfill to the pipe trench above the pipe granular surround material and beneath the road surface in Public Roads shall be to the requirements of "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads", Second Edition, or subsequent amendments published by the Department of Transport, Tourism and Sport, unless otherwise specified and to the requirements of the relevant Road's Authority's Road Opening Licence.

The opening, backfilling and reinstatement of trenches on National Roads shall be in accordance with the TII "Specification for the Reinstatement of Openings in National Roads" July 2011, unless otherwise specified.

In the case of any discrepancy between this Code of Practice and the "Guidelines for the Opening, Backfilling and Reinstatement of Trenches in Public Roads" or the TII "Specification for Road Works" where pipes are located in Public Roads, this Code of Practice and their associated Standard Details shall take precedence.

Selected excavated material may be used as trench backfill in green-field areas above the granular pipe surround material with the approval of Irish Water. This selected back fill shall comply with the requirements of "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, Class 8, Class 2 (Miscellaneous Fill) and is generally referred to as Type B fill. It shall be uniformly compactable material free from clay lumps greater than 75mm, stones greater than 40mm, tree roots, vegetable matter, any kind of building rubbish, etc. This material shall be placed in layers not exceeding 300mm in depth and compacted in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works.

Where Sewer pipelines are installed traversing a public road, the backfill material above the granular surround shall comprise cement bound granular material (CBGM), Category B, in accordance with the TII “Specification for Road Works”, Series 800.

4.9 Anchor/Thrust/Support Blocks for Rising Mains

Gentle curves may be formed in the Rising Main pipeline by angular deflection of the pipe joint. The maximum angular deflection of each joint shall not exceed the manufacturer’s recommendation. At the locations detailed below, where pipes need to be restrained against movement under pressure, concrete thrust blocks shall be provided. Concrete thrust blocks shall be positioned symmetrically with respect to the connecting pipe or bend.

Appropriate thrust blocks shall be designed and installed on Rising Mains where required. Except where welded polyethylene pipes or self-anchoring joints are used, thrusts from bends and branches in Rising Main shall be resisted by concrete thrust blocks cast in contact with undisturbed ground. The thrust blocks shall be designed in accordance with CIRIA Report 128, “Guide to the Design of Thrust Blocks for Buried Pressure Pipelines”. The requirements for thrust blocks for polyethylene pipes shall be based on the manufacturer’s advice.

Anchor and support blocks shall be constructed with concrete, C20/25, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620. The thrust blocks shall be formed using formwork to provide a rough cast finish. Anchor/thrust blocks shall be provided on Rising Mains at bends of curvature of 11.5 degrees or greater, at both sides of air valve chambers, at any abrupt change in vertical or horizontal direction, at scour fittings and at any location where liquid pressure is likely to distort the pipe line installation or cause disproportionate movement. Plastic and polyethylene pipes shall be wrapped in a compressible filler board, in accordance with IS EN 622-1 and IS EN 622-4, with an outer plastic sheeting having a composition in accordance with BS 6076 before being cast against or into anchor/thrust blocks.

Concrete support blocks shall be cast to scour valve tees and air valve fittings installed on polyethylene pipe lines in order to resist torque forces imposed on the fittings during operation. Anti torque support blocks will only be required on sluice valves associated with ductile iron pipe fittings of 150mm and above. Support blocks shall be cast so as not to interfere with the operation and maintenance of the apparatus. In general support blocks shall not cover pipe or fitting joints. Where this is unavoidable, the fittings/bolts shall be wrapped in protective, non-biodegradable, tape.

All thrust/anchor/support blocks shall be allowed to develop adequate strength before any internal pressure is applied to the pipeline.

Support blocks of concrete grade C25/30, in accordance with IS EN 206, 20mm aggregate size, in accordance with IS EN 12620, or special pipe support arrangements, including piling, beam supports, etc., are required where Rising Main pipes are laid in

boggy or swampy conditions. Special support blocks are also required to anchor pipes where gradients are **1:6** or greater. Design of supports, piles, ground beams should be provided to Irish Water for assessment and review and additional information may be required to complete this assessment. Pipe joints shall allow for longitudinal movement due to thermal effects and thrusts due to internal pressure.

The Developer shall advise and seek review by Irish Water's Connection and Developer Services where it is proposed to install rising mains with gradients that are steeper than 1:10. Alternative gradient proposals may be required in such instances.

While anchorage is required to resist thrust, it is not necessarily required at junctions or bends where a fully integrated fusion weld PE pipe system is in place. However, the provision of suitable anchors at bends in excess of 22.5 degrees on fully integrated fusion weld PE pipe systems shall be provided in accordance with the pipe manufacturer's recommendations and requirements. Compressible filler board, in accordance with the provisions of IS EN 622, Part 1 to Part 4, wrapped in plastic sheeting having a composition in accordance with BS 6076, shall be provided for protection between the concrete and the polyethylene pipe. Bituminous material shall not be allowed come in contact with polyethylene pipes.

4.10 Testing of Gravity Sewers and Manholes

The Works shall be tested by the Developer as work progresses and on completion of construction of specific pipe lengths. The main pipeline shall be air or water tested in accordance with the requirements of IS EN 752 and IS EN 1610. On completion of the construction works, all pipelines shall be thoroughly cleaned and all deleterious material removed. The test of Gravity Sewers and Manholes shall be conducted in the presence of representatives of Irish Water or its agents. A Gravity Sewer condition survey (CCTV) shall be carried out by a competent inspection contractor in accordance with **Section 1.9** above.

The pipe test shall be conducted after the Gravity Sewer is installed and jointed and before any concreting or backfilling commences. A further test will be carried out after the backfilling is completed and a further test may be requested after any connections have been made to the Sewer system.

The air test shall be carried out in accordance with IS EN 1610, to either LA or LC requirements as outlined in Table 3 of IS EN 1610. The LA air test will generally be applied and involves the pumping in of air to the gravity pipework until a pressure of 100mm of water is indicated on a U-tube connected to the system. The pipe is left to stand for 5 minutes to permit pressure stabilisation before commencement of the test. A drop of less than 25mm over a period of a further 5 to 7 minutes, depending on the pipe diameter, without further pumping, will give rise to a positive test result. An air test to LC standards as outlined in Table 3 of IS EN 1610 will be required where the water table is likely to be high. This involves the pumping in of air to the gravity pipework until a pressure of 1000mm of water is applied. The pipe is left to stand for 5 minutes to permit

pressure stabilisation before commencement of the test. A drop of less than 150mm over a period of a further 3 to 4 minutes, depending on the pipe diameter, without further pumping, will give rise to a positive test result. The air test shall be conducted in the presence of an Irish Water field engineer or an Irish Water agent's supervisor.

Failure of the air test is not conclusive when failure does occur, a CCTV survey shall be carried out to identify the defect in the Gravity Sewer indicates the repairs required. Following the rectification of the defect, a water test shall be carried out. Acceptance or rejection of the pipe shall be based on the results of the water test.

The water test is to be carried out in accordance with the requirements of I.S. EN 1610. The water test involves the filling of the pipeline to a depth of 1.0m above the crown at the high end Manhole of the pipe while ensuring that the water level above the crown of the pipe at the lower end does not exceed a depth of 5.0m. Steeply graded pipelines shall be tested in stages in cases where the maximum head, as stated above, would be exceeded if the whole of the section were tested in one length.

The pipeline shall be filled with water and allowed to stand for a minimum period of one hour after filling to allow absorption, topping up as necessary to the original level, before starting the test. The test shall be conducted for a period of 30 minutes. The rate of water loss shall not exceed 0.15 litres/m^2 (m^2 refers to the total area of the wetted internal surface) where pipelines are tested on their own. On that basis the maximum water loss for a 100m length of Sewer over the test period would be 7.5 litres for a 150mm pipe, 11.5 litres for a 225mm pipe, 15 litres for a 300mm pipe, etc. This threshold water loss may be interpolated from the above for the various lengths of the Sewer under test between Manholes. Where pipelines and Manholes are tested together, the rate of water loss shall not exceed 0.2 litres/m^2 (m^2 refers to the total area of the wetted internal surface). The water test shall be conducted in the presence of an Irish Water field engineer or an Irish Water agent's supervisor.

Manholes shall be tested after construction by means of a water test for infiltration and exfiltration. The proportion of Manholes to be tested in each Development will be at the discretion of the Irish Water field engineer and will depend on the number of Manholes being provided. The number of Manholes to be tested will be advised by the Irish Water field engineer to the Developer. Manholes shall be substantially watertight with no discernible water loss out of or infiltration into the structure.

The exfiltration test requirement for water tightness of Manholes shall be carried out in accordance with IS EN 1610. The test comprises the following:

- Filling the Manhole up to the up to the soffit level of the cover slab below ground level of the Manhole,
- Allowing the water to set for a period to allow for conditioning, usually 1 hour is sufficient, a longer period may be required in dry weather.
- Water test the Manhole for a duration of 30 minutes (+/- I minute)

- Test requirement is satisfied if the amount of water added to bring the water level up to its original position is less than 0.4 litres/m^2 of wetted internal surface area.

The exfiltration test shall be carried out before backfilling of the Manhole and when the cast concrete Manhole or the surround of pre-cast ring Manholes is in place and cured.

The infiltration test shall to be carried out in accordance with Clause 7.8 of the Civil Engineering Specification for the Water Industry (CESWI), subject to any amendments outlined below. This test is to be carried out after backfilling around the Manhole. The infiltration test may also be carried out on the pipeline alone or on the Manhole and the pipeline. Again the Manhole and the pipeline shall be backfilled. The test is as follows.

- All inlets to the Manhole (or the Manhole and pipeline) are effectively closed off.
- For the infiltration test on the Manhole only, the test requirement is satisfied if the amount of water leaking into the Manhole in a 30 minute period does not exceed 0.4 litres per square meter of wetted internal surface area of the Manhole.
- For the infiltration test on the pipelines only, the test requirement is satisfied if the amount of water leaking into the pipeline in a 30 minute period does not exceed 0.15 litres per square meter of wetted internal surface area of the pipeline.
- If the pipeline and the Manhole are being checked for infiltration, the test requirement is satisfied if the amount of water leaking into the Manhole and pipeline in a 30 minute period does not exceed 0.2 litres per square meter of wetted internal surface area of the pipeline and the Manhole.

All visible leaks from or inflow into the Manhole shall be repaired. Remedial works will be required if these results are not achieved and the tests rerun. Following the water test, pipelines and structures shall be emptied and the water disposed in an environmentally safe manner. All water used for testing shall be clean and free from impurities. Discharge of the test water to Network shall not take place without Irish Water's express approval.

Pipes not within the Attendant Grounds, which will be the responsibility of individual property owners, should also be tested to achieve a satisfactory air test result in accordance with the relevant section of the Technical Guidance Document associated with the Building Regulations.

Pipes not within the Attendant Grounds will be the responsibility of individual owners shall be dye tested to trace the pipe and ensure proper connectivity to the appropriate Networks (Wastewater Drains to the Wastewater Sewer and storm Drains to the Storm Water Sewer). The Irish Water field engineer may instruct the Developer to carry out random inspections and dye surveys (and CCTV surveys, if necessary) to confirm the proper connection of the services to the Networks. These surveys shall be carried out at the Developer's cost and in the presence of the Irish Water field engineer, if deemed necessary. Any misconnection of drains to Sewers shall be rectified and connections made to the proper collection pipework system.

4.11 Pressure Testing of Rising Mains

4.11.1 General

The Rising Main shall be pressure tested following installation of the pressure main on site. The pressure tests shall be conducted by the Developer's contractor experienced in such testing procedures in the presence of an Irish Water's field engineer or an Irish Water agent's supervisor.

Rising Mains shall be tested after they are jointed and before full backfilling commences in as far as practicable. During testing, sufficient backfilling material shall be provided above the pipe crown to resist uplift or buckling movement of the pipe and all joints shall be exposed.

Testing shall be carried out between suitably supported blank end pieces. Testing between 'live' shut valves will not be accepted. Before testing, valves shall be checked and sealed, the section of Rising Main filled with water and the air released. Water used for testing should be obtained from the existing water supply system. This water will be provided, subject to availability, by Irish Water at the Developer's expense.

The following general requirements are relevant:

- To avoid airlocks there must be suitable air valves on the pipeline,
- Filling must proceed slowly, preferably from the lower side,
- The test must be hydrostatic and shall take place between blank flanges; bolted or welded to pipe ends or end caps fully supported by anchor blocks,
- All pressure gauges used for the monitoring of tests must be plate sized pressure gauges or digital loggers with an appropriate pressure range consistent with the pressure being measured, properly calibrated with calibration records available for inspection, to ensure that any losses can be adequately monitored.

All the exposed parts of the pipeline, including the chambers, shall be visually checked and any leaks or damp spots rectified.

Any water used for testing shall be disposed of in a safe and environmentally suitable fashion. All water used for testing shall be clean and free from impurities. Discharge of the test water to Network shall not take place without Irish Water's express approval.

4.11.2 Testing of Ductile Iron Pressure Pipelines

Testing of Ductile Iron Rising Mains shall be undertaken in accordance with IGN 4-01-03, Guide to Testing of Pressure Pipes and Fittings for Use by Public Water Suppliers, October 2015. A formal test report, to the requirements of Irish Water, shall be submitted to Irish Water Field Engineers giving the complete details of the test that was

carried out in accordance with Section 4 of IGN 4-01-03, regardless of the result of the test.

The system test pressure (STP) on the Ductile Iron Rising Main shall be 1.5 times MDP at the lowest point of the pipe. MDP is a pressure equivalent to the sum of the maximum continuous operating pressure of the pipeline plus an allowance for surge pressure. The allowance for surge pressure, where this is not known, shall not be less than 2 bar. The maximum continuous operating pressure of the pipeline may not be known in every case. In any event, the system test pressure on the Ductile Iron Main shall be at least 10 bar.

In all instances, the test pressure should not be greater than 1.5 times the maximum pressure of the lowest rated component (the pressure that a component can withstand continuously in service).

A preliminary test phase shall be carried when testing Ductile Iron pressure pipelines where the pressure is taken to the operating pressure (without exceeding specific test pressure (STP)) to:

A) Stabilise the part of the pipeline to be tested by allowing most of the time dependent movements.
B) Achieve an appropriate saturation with water when using water absorbing materials (e.g. cement linings on iron pipes).

For iron pipes with epoxy lining the settlement test should be completed in 15 minutes. Where Ductile Iron pipes have cement linings, the Rising Main should be allowed to ‘settle’ for a 24 hour period.

The pressure in the pipeline shall then be raised steadily until the specified test pressure is reached in the lowest part of the section and the pressure shall be maintained at this level, by pumping if necessary, for a period of one hour. If there is less than 1% air in the main, the pressure should rise at a uniform rate.

The pump shall then be disconnected, and no further water shall be permitted to enter the pipeline for a further period of one hour. At the end of this period, a record of the pressure will be made by the testing contractor. The original pressure shall be then restored by pumping and the loss measured by drawing off water from the pipeline until the pressure as recorded at the end of the test is again reached. The acceptance criteria for the pressure test shall be those outlined in Section 6.4, Table 2, of IGN 4-01-03.

If the pipe fails to meet the acceptance criteria, the test shall be stopped and the excess water bled carefully from the system until only static head remains. A search for the potential leak should be initiated. After leaks are found and repaired, the test shall be repeated.

In addition to any tests on separate sections, the whole pipeline shall be tested on completion to the same pressure and by the same procedure as that outlined for individual sections.

4.11.3 Testing of Polyethylene Pipelines

It is not necessary to have any preliminary test for polyethylene (PE) pipes. The amount of exposed pipe shall be kept to a minimum to reduce the effect of temperature changes. The testing of PE Pressure Pipelines which are not coiled pipes or where all the joints are not visible during the test shall be carried out in accordance with the requirements of IGN 4-01-03, Guide to Testing of Pressure Pipes and Fittings for Use by Public Water Suppliers, October 2015. A formal test report, to the requirements of Irish Water, shall be submitted to Irish Water field engineers giving the complete details of the test that was carried out in accordance with Section 4 of IGN 4-01-03, regardless of the result of the test.

The system test pressure (STP) on the PE Rising Main shall be 1.5 times MDP at the lowest point of the pipe. MDP is a pressure equivalent to the sum of the maximum continuous operating pressure of the pipeline plus an allowance for surge pressure. The allowance for surge pressure, where this is not known, shall not be less than 2 bar. The maximum continuous operating pressure of the pipeline may not be known in every case. In any event, the system test pressure on the PE Rising Main shall be at least 10 bar.

The maximum system test pressure shall not exceed 1.5 times the maximum rated pressure (maximum pressure that a component can withstand continuously in service) of the lowest rated component.

Mechanical fittings are usually only tested to 20 bar. If the onsite test pressure is to exceed this, a check shall be carried out to ensure that the fittings can withstand the pressure for the test duration.

The acceptance criteria for the pressure test shall be those outlined in Section 5.4.4 of IGN 4-01-03. If the pipe fails to meet the acceptance criteria, the test shall be stopped and the excess water bled carefully from the system. A search for the potential leak shall be initiated. After leaks are found and repaired, the test shall be repeated, but only after a time greater than four times the total original test time has elapsed to allow for complete creep deformation recovery.

All electro fusion jointing and testing shall be in accordance with WIS-4-32-08, Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 materials. For all saddle joints a 2 minute hydraulic test at 18 Bar shall be applied to the fused fitting prior to tapping in accordance with WIS-4-32-08.

4.12 Connections

The mode of connection and layout of any junctions or connections between pipes, whether at Manholes, inspection chambers, access points or otherwise shall be designed to minimise the risk of blockage. Where feasible, connections shall be to Manholes and not directly to the Works. In all cases a private side inspection chamber is required on each wastewater service connection in accordance with **Section 3.11.14** above.

As far as practicable, junctions and connections shall be built in for all planned users when Sewers are constructed to avoid damage to the Sewer by installing connections at a later date when the system is live. Where it is necessary to make a post-construction connection the upstream end of any unused connection should be sealed until required. Where there is a Manhole adjacent, the connection should be made to the Manhole. Where there is no Manhole, it may be necessary to construct a new Manhole.

The vertical angle between the service connecting pipe and the horizontal shall be between 30° degrees and 90°.

Where the connection is being made to a Sewer with a nominal internal diameter of 300mm diameter or less, connections shall be made using 45° angle Y branch junctions.

Retrospective connections made with junction fittings shall be made by cutting the existing pipe, inserting the junction fitting, and jointing with flexible repair couplings or slip couplers.

For connections being made to a Sewer with a nominal internal diameter greater than 300 mm, the following shall apply:

a) where the diameter of the connecting pipe is greater than half the diameter of the Sewer, an access Manhole should be constructed to form the Connection Point; or,
b) where the diameter of the connecting pipe is less than or equal to half the diameter of the Sewer, then the connection should be made using a preformed Y-branch fitting with a 45 deg. long radius bend to form the connection to the Works

Connections made with saddle fittings to concrete pipes shall be made by cutting and safely removing a core from the pipe and jointing the saddle fitting to the pipe in accordance with the manufacturer's instructions to ensure a watertight joint. The connecting pipe shall not protrude into the Sewer. Connections to PVC or structured wall pipes shall be achieved by installing junction connections pieces as the pipe is installed.

The use of 90° Y-branch or saddle connections to the Sewer may be allowed, subject to Irish Water review, provided the branch or saddle incorporates a swept connection to direct Wastewater in the same direction of flow in the Sewer. Saddle connections shall only to be provided for connections to existing Sewers, subject to Irish Water approval.

The service connection pipe between the Sewer connection fitting and the property Curtilage boundary shall be installed with generally no more than two long radius 45 deg. bends to orientate the service connection from horizontal to vertical towards the Sewer connection point. It shall be tested to achieve a satisfactory air test result as outlined in **Section 4.10** above.

4.13 Protection against Flooding

The layout of the Works shall minimise the risk of damage to property from flooding in the event of excessive flows, blockage, or failure of pumping stations on the system.

Flooding caused by blockages of Wastewater pipes shall have identified flow paths and shall not cause internal property flooding.

In designing the Development's site layout and the Works, designers shall also demonstrate flow paths and the potential effects of flooding resulting from blockages, pumping station failure or surcharging in downstream combined Sewers, by checking the ground levels around the likely points that wastewater would flow from the system, to identify the flood routes.

Part 5 – Pumping Stations

5.1 Pumping Stations Provision

It may be necessary to incorporate pumping stations in the Works. This Section of the Code of Practice outlines Irish Water's requirements on such installations.

These requirements apply to small to medium sized pumping stations which will be designated as Type 1, Type 2 and Type 3 pump stations in the following Sections. Small pumping stations, designated as Type 1, are those serving typically five dwellings or less. Pumping stations serving typically six to twenty dwellings are designated as Type 2, will be regarded as mid-range sized pumping stations. Medium sized pumping facilities are designated as Type 3 will serve more than twenty dwellings with an upper limit overall power capacity of less than 20kW installed power.

Pumping stations of large capacity are not normally required in Developments that are the subject of this document. These higher capacity pumping stations also require the specific approval of Irish Water. The specific requirements associated with these types of pumping stations are not covered in this Code of Practice.

5.2 General Requirements

The design of the Works shall minimise the use of energy over the whole operational life cycle of the system. However, there may be a necessity to collect Wastewater in low lying areas and lift it to a Gravity Sewer or to a pipe connected to the ultimate treatment location.

Wastewater pumping stations or pumped systems shall only be used where their whole life cost is less than the cost of conventional gravity systems over a period of 40 years, based on a Net Present Value (NPV) assessment, and where the proposed Wastewater system is consistent with Irish Water's technical design vetting assessment acceptance. Full gravity Works shall be provided unless the physical conditions of the site do not allow this. Pumping stations will only be Vested by Irish Water where the Developer can provide clear evidence that a pumping station is required as outlined above in the Design Submission, **Section 2.3**.

In all cases, the impact on the downstream infrastructure, existing Sewers, pumping stations and Wastewater treatment plants, shall be taken into consideration when proposing and designing pumping stations. It may be necessary to curtail the discharge rate, provide balanced storage, etc. to limit the impact of the pump station operation on the downstream infrastructure.

Pumping stations shall be fully automated with provision made for future remote monitoring by telemetry as outlined below in **Section 5.26**. A dedicated, metered, power supply shall be provided to the pump station with a separate billing account. No other

equipment, site lighting system, etc., outside the curtilage of the site shall be served from this metered power supply.

All pumping station plant and equipment shall be fully tested to ensure adequacy and to establish that the pumping station as a whole is fit for purpose for its intended use. The testing shall be carried out with water before allowing Wastewater into the facility. A full operational test of all pumps, pump controls, pump protection devices, telemetry systems, etc. shall be demonstrated to Irish Water personnel prior to commissioning of the plant with Wastewater and the results of these tests shall be included in the **Final Documentation**.

All operation and maintenance manuals, As-Constructed Drawings, Control Panel Wiring Diagrams, Control Philosophies, Safety File, etc. shall be provided as part of the Final Documentation to Irish Water personnel prior to commissioning in accordance with **Section 5.24** of this Code of Practice.

The ownership of the pumping station structures and associated plant, kiosks, Chambers, etc. shall only vest in Irish Water on issue of the Conformance Certificate. The land on which the pumping station and associated plant is located shall be the subject to a Grant of Deed of Easement for the benefit of Irish Water. The access route and parking areas associated with the pumping station shall be the subject of a Right of Way Agreement. Arrangements for Vesting of the completed Pumping Station shall be in accordance with Irish Water requirements as outlined in the Connection Agreement.

To ensure that Wastewater flooding does not occur at or upstream of the pumping station during normal operation or during plant or power failure, additional storage shall be provided at all pumping stations. This storage shall be provided above the highest pump cut in level and shall ensure that surcharging of the collection system does not impact any existing or possible future connections. The required emergency storage capacity will depend on the size of the Development. Emergency storage capacity of 24-hour of Dry Weather Flow is required for smaller Developments of up to 250 units. The emergency storage requirement will be reduced for larger developments in accordance with **Section 5.11** below. Storage capacity in the Sewer or Manholes may be utilised and calculations shall be provided at design stage. These storage tanks can give rise to septicity and odour. Therefore, the provision of such facilities shall ensure that these risks have been adequately and satisfactorily addressed.

5.3 Specific Minimum Requirements

Specific minimum requirements for pumping stations are as follows:

5.3.1 Pump stations to have a minimum of two submersible pumps;
5.3.2 All pipework and fittings within the pump station shall be ductile iron to IS EN 598, with appropriate colour and marking;
5.3.3 Pumps to be provided on a duty/standby control arrangement or if more than two pumps required, the arrangement to be duty/assist/standby;

5.3.4 Plate to be provided in the kiosk to allow nomination of the pumps (e.g. Pump No 1, Pump No 2, etc.);
5.3.5 Electrical, control and telemetry equipment and installation to be carried out in accordance with **Section 5.16** to **Section 5.27** below;
5.3.6 Electrical and control equipment to be located in a vandal resistant kiosk or structure situated adjacent to but offset from the pumping station;
5.3.7 Emergency Wastewater storage capacity to be provided in all pumping stations and equipped with appropriate self-cleaning wash-down facilities, along septicity and odour mitigation provisions;
5.3.8 Access for operation and maintenance vehicles, including vacuum tanker vehicles, to be provided;
5.3.9 A dedicated, metered, power supply to be provided to the pump station serving only the pump station equipment and associated plant;
5.3.10 The pump station shall be made ready to facilitate the installation of telemetry plant for data reporting to Irish Water central facility;
5.3.11 Alert system and call out emergency response to be provided in the event of plant breakdown or malfunction;
5.3.12 Flow metering facilities to be provided on the Rising Main as appropriate, complete with meter chamber, isolating sluice valves, etc.;
5.3.13 Odour control equipment to be provided to eliminate the risk of odour nuisance arising, comprising a vent-column, complete with passive odour control;
5.3.14 Lifting equipment to be provided for the removal of plant and equipment (See **Section 5.30** below);
5.3.15 Safety equipment, comprising lifting davit, safety harness, etc. to be provided for controlled and planned safe access for the wet well;
5.3.16 Pump stations wet well and valve chamber to be provided with pipework, to allow emptying of the Rising Main and wet well by a vacuum tanker:
5.3.17 Suitable safe access to all components of the pump station, including all operational chambers, inlet manhole, wet well, valve chamber and flow meter chamber, for operating, maintenance and possible future replacement;
5.3.18 Safe working areas around the various components of the pumping station, as listed in **Section 5.3.17** above. .

5.4 Layout of Pumping Station

Subject to Planning Permission requirement, the layout of the pumping station site and access road shall be arranged so that:

5.4.1 There is sufficient space to accommodate a vacuum tanker off road, and a large van or a mobile pump/generator within the site;
5.4.2 There is sufficient space between the various units on the site to enable maintenance operations and equipment replacement to be carried out, especially between the pump station sump/valve chamber and control equipment kiosk or structure;

5.4.3 There is sufficient space to carry out the chosen method of pump maintenance and installation of temporary pumps;
5.4.4 The doors to control kiosk(s) open safely and provide sufficient room for operators to safely carry out maintenance, repairs or replacement;
5.4.5 The need for personnel entry to confined spaces is minimised;
5.4.6 The inlet pipe is above the highest cut in level of the pumping plant units;
5.4.7 The pump delivery pipework within the wet well is preferably opposite to the inlet Sewer with sufficient baffling facilities, comprising stainless steel baffle plate and stainless steel associated fixings, to protect the pumping plant;
5.4.8 The access is sufficiently wide to accommodate a vacuum tanker, a large van or a mobile pump/generator;
5.4.9 Access is provided to the pumping station site is via the access road suitably designed and constructed for such access with appropriate safe sight distances;
5.4.10 Adequate site security and emergency lighting, using LED, is provided to achieve 100 lux at ground level, with intensity adjustment appropriate for the site location, complete with photoelectric cell controller and over-ride control switch;
5.4.11 No overhead obstructions or electrical cables are located at or near the site that could pose a risk of electrocution, as outlined by a safety risk assessment;
5.4.12 The location of the pumping station is not susceptible to flooding;
5.4.13 Security fencing will not be required except in exceptional circumstances as outlined in **Section 5.6** below.

The site of the pumping station and access road thereto shall be of sufficient width, gradient and suitably surfaced to ensure reasonable access for Irish Water vehicles, plant and operatives and to facilitate the various maintenance operations, including emptying of contents, provision of stand-by generation plant, etc.

Before the location of a pumping station is decided, the Developer shall consult with the electricity and telecommunications providers on the availability and cost of providing the requisite power supply, the supply characteristics, the security of supply and Easement. The Developer shall also carry out a GMS signal strength survey for 3G for the telemetry system at the station can be transmitted from the transmitter and received at the reception point. The electricity and telecommunications supply arrangements and GSM survey shall be the Developer’s responsibility and cost and these shall be provided for the exclusive operation of the pumping station.

The last access Manhole on the Gravity Sewer system upstream of the pumping station shall be located adjacent to the wet well within the site of the pumping station compound. It shall be designed to allow for over-pumping of the influent. This inlet Manhole upstream of the wet well shall be fitted with a hand operated isolating penstock.

5.5 Location of Pumping Station

Small pumping stations (Type 1) shall be located no closer than **5.0m** to a property boundary in order to minimise the risk of odour, noise and vibration nuisance. This distance shall be increased to **10.0m** for mid-range sized pumping stations (Type 2) and to **15m** for medium sized pumping stations (Type 3). The distance shall be measured from the pumping station site boundary to the boundary of the nearest habitable, commercial, industrial or mixed use property. This distance may be subject to change depending on local circumstances and early discussions with the Planning Authority and Irish Water. Facilities for odour control shall be installed (comprising a vent stack with passive and/or forced odour control systems) to ensure that the pumping station will not create odour nuisance impact due to being located in close proximity to dwellings and public areas. The site layout shall included and indicate the requisite dimensional requirements from adjoining property boundaries, location of odour control unit/vent stack.

The pumping station shall not be located within a public or private road, at the end of private driveways, in locations which may be used for vehicle parking, in places where maintenance work may obstruct rights or way, emergency vehicle access or where there is a risk of harm at the pumping station from moving vehicles to operatives carrying out maintenance, renewal, replacement and upgrade activities. The location shall be chosen so as to allow safe and reasonable vehicular access for the purpose of repair and maintenance. Long reversing access ways are not acceptable. Ideally, the access to a pumping station should be from a public road or by the provision of a dedicated access road from the public road. Shared access with domestic driveways is not deemed suitable. The access road gradient shall be as level as possible or within acceptable road gradient appropriate for the maintenance vehicle(s) requiring access to the site.

Provision shall be made for access by a tanker to empty the contents of the wet well and any storage facility in the event of failure. The tanker size will depend on that which is available to Irish Water or its agents for emptying of the facility but access for Heavy Goods Vehicles, such as an 18 m^3 tanker, shall be provided as a minimum. Access for the provision of stand-by power generation plant shall also be made available. The size of the standby power unit will be dependent on the pumping capacity of the station.

The pumping station shall not be located in areas that are susceptible to flooding at a frequency of more than 1:30 year recurrence. The pumping station facility shall be designed for inundation. The finished slab level of the pumping station shall be positioned above the 1:100 year flood level. All electrical control equipment shall be housed in suitably IP rated enclosures and positioned above the 1:200 year flood level. A Flood Risk Assessment confirming compliance with this **Section 5.5** of this Code of Practice dealing with flood risk analysis, as required in the Design Submission, if applicable, as outlined in **Section 2.3** above.

5.6 Fencing and Boundary Security

It should be noted that the Local Authority Planning Department may determine the requirements for fencing, site layout, control plant kiosk/structure, etc. under the Planning Permission. The pumping station shall be secure in its own right without having to rely on security fencing. Kiosks and access covers shall be locked and secure in their own right.

Fencing of pumping stations sites is not required by Irish Water and will only be necessary in exceptional circumstances. Irish Water shall be consulted in relation to the need or otherwise for the fencing of pumping station sites and its decision will be determined having considered public safety, the likelihood of vandalism, the depth of the pumping station structures, the extent and type of pedestrian traffic and whether special activities are taking place on the site.

If security fencing is required, it shall comprise a 2.4m high, corrosion resistant palisade fencing. In particular situations, subject to Irish Water approval, wire mesh fencing may be required. The security rating shall be in accordance with Irish Water's security policy and the fence security rating is to be agreed with Irish Water in advance.

Palisade fencing, where provided, shall comply with IS EN 1722-12, comprising 17 No, 2.5mm thick, pales, with 95mm gaps, welded to 2 no mild steel rails (50mm x 50mm x 5mm angles). The steel rails shall be fixed to vertical posts (100mm x 55mm RSJ sections), which are provided at 2.7m centres. Fixings shall comprise mild steel anti vandal bolts and nuts. The fencing units shall be hot dipped galvanised to IS EN 1461 (2009) and subsequently electrostatically powder coated in a plant complying to EN 1722 -16.

Wire mesh fencing, where provided, shall comply with IS EN 1772-14, comprising an 868 mesh system (200mm x 50mm spacing) with a galvanised and plastic coated finish. The mesh shall be clamp fixed to 60mm x 60mm posts at 2,500mm centres.

The fence panels shall be fixed to fence pillars. Corner pillars shall be braced in both directions. All fixing bolts shall be tamper resistant or burred over. The fence, pillars, bracing, runners, diagonals, gate posts and gates, etc. shall be in accordance with the manufacturer's instruction and the designs shall be provided to Irish Water for review and vetting. The gate posts, pillars and bracing shall be supported in concrete bases, Grade C30/37 to IS EN 206, of suitable size to resist imposed loadings.

Similar type access gates to the palisade or wire mesh fencing panels, as appropriate, shall be provided. The access gates shall be of sufficient width to accommodate maintenance vehicles, tankers, etc. The access gates shall be provided with slide bolts, shooting bolts and padlocks. If opening outwards, the access gates shall be set back from parking and access areas by the width of the leaf of the gate. Gate hinges shall be designed so that it is impossible to remove the gate by lifting when it is closed and locked in position. Drop bolts shall be fitted to each gate leaf in such a way that they

cannot be removed but that they allow the gate to be secured in both the open and closed position. In certain circumstances, a pedestrian gate shall be provided in the security fence if required by Irish Water.

Anti-burrow features shall be provided for circumstances where Enhanced Security is required by the provision of a 300mm wide by 150mm deep concrete sill along the base of the fence line. The sill shall be formed using in-situ reinforced concrete, Grade C25/30 to IS EN 206. All fence material and workmanship shall be in accordance with IS EN 1722-14.

The colour of the fence, access gates and Accessories shall be holly green 14C39 in accordance with BS 4800.

In certain circumstances, a 2.4m high security wall may be deemed adequate so as to match surrounding structures. In this circumstance, a steel access gate shall be provided as outlined above.

5.7 On-Site Parking and Hard-Standing

It shall be noted that the Local Authority Planning Department may determine the requirements for on-site parking under the Planning Permission. Small, medium and mid-range sized pumping stations located off public roads with adequate parking or a dedicated lay-by will not require dedicated on-site parking. Where access is from a traffic-sensitive street or other major road or where parking is not available without obstructing the road, provision shall be made for adequate parking (e.g. in a lay-by) for a tanker adjacent to the site. If access is from a public road, the pump station location shall be set back from the edge of the road for a distance of one vehicle length, based on the largest vehicle accessing the site. The maintenance vehicle shall be capable of getting as close as possible to the wet well Chamber. The access provision to and from the pumping station shall enable such access to be achieved without undertaking unsafe vehicle movements. The access shall also be provided to comply with the most up-to-date Local Authority Design Manuals particularly in respect of road curves and turning circles.

On-site hardstanding areas shall be surrounded by pre-cast kerb units (255mm x 125mm set in a bed and haunch of Grade C25/30 concrete to IS EN 206) or slip formed concrete kerbing, installed to match the level of the surrounding ground. Such hard-standing may comprise permeable or impermeable surfaces, depending on the water service activities being carried out on the site and on the sub-surface ground conditions at the site.

Permeable surfaces shall comprise a 500mm depth of compacted Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works, with a 75mm layer of 10mm single sized aggregate on a geotextile weed barrier founded on load bearing subgrade material.

Impermeable surfaces shall comprise a 500mm depth of compacted Clause 804 granular material, in accordance with the Transport Infrastructure Ireland (formerly National Roads Authority) Specification for Road Works with either a concrete or macadam finish.

Where vacuum tanker access is provided or where HGV access is required, the hard-standing shall be designed to carry such vehicles, (including 35/40 tonne ridged or articulate vehicles), and shall comprise a reinforced concrete slab (Grade C28/35 to IS EN 206 - 20mm aggregate to IS EN 1260) on a Clause 804 granular sub-base founded on load bearing subgrade material. For lighter vehicles, a tarmacadam surfaces, comprising 75mm wearing course on a 75mm well compacted regulating course shall be placed on the Clause 804 granular sub-base, shall be provided.

Where hard standing areas are located over locations that have been excavated for construction of the wet well, valve chamber, emergency storage tank and other deep components, backfill beneath the hardstanding area shall be carried out with "acceptable material" as outlined in Clause 601 of the TII "Specification for Roadworks, Series 600 – Earthworks", Table 6/1, Class 6F1 or 6F2 material and compacted accordingly to ensure that the sub-base is capable to taking the applied loads.

5.8 Hydraulic Design of Pumping Stations

The design flow rate of a pumping station will depend on the Wastewater flow rate and volume arriving to it from the Gravity Sewer system. Generally, pumping stations are designed to limit the number of pump starts so that the pumping plant is not damaged by excessive start/stop activity, generally not exceeding 10 starts per hour. The pumping plant shall be fitted with direct on-line starters for motors sizes up to 5 kW. Motors rated 5kW and above shall be provided with star delta starters, soft starters or variable speed drives (VSDs). The VSDs shall be installed in separate Form 4 ventilated enclosures to manufacturers' requirements. Adequate cooling and ventilation shall be provided in the pump station kiosk to ensure that the VSDs operate within the design tolerances with regard to ambient temperature within the space.

The pumping duration of a pump unit shall not be less than 60 seconds. The pumping capacity shall ensure that the Wastewater is passed from the wet well and the Rising Main without excessive residence time which might give rise to septic conditions. Generally the combined residence time in the wet well and the Rising Main shall be less than six hours. A pumped flow rate shall be chosen to achieve at least a minimum flow velocity in the Rising Main, as outlined in **Section 3.7** above.

The developer is to provide IW with hydraulic calculations as part of his design submission for the proposed pump station, as required in **Section 2.3** above.

Generally, pumping plant shall be sized to deliver a minimum peak flow rate of six (6) times the incoming dry weather flow (DWF) but pump delivery of three (3) times the dry weather flow (DWF) may be appropriate if adequate balance storage of the Wastewater

is provided. The rate of pumping shall ensure compliance with the rising main velocity range outlined in **Section 3.7.2** above.

Where there are limitations on the capacity of the downstream Network to accept the instantaneous design pumped flows, consideration shall be given to adjusting the control philosophy of the pump station to limit the forward flow and, therefore, reduce the risk of negative impact on the downstream network. This may include (but is not limited to) the provision of on-site balance storage, change to proposed pump model or the use of variable speed drives to limit the flow under conditions where the receiving sewer capacity is reduced and the flow is not restricted beyond the six-hour residence time, as set out above. Such proposals, including the proposed control philosophy, shall be provided to Irish Water for review and assessment.

Balance storage may be required in association with the pumping station to provide a minimum 10-hour and up to a maximum 24-hour storage capacity. The required storage capacity will depend on the size of the Development. Emergency storage capacity of 24-hour Dry Weather Flow is required for Developments up to 250 units. The balance storage requirement capacity will be reduce for larger Developments in accordance with the requirements of **Section 5.11** or with specific advice from Irish Water's Connections and Developer Services.

The pumping plant shall have 100% standby capacity. The plant shall be configured to allow future retrofitting with a telemetry outstation to transfer data from the pumping station to an Irish Water control centre as outlined in **Section 5.26** below.

For pumping stations where phased development is anticipated, the pump station structure shall be provided to facilitate the fully developed site. Pipework shall be provided for the ultimate flows. This might involve the installation of pipes within the wet well and provision within the valve chamber for future pump units which are initially not in use. The pumping plant shall be provided to accommodate the likely medium term anticipated flow, provided this does not create a nuisance or septicity problem. In some instances, twin Rising Mains may be required to accommodate the phased flow increase over the life cycle of the pumping facility. Where pump station expansion is proposed for future phased development, the initial Design Submission (See Part 2 Design Requirements and Design Submissions of this Code of Practice) shall include the design calculations for the phasing of the Pumping Station.

The pumping plant shall be designed to pump against a design head comprising a combination of the static head and the pipe friction head. The pumping station design static head for the design flow shall be based on the difference in level between the mid-point of the duty pump start level in the wet well and the discharge point at the header Manhole. The design pipe friction head will depend on the pipe size, the pipe fittings, velocity in the pipe as well as the friction factor of the pipe material. The pipework associated with the pumping plant shall be adequately restrained to resist vibration and impact arising from the operation of the pumping plant.

The pumping station shall be provided with an ultrasonic level control system with operator adjustable set points for pump unit cut in and cut out as well as top level cut in and low level over-ride cut out. The cut-out level shall be set such that it is above the top of the pump motors. Appropriate set points shall be provided if duty and assist pumping plant is included in the pumping station. Duty and standby pumping plant shall be provided at each pumping station. A standby pump unit shall be provided if a duty/assist pumping arrangement is required. A hard wired high level float switch shall be provided in each pumping station and these shall be linked to the telemetry control system. Automatic duty/standby switch over shall be incorporated into the pump control system. A manual override shall be provided in the pump control system. The pump units shall operate safely and effectively in accordance with the pump manufacturer's instructions such that the pump units do not exhibit damaging cavitation, vibration, air locking or surface vortices.

5.9 Pumping Plant

Having regard for the provisions of **Section 5.8** above in relation to hydraulic design of pumping stations and taking cognisance of phased capacity allowance, the specific minimum requirements for pumping plant are as follows:

5.9.1 Pumping plant shall be of failsafe design;
5.9.2 All plant and equipment shall be suitably Ex-rated in accordance with the Hazardous Area Classification for the pumping station site;
5.9.3 Pumping plant shall be duty and standby arrangement or duty/assist and standby arrangement;
5.9.4 Pumps shall be submersible pumps with automatic decoupling arrangements complete with twin guide rails, easy lift, etc.;
5.9.5 Pumping plant shall be of proven track record;
5.9.6 Automatic selection rotation of the duty/standby or duty/assist/stand-by pumps shall be provided on an hours run basis with manual over-ride;
5.9.7 Pumps to be sized to pump forward a minimum of six (6) times DWF (with a minimum of three (3) times DWF, if storage is provided) provided the velocity in the rising main is within the range outlined in Section 3.7.2 above;
5.9.8 Pumps shall be suitable for pumping unscreened Wastewater containing fibrous material and large solids. Pumps connected to small diameter Rising Mains to be fitted with an anti-blockage/anti-ragging system and additional anti blockage requirements will be required for Rising Mains of 80mm diameter and less;
5.9.9 Pumps shall have, in general, a minimum discharge size of 80mm;
5.9.10 Pump control shall be via ultrasonic level transducers, located above liquid level, in an easily accessible location, while not encroaching or impeding access.
5.9.11 The ultrasonic controller shall be suitable for fascia or panel mounting and shall incorporate a number of relays (minimum of five) to operate the pump units and alarms according to the required control philosophy;

5.9.12 The pump guide system shall be provided to allow the pump units to be automatically coupled shall the outlet pipework and held in place by its own weight;
5.9.13 The guide system shall allow the pump units to be lifted to the top of the wet well without the need to undo any fixing arrangements or to enter the wet well;
5.9.14 Anchor bolts shall be stainless steel, stainless steel and galvanised steel surfaces shall not come into contact with each other;
5.9.15 Pumps to be mounted on a cast iron coupling/duck-foot pedestal, with automatic decoupling arrangements;
5.9.16 Pump arrangement shall be provided to allow easy installation and speedy removal from the sump without need for operator entry to the sump;
5.9.17 Pumps guide rails shall be of stainless steel (grade 316);
5.9.18 Pumps shall be provided with certified, stainless steel lifting chain (designed to IS EN 818 – Part 7), suitably sized and fit for purpose, with 8mm thick links, at least, and large links at not more than 1m intervals;
5.9.19 All statutory inspections shall be undertaken during the Defects Liability Period. In particular, the stainless steel chains are to be subject to 6 month inspection, the lifting chain at the end of the Defects Liability Period shall have a current valid certification for a further period of 3 months;
5.9.20 Discharge pipework within the wet well shall be complete with bends, radial tee-pieces, fittings, etc. to link the wet well pipework to the valve chamber pipework;
5.9.21 Pipework within the valve chamber shall incorporate isolation valves (one per pump installed), non-return valves (one per pump installed), bends, radial tee-pieces, etc.;
5.9.22 Non-return valves shall have removable covers, ductile iron body with resilient seated disc and stainless steel hinge pin, complete with either a lever arm and weight;
5.9.23 Bends shall be swept/slow bends to minimise blockages and pipe friction losses;
5.9.24 Sluice valves shall be provided with removable hand-wheels;
5.9.25 Flange adaptors shall be provided to permit ease of removal of valves from the pipework;
5.9.26 All pipework and valves shall be of ductile iron to IS EN 598, suitable for use with sewage, with PN-16 flanges to BS EN 1092-1, with appropriate colour and designation marking;
5.9.27 Pump motors shall be high efficiency with Class F insulation and IP68 rating and must meet IE3 efficiency standards or better;
5.9.28 Pump efficiency shall be maintained within 15% of its maximum efficiency over the whole of the specified duty range;
5.9.29 Motors shall include stator over-temperature protection in the form of thermistors embedded in each phase of the windings, over-temperature protection shall automatically re-set when the temperature returns to normal and protection from seal leakage shall also be provided;

5.9.30 Pumps shall have a maximum speed of 1500rpm. Pump characteristics shall be stable, non-overloading and shall be such that the pumps shall operate as close to maximum efficiency at the design point (Speeds in excess of this may be allowed in the case of non-clogging macerator pumps, where these are provided);

5.9.31 Pumps shall be provided with indicator plates providing information for the pump, motor, etc. A duplicate stainless steel plate to be provided and mounted in the kiosk or control structure;

5.9.32 Each pump unit shall be supplied and fitted with a cable of suitable length to reach the means of termination which shall be either (a) a control kiosk MCC gland plate and terminals or (b) an intermediate junction box in the valve chamber or (c) an intermediate junction box housed in an intermediate kiosk;

5.9.33 A spare name plate for the pump shall be fixed to the plywood panel support board within the kiosk.

It is the responsibility of the Plant Designer to ensure that Area Classification is applied to the design of the pump station and to identify the potential for flammable or explosive atmospheres to develop in or around the pump station. ATEX Directives 1999/92/EC and 1994/9/EC are to be adhered to. IS EN 60079 shall also be adhered to in regard to Area Classification. The drawings submitted and the specification of the pump station shall demonstrate the Area Classification of the pump station or otherwise the absence of zoning.

5.10 Wet Well

The wet-well of the pumping station can be of rectangular or circular plan section with a minimum 1,800mm x 2,500mm plan or 1,800mm diameter shape. The shape of the wet well shall be such that solid matter does not accumulate in dead spots within the well. The shape of the wet well and its benching as well as the location of the inlet Sewer arrangement shall ensure satisfactory flow conditions to the pump unit to avoid the formation of damaging vortices. This is best achieved by installing the incoming Sewer on the centreline between the submersible pump units at a depth between 0.15m and 1.15 m above the pump highest cut in level. An inlet baffle shall be provided for the Sewer inlet to prevent excessive aeration of the Wastewater or the interference with ultrasonic beams used for level sensing. There shall be a minimum capacity between the start and stop level controls to give a maximum of 10 starts per hour.

The depth of the wet well shall be suitable to accommodate the incoming Gravity Sewer, the pumping plant, the minimum pumping storage between cut-in and cut-out, etc. The maximum depth of the wet well shall be 6.0m below ground level. Wet wells of depth greater than 6.0m shall require specific approval of Irish Water and will require the submission of a specific detailed design for review.

An inlet collection Manhole shall be provided just upstream of the pump station wet well in all situations. Where there are multiple Sewers draining to the pumping station site,

the inlet collection Manhole will combine flow to the wet well in a single inlet pipe. Provision shall be made for isolating the incoming flow by means of a hand-operated valve or penstock. This unit shall be located in the inlet collection Manhole upstream of the wet well and not in the wet well itself.

If off-line emergency storage is provided for the wet well, a high-level overflow, completed with a stainless steel baffle to prevent floating solids entering the emergency storage tank, shall be provided. A return flow pipe shall be provided, complete with a flap valve, between the emergency storage tank and the wet well to return stored flows. The overflow and return pipework is detailed in **Section 5.11** below.

Benching in the wet well shall be provided to eliminate “dead zones” within the wet well to prevent siltation or accumulation of debris. The benching shall start no more than 100mm from the pump unit volute or in accordance with the pump manufacturer’s recommendations. The slope of the benching shall be a minimum of 45 degrees. The area under the pump shall be as small as possible to ensure well cleansing and the flat floor area shall be kept to a minimum. The wet well shall be kept to a minimum to reduce the amount of benching that is required.

The wet well shall be designed, as far as practicable, to eliminate the need for man-entry for maintenance. No permanent ladder or step irons shall be located within the wet well. If the wet well is deeper than 4m, Irish Water may require additional safety measures to be installed within the well for maintenance purposes.

The wet well shall be constructed using in-situ reinforced concrete, Grade C30/37 to IS EN 206, or with pre-cast concrete units. The wet well shall be water tight for both ingress of groundwater and egress of Wastewater. The minimum factor of safety against flotation for the empty structure subject to groundwater pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used. The developer shall submit site specific anti-floatation calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete), as required in **Section 2.3.28**.

If constructed with in-situ reinforced concrete, the wet well structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The surface finish of the internal surface of the wet well shall be fair faced finish (F2 or better) obtained using forms to provide a hard surface with true, clean edges. Only minor surface blemishes are permitted. Fins and other projections shall be removed and the surface made good. The cover slab shall be designed to withstand accidental vehicular wheel loads. Reinforcement used in the wet well structure shall be high yield steel in accordance with BS EN 4449.

If precast concrete units are used for wet well construction, they shall conform to IS EN 1917 and IS 420. Joints between the precast components shall provide equivalent water resistance as required in IS EN 1992 – Part 3. The precast units shall be surrounded

with at lease a 150mm thickness of C30/37 to IS EN 206, 20mm aggregate size to IS EN 12620. This composite structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2).

The use of alternative pre-cast concrete system units may be allowed, subject to Irish Water review, provided that they are deigned to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). These structures shall be partially or fully surrounded in concrete at lease a 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620, where required for sealing joints and pipe connection locations unless otherwise agreed with Irish Water. These tanks shall be installed in accordance with the manufacturer's requirements subject to adherence to good site practice.

The pipe manufacturer's recommendations shall be followed where a Rising Main passes through the wall of a wet well to safeguard against the integrity of the main from differential settlement or movement. If pipes through the wall are installed in box-out openings, subsequent filling of the opening shall be carried out with grade C25/35 to IS EN 206, 20mm aggregate size to IS EN 12620, concrete to ensure a completely watertight structure. The pipe shall be fitted with puddle flanges as they pass through the wall. The Developer shall provide details in all instances of the sealing methodology where the process pipework passes through the wall of a chamber either where the intention is to cast in process pipework after installation or where it is proposed to integrate same in pre-cast units.

The building in of pipes through walls, roofs and other concrete structures shall be carried out to prevent liquid leakage into or out of the structure. Puddle flanges shall be provided to prevent such leakage and to ensure watertight construction. Where necessary, thrust flanges shall be provided to resist imbalanced forces acting on the pipe.

The pump station wet well shall be provided with pipework, 80 mm minimum diameter, terminating 100mm from the low side of the sump floor and extending through the wall of the valve chamber. Pipework sizes below 80mm diameter may be allowed in small capacity pumping station installations with the written approval of Irish Water. This pipe system shall be fitted within the valve chamber with a non-return valve and male Bauer coupling in the valve chamber, to allow emptying of the Rising Main by a vacuum tanker.

Backfill around the wet well shall be placed so that a 500mm width of Clause 808 material, compacted in 300mm layers, is provided to ensure adequate support beneath any structures or structural surrounds. Free draining granular material, 500mm wide, shall be provided round the wet well close to ground level of the unit.

5.11 Emergency Storage

Unless specified by Irish Water, an emergency overflow to a watercourse or Storm Sewer is not to be provided for Wastewater pumping stations. Emergency storage is required at each pump station by the provision of a larger wet well, a single separate specifically designed off-line storage tank or an enlarged Sewer shall be provided in order to provide additional storage and thereby reduce the risk of localised flooding or pollution during plant or power failure. If the storage is provided within the wet well, the storage capacity shall be accommodated above the highest cut in level pump setting and below the invert of the incoming connected inlet Sewer. If part of the incoming Sewer is used for a portion of the storage, it shall be limited to ensure that surcharging of the collection system does not impact any existing or possible future connections. The plan area of the wet well below the high level alarm pump setting shall not be increased to form any of the required storage.

The minimum factor of safety against floatation for the empty emergency storage structure subjected to groundwater upward pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known, or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used. The developer shall submit site specific anti-floatation calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete), as required in **Section 2.3.28**.

Emergency storage capacity, based on dry weather flow, shall be provided at the pumping station. The required storage capacity will depend on the size of the Development. Emergency storage capacity of 24-hour Dry Weather Flow will be required for Developments up to 250 units. The emergency storage capacity requirement will be reduced to 18, 12 and 10 hours on a stepped approach for larger Developments in accordance with the Table below or specific advice from Irish Water's Connections and Developer Services.

Houses	Storage Hours	Max Storage Volume (m^3)
0 – 250	24	112
250 - 333	24 for 250 and 18 thereafter	139
334 - 1667	24 for 250, 18 up to 333 and 12 thereafter	437
1668 - 3333	24 for 250, 18 up to 333, 12 up to 1667 and 10 thereafter	746

A minimum 225mm diameter high-level overflow pipe, complete with stainless steel baffle, as referred to above in **Section 5.10**, or a pipe to match the capacity of the incoming Sewer, whichever is larger, shall be provided between the pump station wet well and the storage chamber if off line storage is provided. The return pipe feeding back to the pump station shall be of a similar diameter and shall be fitted with a proprietary non-return valve at the wet well chamber. Rocker pipes and joints shall be provided in the ductile iron overflow and return pipes.

In exceptional circumstances, if an emergency overflow is to be provided, the following legislative or written consents will at least be required. Consent to discharge from the Environmental Protection Agency,

5.11.1 Consent from the appropriate Local Authority to place an outfall in a watercourse in accordance with the Water Pollution Act,
5.11.2 Planning Permission from the relevant Planning Authority,
5.11.3 Easement and right to discharge from affected land owners
5.11.4 Consent from Inland Fisheries Ireland and/or Waterways Ireland, if relevant,
5.11.5 A Foreshore Licence if the discharge is to a foreshore area.

The Developer shall provide the requisite consents from the relevant regulatory authorities (Local Authority, EPA), upfront in the Design Submission documentation.

In the exceptional situations where emergency overflows to water bodies are allowed and installed, the overflow pipe or weir shall be fitted with mechanical self-cleaning screens and baffle plates to retain floating material, debris, etc. within the collection Network for subsequent forward pumping. The aperture size of the overflow screen will depend on the receiving water body and it shall comply with the requirements of the document available from the Environmental Protection Agency, Urban Wastewater Treatment Directive (91/271/EEC), Procedures and Criteria in relation to storm water overflows, as published by the Department of Environment (1993) and any other legislative requirements.

The single storage tank shall be constructed using in-situ reinforced concrete, Grade C30/37 to IS EN 206, or with pre-cast concrete units. The storage tank shall be water tight for both ingress of groundwater and egress of Wastewater. The minimum factor of safety against flotation for the empty structure subject to groundwater pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used.

If constructed with in-situ reinforced concrete, the storage tank shall be designed to IS EN 1992 – Part 3 Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The surface finish of the internal surface of the wet well shall be fair faced finish (F2 or better) obtained using forms to provide a hard surface with true, clean edges. Only minor surface blemishes are permitted. Fins and other projections shall be removed and the surface made good. The cover slab shall be designed to withstand accidental vehicular wheel loads. Reinforcement used in the storage tank structure shall be high yield steel in accordance with BS EN 4449.

If a precast concrete unit is used for the storage tank construction, it shall be designed to IS EN 1992 – Part 3 Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2).as liquid retaining structures. Joints between the precast components shall be fully sealed to prevent ingress of ground water and egress of the storage tank contents and shall provide equivalent water resistance as required in IS EN 1992 – Part 3 Design of Concrete Structures - Part 3: (Liquid retaining

and containment structures, Tightness Class 2). These structures shall be partially or fully surrounded in concrete at lease a 150mm thickness of C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620, where required for sealing joints and pipe connection locations unless otherwise agreed with Irish Water. These tanks shall be installed in accordance with the manufacturer's requirements subject to adherence to good site practice.

The pipe manufacturer's recommendations shall be followed where pipes pass through the wall of the emergency storage tank to safeguard against the integrity of the main from differential settlement or movement. If pipes through the wall are installed in box-out openings, subsequent filling of the opening shall be carried out with grade C30/35 to IS EN 206, 20mm aggregate size to IS EN 12620, concrete to ensure a completely watertight structure. The Developer shall provide details in all instances of the sealing methodology where the process pipework passes through the wall of a chamber either where the intention is to cast in process pipework after installation or where it is proposed to integrate same in pre-cast units.

The building in of pipes through walls, roofs and other concrete structures shall be carried out to prevent liquid leakage into or out of the structure. Puddle flanges shall be provided to prevent such leakage and to ensure watertight construction. Where necessary, thrust flanges shall be provided to resist imbalanced forces acting on the pipe.

Backfill around the wet well shall be placed so that a 500mm width of Clause 808 material, compacted in 300mm layers, is provided to ensure adequate support beneath any structures or structural surrounds. Free draining granular material, 500mm wide, shall be provided round the wet well close to ground level of the unit.

5.12 Valve Chamber

The valve chamber is provided to house valves and fittings associated with the pumping plant. It shall be separate from the wet well but it may be structurally attached to the wet well. The valve chamber shall be fully sealed from the wet well and it shall be provided with a manually operated Drain valve to allow the discharge of liquid from the valve chamber to the wet well. The size of the valve chamber shall be adequate to house all equipment and provide adequate space for maintenance, plant replacement, etc. The valve chamber shall house the following:

5.12.1 Discharge pipework complete with radial bends, radial tee pieces, valves, fittings, etc. to link the wet well pipework to the Rising Main pipe;

5.12.2 A gate valve for each pump unit mounted horizontally in the pump outlet pipework and arranged to isolate the pump unit from the Rising Main;

5.12.3 A non-return valve for each pump unit mounted horizontally in the pump outlet pipework, upstream (wet well side) of the gate valve, and arranged to prevent flow reversal under normal operating conditions in the Rising Main;

5.12.4 A gate valve and 100mm male Bauer coupling mounted vertically on a tee piece in the Rising Main, upstream of the Rising Main gate valve and check valve for pumping out of the Rising Main;

The valve chamber shall be provided with a hand operated valve and gravity drain into the wet well. The valve shall be installed in a drain sump at the corner of the valve chamber floor area. The floor of the valve chamber shall slope to the sump to enable collection of any accumulated liquid in the valve chamber. The discharge drain shall be protected to ensure that flows of noxious gas cannot enter the valve chamber from the wet well.

The valve chamber shall have a maximum depth of 1.5m from soffit of the roof slab to the floor of the chamber. Appropriately sized covers shall be provided to the openings in the roof slab of the chamber. Adequate clearance shall be provided beneath all pipework to allow safe access to flange bolts for maintenance operations to be carried out.

The valve chamber shall be constructed using in-situ reinforced concrete, Grade C30/37 to IS EN 206, or with pre-cast concrete units. The chamber shall be water tight for both ingress of groundwater and egress of Wastewater. The minimum factor of safety against flotation for the empty structure subject to groundwater pressure shall be 1.2. This shall only be used where the maximum groundwater level is accurately known or, if not reliably known, a groundwater level equivalent to the finished ground level shall be used. The developer shall submit site specific anti-floatation calculations and measures proposed in respect of pump station structures (cast in-situ or pre-cast concrete), as required in **Section 2.3.28**. .

If constructed with in-situ reinforced concrete, the valve chamber structure shall be designed to IS EN 1992 – Part 3 Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). The surface finish of the internal surface of the chamber shall be fair faced finish (F2 or better) obtained using forms to provide a hard surface with true, clean edges. Only minor surface blemishes are permitted. Fins and other projections shall be removed and the surface made good. The cover slab shall be designed to withstand accidental vehicular wheel loads. Reinforcement used in the valve chamber structure shall be high yield steel in accordance with BS EN 4449.

If precast concrete units are used for valve chamber construction, they shall conform to IS EN 1917. Joints between the precast components shall provide equivalent water resistance as required in IS EN 1992 – Part 3. The precast units shall be surrounded with not less than 150mm thickness of Grade C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620. This composite structure shall be designed to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2).

The use of other pre-cast concrete units may be allowed, subject to Irish Water review, provided that they are deigned to IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). These tanks shall be installed in accordance with the manufacturer's requirements subject to adherence to good site practice.

The chamber shall be fitted with Manhole steps to comply with IS EN 13101, Type D, Class 1, galvanised mild steel and plastic encapsulated. Access to the confined space within the chamber shall be by way of a safe access plan.

The pipe manufacturer's recommendations shall be followed where pipes pass through the wall of the valve chamber to safeguard against the integrity of the main from differential settlement or movement. If pipes through the wall are installed in box-out openings, subsequent filling of the opening shall be carried out with grade C30/35 to IS EN 206, 20mm aggregate size to IS EN 12620, concrete to ensure a completely watertight structure. The Developer shall provide details in all instances of the sealing methodology where the process pipework passes through the wall of a chamber either where the intention is to cast in process pipework after installation or where it is proposed to integrate same in pre-cast units.

The building in of pipes through walls, roofs and other concrete structures shall be carried out to prevent liquid leakage into or out of the structure. Puddle flanges shall be provided to prevent such leakage and to ensure watertight construction. Where necessary, thrust flanges shall be provided to resist imbalanced forces acting on the pipe.

Backfill around the wet well shall be placed so that a 500mm width of Clause 808 material, compacted in 300mm layers, is provided to ensure adequate support beneath any structures or structural surrounds. Free draining granular material, 500mm wide, shall be provided round the wet well close to ground level of the unit.

Cable ducts into the valve chamber and between the valve chamber and the wet well shall be sealed watertight. Gas tight sealing glands shall be provided between the valve chamber and the wet well and the valve chamber and the kiosk to prevent the migration of gas into the valve chamber and between the wet well and the control kiosk.

5.13 Flow Metering

Flow meters shall be provided to measure and record the Wastewater flow being pumped forward through the Rising Main. Magnetic flow meters, to IP68, shall be provided complete with a digital display showing instantaneous and accumulated flow records. A "no-flow" protection facility shall be provided for the pumps. Flow meter and associated equipment, including calibration test certification, will be required for all pumping stations. The controller for the magnetic flowmeter shall be mounted in the kiosk.

The flow meter shall be provided in a separate flow meter chamber, located a sufficient distance from all fittings and bends, to ensure that interference of the measurement does not arise from flow turbulence associated with such fittings.

The flow meter chamber shall have minimum plan dimensions of 1500mm x 1500mm. It shall include a flow meter, positioned in accordance with the manufacturer's instructions. Sluice valves shall be provided adjacent to the meter chamber and valve chamber to allow isolation, removal or servicing of the meter. The valve shall be provided after the flowmeter at least a separation distance equivalent to that recommended by the flowmeter manufacture. The pipework within the meter chamber shall incorporate a dismantling joint to allow removal of the flow meter.

5.14 Access to the Wet Wells, Valve Chambers and Other Chambers

The top of the wet well, valve chamber, meter chamber and other associated chambers shall be situated flush with the surrounding paved areas. Where the intention is to use a pre-cast concrete cover slab, The Developers shall in those instances provided details or the proposed cover to the pre-cast concrete manufacturer in advance to ensure that the cover units fit the openings and are flush with the surface of the finished roof slab. The Developer shall also bear in mind that pump station installations are to be designed to prevent inundation.

Access covers in the roofs of the wet well, valve chamber and other chambers shall be flush with the roof slab and large enough to allow for pump units, valves and flow meters to be removed easily and safely out of the well/chamber for above ground inspection, maintenance, etc. Openings in all other chambers shall not be smaller than 675mm x 675mm.

The opening and access covers for the wet well and valve chamber shall have the following features:

5.14.1 Covers to be secure and capable of providing safe and easy access to the chambers for inspection, maintenance and operation;

5.14.2 Covers to be fabricated from Durbar plate, minimum 4mm thick, galvanised to IS EN 1461 (2009) (minimum zinc coating of 70 microns) with non-slip surface and finished flush with the roof slab of the chamber(higher specification material or finishes may be required in aggressive environments, e.g. coastal sites);

5.14.3 Hinged covers shall be provided as a minimum for single, twin and triple leaf covers;

5.14.4 A factory fitted seal shall be provided between the cover and frame for wet well and overflow chamber covers and each leaf shall also be fitted with and odour control seal;

5.14.5 The minimum allowable access for wet wells and valve chambers to be 1,400mm x 800mm, access openings to Manholes and other infrequent access chambers may be 675mm x 675mm;

5.14.6 Chamber access covers with a clear opening exceeding 1000mm shall conform to BS 9124;
5.14.7 Hinged covers to be used in all openings exceeding 675mm x 675mm;
5.14.8 Hinged cover to incorporate a recessed facility for securing of the cover with an approved padlock;
5.14.9 Covers to be lockable to LPS1175, SR2 using high security locks;
5.14.10 The padlock facility shall have a cover plate which shall automatically fall flush with the surrounding cover lid;
5.14.11 Each cover leaf shall incorporate an auto-locking safety stay;
5.14.12 Each leaf of the cover to have torsion spring assistance to ensure a lifting effort of less than 25kgF;
5.14.13 The location of the hinges and the lift assistance sets shall not impinge on the safe entry to the chamber;
5.14.14 For pumping stations wet wells and valve chambers, a hinged, safety, fall protection grid in two sections to be provided below the cover and to be capable of withstanding a 250kg load over the total area of the grid. The lifting effort of the grid shall not exceed 25kgF. When lifted, the grid shall be capable of being secured in the upright position;
5.14.15 In a closed position, the covers shall be capable of withstanding a 6 tonne static wheel load, as a minimum. Where there is a risk of traffic loading on the cover, it shall be capable of withstanding such loadings as a minimum;
5.14.16 Provision to be made within the wet well covers and frames to allow the main cover to be closed while the pump unit and any associated cables are removed;
5.14.17 Closure of the wet well cover to be possible with the pump unit at a minimum height above the frame to provide a safe working platform for maintenance, if so desired;
5.14.18 For large openings, segmental multi cover units shall be provided;
5.14.19 Beams for supporting segmental multi unit assemblies, including associated brackets, to be of steel and post galvanised to IS EN 1461 (minimum zinc coating of 70 microns). These beams must not obstruct access or be easily removed.

Covers to meter chambers and other Manhole chambers on the pump station site shall comply with **Section 3.12** above, and shall be sealed if the site is located in an area which might be prone to flooding.

Access to meter chamber, the valve chamber and other chambers (excluding the wet well and the emergency storage tank) shall be by Manhole proprietary rungs built into the walls. They shall comply with the requirements of IS EN 13101 (2002), Type D, Class 1. Galvanised mild steel step rungs, 20mm diameter, shall be provided with plastic encapsulated finish. Steps shall be 300mm wide and located 230mm apart vertically. The vertical distance between the top of the chamber cover and the first step in the chamber shall not exceed 675mm. All step irons shall be centred under the access opening in the Manhole roof slab. Alternatively, galvanised mild steel ladders

may be provided, in accordance with **Section 3.12** above, subject to the requirements of Irish Water or where the depth of the chamber exceeds 3m.

5.15 Venting of Wet Well and Chambers

The selection of the method of venting of the wet well shall take into account the risk of toxic fumes, dangerous gasses, odour nuisance, etc. Generally, the wet well and the emergency storage tank shall be vented via a duct extending from the 'high points' of the wet well and connected to free-standing vent columns or vent stacks. In odour sensitive areas, passive activated carbon filters shall be provided to vent column(s)/stack(s). The activated carbon filters shall be of robust proprietary manufacture and sized to have a minimum retention time of 3 seconds at maximum flow-rate. Where mechanical ventilation is deemed necessary, it shall be of robust design and all control equipment shall be housed in a separate panel within the control kiosk.

5.16 General Electrical Requirements

Suitably rated electrical and plant control equipment shall be provided at the pumping station to ensure efficient and continuous operation of all plant and equipment. The plant telemetry equipment and installation shall be provided in accordance with **Section 5.26** and **Section 5.27** below. The electrical and control plant and equipment for the pumping station shall be located in a kiosk or structure within the pumping station site. The kiosk(s), including the electrical/control panels, shall be located at least 2m remote from the pumping plant.

The incoming electricity supply to the pumping station shall be 400 V, 3-phase and neutral, 4-wire, 50 Hz, with phase failure protection fitted to the incomer phases to prevent motor burnout due to phase failure. All electrical work associated with pumping station shall be carried out to IEE Regulations. The electrical installation work shall be carried out by a Contractor who is included in an approved Register for Electrical Contractors (e.g. RECI, IREC, etc.) and will carry out the works in accordance with this Part 5, which is generally in line with Irish Water's WIMES Electrical Specification.

The Developer/Developers Electrical Contractor is responsible to apply to ESB Networks for a dedicated and metered power supply and this shall be provided to the pump station serving only the pump station plant and associated equipment. The Developers Electrical Contractor must comply with requirements of ESB Networks and shall seek approval from ESB Networks for starter arrangement's (Star/Delta).

On completion of the electrical installation, the developer shall provide Irish Water with an electrical installation certificate, a signed declaration that the pumping station operates in accordance with the schematic diagrams and the required control philosophy.

A separate distribution board for building services shall be provided for an electrical heater, light and a 220V, 16amp, electrical weatherproof socket. Lightening protection shall also be provided.

5.17 Cables

Submersible pump power cables shall be multicore, flexible cord, vulcanised rubber insulated with tough rubber sheath and outer PCP sheath. All metal equipment at the pumping station (pump guide rails, covers, etc.) shall be bonded to earth, via earth rods located in inspection pits with removable covers, remote from the wet well location. The power cables shall comply with the following requirements:

5.17.1 Single core cables shall have a minimum CSA of 0.75 mm^2

5.17.2 Analogue signal cabling shall comprise screened cables (individually and/or collectively screened) and/or twisted pairs

5.17.3 Neutral conductors shall have the same CSA as their associated line conductors

5.17.4 Wires shall enter and leave an enclosure via a terminal rail and shall not be joined between terminals. Permanently-fixed insulating bushes shall be provided where wiring passes through internal plates or partitions

5.17.5 Cables shall run to enclosure doors in spirally-wrapped protection or similar.

5.17.6 Different categories of cabling and wiring shall be installed so as to prevent interference with each other.

The following requirements shall also apply as a minimum:

5.17.7 Cabling and wiring associated with intrinsically-safe circuits (IS) shall be segregated from other circuits in accordance with BS EN 60079-14. IS circuit trunking shall be appropriately labelled with no other circuits enclosed within it; and

5.17.8 If lightning and/or surge protection measures have been used to protect individual circuits, these circuits shall be segregated from the wiring of other unprotected circuits.

5.17.9 The colours of cables shall comply with the Table below.

Colour Code for Wiring

Function	Colour
Protective conductor	Green and Yellow
Current transformer (CT) circuits	White
Power Circuits	
Phase of a single phase circuit	Brown(4)
Phase 1 of a three-phase AC circuit	Brown(3)
Phase 2 of a three-phase AC circuit	Black(3)

Phase 3 of a three-phase AC circuit	Grey[3]
Neutral of a single- or three-phase circuit	Blue
Control Circuits	
110 V ac	Red
24 V ac	Yellow
24 V dc	Yellow
Negative Voltage	Blue
Inter-compartment, unsheathed	As per voltage
Inter-compartment, sheathed	Grey sheath, White cores
Signal Circuits	
Volt free, known voltage	As Per voltage
Volt free, unknown voltage	Red
Telemetry digital signals (single cores)	Pink[1]
Telemetry digital signals (multicore RTU-MCC)	White
Analogue 4-20 mA/1-5 V DC Single cores (multi drop applications only)	As per voltage[2]
Analogue 4-20 mA/1-5 V DC Screened (all standard applications including telemetry)	+ve – White[5] -ve – Blue[5]
Intrinsically-safe	Light Blue

Colour Code notes to Table:

(1) Signal and voltage/current and source/sink cabling

(2) For example, 24 V applications will have Yellow(+) and Blue(-)

(3) Brown may be used for all three phases, identified L1, L2 and L3 at each end of the conductor and at intervals along its length

(4) If there is more than one type of single phase wiring present within the electrical assembly, the wiring shall be phase coloured

(5) For example, for cables to PAS 5308-2/BS EN 50288-7, a single pair is coloured White/Blue

5.18 Cable Installation

5.18.1 General

Pump cables shall have sufficient slack and shall be tidily wound and secured to a stainless steel hook or bracket under the pump sump cover where they can be easily accessed and will not interfere with the lifting of the pump or become weighed down with debris or rags.

Where the kiosk/structure housing the control equipment and wet well are located a convenient distance apart the cabling shall be wired directly from the wet well to the kiosk/structure control panel.

All cables shall be installed using a proprietary cable support system and installed in accordance with the manufacturers recommendations. Cable tray shall be fabricated from heavy duty PVC, GRP, heavy duty hot dipped galvanised steel or from stainless steel. Choice shall be made with regard to weight and number of cables. Only heavy duty PVC cable tray will be permitted within wet wells.

Cable junction boxes shall not be installed internal within wet wells irrespective of their hazardous area zoning. If junction boxes are to be installed for cabling between the wet well and kiosk/structure housing the control panel, they shall be installed in either (a) an intermediate junction box in the valve chamber or (b) an intermediate junction box housed in an intermediate kiosk, manufactured with galvanised mild steel or stainless steel (grade 316L) or other approved material subject to the site environment.

Joints shall not be permitted in individual power and control cables, except at junction boxes.

5.18.2 Glanding

Cable glands shall be suitable for the type of cable being installed and its intended operating environment. Cable gland selection shall, as a minimum, consider the following performance requirements:

5.18.2.10 mechanical properties,
5.18.2.11 electrical properties; and
5.18.2.12 resistance to external influences.

The minimum degree of ingress protection shall be IP66

Where a cable gland is through a painted or otherwise coated metallic surface, provision shall be made to ensure earth continuity between the gland and the enclosure.

5.18.3 Termination

Wiring shall be terminated using crimped connectors or lugs, both of which shall be suitable for the conductor and the type of termination, as recommended by the manufacturer. For screened signal cables, screens shall be connected to earth using a proprietary 360° connection.

5.18.4 Junction Boxes

Junction boxes shall be designed for bottom cable entry. Junction boxes shall be sized so that there is adequate space between the point of cable entry and the terminals, such that cable cores may be spread, loomed, identified, terminated and subsequently

removed for testing, without experiencing excessive bending or stress. Junction boxes shall be provided with an adequate means of earthing. Terminals shall be clipped to rails fixed to the back of the junction box or supported off brackets integral with the junction box. When a junction box is open, the degree of ingress protection to any live part, or to any part that could be energised at above low voltage during any test procedure, shall be a minimum of IP2X.

5.18.5 Identification of Wiring

All cabling and wiring shall be identified at both ends by interlocking ferrules or approved Irish Water method. All spare cores shall be identified. The colour code for wiring shall be in accordance with WIMES. The following requirements shall apply:

- No more than two conductors shall be connected to one side of a terminal.
- Spare cores shall be terminated at both ends.
- Terminals shall be safely and easily accessible after all wiring has been installed and terminated.
- Terminals shall be grouped together and segregated according to operating voltage and function by terminal rail mounted barriers.
- Terminals used for the connection of intrinsically-safe circuits shall be coloured blue and be physically separated from other terminal groups by a minimum distance of 50 mm. These terminals shall have a clear shrouded cover and be fitted with an appropriate warning label.
- Unless otherwise specified by the instrument manufacturer, all instrument cable screens shall be tied back and insulated from earth at the instrument end of the cable, and at the control panel end of the instrument cable the screens shall be connected to the instrument earth bar, i.e., one common star point.
- After installation of cables, all ducts shall be sealed with an approved proprietary sealant. Where the seal is providing a barrier between hazardous and non-hazardous areas, a transit plate arrangement or other approved proprietary sealing arrangement shall be installed, tested and certified as DSEAR compliant.

5.19 Control Panels General Requirements

The pump control panel for pump plant exceeding 7.5 KW shall be Form 4 Type manufactured and fabricated to IEE Regulations. Otherwise, the pump panel shall be Form 2 or better.

The control panel shall have provision for connection of an external standby generator. The power supplier shall be notified of this installation to allow for an isolation or ‘kill’ switch.

When the control panel is isolated and open, the degree of ingress protection (IP rating) of any remaining live part, or of any part which could be energised at above extra-low voltage during any test procedure, shall be a minimum of IP2X.

Suitably-rated protection devices shall be provided at all points necessary for the protection and isolation of power and control circuits, and to minimise disruption to the overall system on the failure of a component part of the system

Compartments that contain both extra-low and low-voltage systems shall be arranged so that systems of differing voltages are physically segregated from each other

When the control panel is isolated and open, the degree of ingress protection (IP rating) of any remaining live part, or of any part which could be energised at above extra-low voltage during any test procedure, shall be a minimum of IP2X.

The electrical assembly shall be designed for bottom entry of the pump cables. LED Indicator lamps, Filament lamps shall not be used

All control panels shall incorporate, at a minimum, the following:

- Generator incomer section complete with generator changeover switch interlocked with mains supply incomer isolation switch;
- A hand/off/reverse selector for each pump, subject to manufacturers approval;
- A “Pump Unit Start” push button;
- A “Pump Unit Stop” push button;
- Ammeter and hours run meter for each pump;
- Run light and trip lights for each pump (one for temperature and one for seal failure);
- Reset button for each pump;
- Duty/Standby or Duty/Assist/Standby selector for each set of pumps;
- Lockable mains incomer isolator;
- Lockable door interlock isolators for all starter sections;
- A sump level indicator for recording the Wastewater surface level in the pump sump on a separate wall mounted unit within the kiosk;
- Flow Indication – both instantaneous and totalised either on a separate wall mounted unit within the kiosk;
- Volt free contacts, as outlined in Section 5.24, for future retrofitting of a telemetry system.

The IP rating of the electrical assembly shall be IP54. This IP rating shall apply to the complete assembly including all components mounted on the assembly.

The control panel shall have provision for connection of an external standby generator. The connection for a mobile generator provided on the incoming section of the electrical assembly shall be a 125 A, 5-pole (L1, L2, L3 + N + E), male appliance inlet to BS EN 60309. A removable link shall be provided to disconnect the pumping station from the DNO's main earth terminal (MET), in the event that a mobile generator is connected to the pumping station. A stud terminal shall also be provided in the kiosk for connection of the mobile generator star point to the earth electrode. A label shall be fixed adjacent to

the stud terminal stating "Bolted Earth Connection shall be made before Generator Is Connected with Main Plug And Socket".

5.20 Form 4 Control Panel Compartments – Additional Requirements

Each compartment of a Form 4 control panel shall include an earth stud, connected to the earth bar or main earth stud by a separate protective conductor. Protective conductors shall be sized to withstand the fault level, subject to a minimum CSA of 6 mm^2.

Each compartment shall have protective conductors, with a minimum CSA of 2.5 mm^2, or braided straps of the appropriate CSA for earthing and EMC requirements, taken from the compartment earth stud to the compartment door, the component mounting plates and earth terminals, the equipment mounting rail earth terminals; and the metal cases of instruments.

For pumps with motor of 11kw the control panel shall also incorporate, at a minimum, the following:

- Power meter with volts, power factor, Kw, Kwh, power outage for Kwh, etc. displays.
- Power Factor Correction
- Surge and Lightening protection

In addition to the requirements outlined above in **Section 5.19**, the Form 4 control panel shall incorporate the following requirements.

5.20.1 Incomer Section

The incomer compartment shall contain the following:

- Suitable 4-pole (3-phase and switched neutral) fuse switches with suitably-rated HRC fuses, mechanically interlocked and assembled to form a switch for the mains and standby generator supplies. The switch shall be labelled “Mains/Off/Generator” and the door shall be interlocked and padlockable in the “Off” position;
- A phase failure, phase reversal and low voltage protection relay to provide a “Mains Failure” telemetry signal. The phase failure detection relay shall be connected downstream of the "Mains/Off/Generator" switch;
- A set of fuses and a neutral link for the phase failure relay and voltmeter
- A control circuit transformer (CCT) for the common control compartment (CCC),
- A power monitoring facilities if the rating of each pump unit is above 10 kW
- A fuse-fed, single phase and neutral distribution board, complying with BS EN 61439-3, with integral isolator and hinged cover. All MCBs, RCDs and RCBOs incorporated within the distribution board shall comply with BS EN 60898, BS EN 61008 and BS EN 61009, respectively, and be padlockable in the “Off” position.

5.20.2 Control Circuit Supply

The control circuit supply voltage shall be 110v AC or 24v DC. The common control and motor starter functional units shall each be provided with a dedicated control circuit transformer. The common control and motor starters shall each be provided with a means of switching, isolation and short-circuit protection for the incoming control circuit supplies. Control circuit supplies shall be energised when the associated fuse switch is in the “On” position. The primary and secondary windings of all CCTs shall be protected by fuses or double pole MCBs. Removable neutral links shall be provided if protection is afforded by fuses.

5.20.3 Motor Starter Compartments

The motor starter compartment shall contain the following:

- A triple-pole fuse switch with three suitably-rated HRC fuses and auxiliary switching of all live and neutral control circuits (complete with test position);
- A 3-phase thermal overload relay with single phasing protection

All motor protection systems shall be of the electrically-latched and manually-reset type. The operating handle for the fuse switch shall be door-interlocked and padlockable in the “Off” position. Each motor start compartment shall include the following:

a) a “Hand/Off/Auto” selector switch;
b) “Common Fault Reset push button;
c) “Pump Unit Start” push button;
d) “Pump Unit Stop” push button;
e) “Pump Unit tripped lamp;
f) “Pump Unit Running” lamp;
g) “Auto-available” lamp;
h) individual fault lamps;
i) Amp meter per pump
j) Hour Run clock per pump

5.21 Earthing and Bonding

The assembly earthing system shall incorporate an earth bar or main earth stud. The earth bar or stud shall be provided with facilities for connecting to the main earth terminal provided by the electrical power supplier.
Each metal gland plate shall be connected directly to the earth bar or stud by a separate protective conductor. Protective conductors shall be sized to withstand the fault level, subject to a minimum cross-sectional area (CSA) of 6 mm^2.

Separate earth bars or studs shall be provided for connecting equipment requiring a clean earth or an intrinsically-safe earth directly to the Mains Earth Terminal. If required, such earth bars or studs shall be located adjacent to the equipment requiring a clean earth or an intrinsically-safe earth, as appropriate.

5.21.1 Earth Electrode

The earthing system shall be designed and installed to include the earthing and bonding of all exposed metalwork. A main earth bar and earth rod or mat system shall be provided. The earth rod resistance shall be tested when disconnected from the rest of the earthing system. A stud terminal shall also be provided in the kiosk for connection of the mobile generator star point to the earth electrode. The earth electrode shall provide a maximum effective earth resistance of 10 Ohms or less. The earth rod resistance shall be tested when disconnected from the rest of the earthing system. The earth electrode shall be connected to the power supplier's main earth terminal (MET) via a removable test link.

5.21.2 Bonding

All extraneous conductive parts of the pumping station shall be connected to the main earthing terminal. The bonding conductor shall be connected to the various connection points in the kiosk, valve chamber and wet well. The bonding conductor shall be continuous and not cut at each connection. Metallic cable and wiring support systems shall be bonded to all non-electrical services.

5.22 Pumping Station Control Panel Enclosure

A pump station control kiosk enclosure shall be provided to accommodate metering equipment, pump control panels, telemetry equipment, heating and lighting systems, a socket point for a standby generator, a 220V and 110 V external use socket, etc. The power supplier will provide a separate kiosk for the electrical supply.

The minimum size of the kiosk for Type 1 and Type 2 pump stations shall be 1,200mm (L) x 1,800mm (H) x 1,200mm (D). The minimum size of kiosk for the Type 3 pump stations shall be 2,000mm (L) x 2,000mm (H) x 1,200mm (D). In all instances there shall be a clear minimum working space between the front of the panel and the plinth edge of 750mm. The roof of the unit shall have a slope front to back. Standard warning notices shall be placed on the kiosk to warn of danger. The size of the power supplier's kiosk shall be to ESB Network's requirements.

The kiosk shall be a of a 'walk- in' design with open base and one piece roof that slopes to the rear. The kiosk shall be supported on a reinforced concrete plinth extending 150mm in each direction beyond the external plan dimensions of the kiosk. The plinth shall have a level finish, with 25mm chamfered edges, 150mm above the finished ground level. The kiosk shall be bolted to the plinth through a bottom flange with galvanised mild steel or stainless steel anchor bolts. The bottom flange shall be seated on a neoprene gasket and sealed with mastic to prevent ingress of water.

The plinth shall incorporate appropriate ducting to connect into the site power, telemetry and control ducts to facilitate cabling between the kiosk and the various chambers

within the pumping station site. Long radius bends shall be incorporated in the ducting, sharp elbows shall not be used.

The walls, roof and doors of the kiosk shall be constructed from either galvanised mild steel, 3mm minimum thick welded plate, with polyester coated finish, or in stainless steel in severe environments. Metallic kiosks shall be fully bonded and earthed. Alternative forms of kiosk construction other than galvanised mild steel or stainless steel will generally be required in areas subject to vandalism, e.g. enclosure of the kiosk(s) in a block-work or reinforced concrete enclosure with vandal proof doors.

The edges of the kiosk doors shall be stiffened by steel sections. The rear wall of the kiosk shall be reinforced with stainless steel sections to which a marine plywood board, 18mm thick, is fixed to support the electrical assemblies associated with the pumping plant.

The walls of the kiosk shall have turned bottom flanges, with suitably factory formed holes to accommodate the bolts securing the kiosk to the concrete plinth. The bottom holes shall be reinforced with 5mm thick steel plate, welded to the steel wall of steel fabricated kiosks. The holding down bolts shall be galvanised mild steel or stainless steel expanding anchor bolts complete with large washers. The bolts shall be located at suitable intervals to prevent bottom flange distortion.

The quality of the kiosk construction shall ensure that the following is achieved:

5.22.1 A thermal transmittance of 1.5W per m^2K;

5.22.2 A fire resistance (retention of stability, integrity and insulation) equivalent to Class 2 of BS 476, when tested in accordance with BS 476 for a period exceeding 30 minutes;

5.22.3 An IP rating of IP55 at least or equivalent.

The preferred exterior colour of the kiosk is dark green (to BS 4800 (2011) 14C 39).

The doors of the kiosk shall be single or double leaf steel with multiple locks to LPS 1175, SR3 or IS EN 1627. There shall be a minimum double lock with bolts that engage into the sill and header as well as between the two leaves or leaf and frame. The leading edge of the leaves shall have rebated edges or fitted with astragals. The door leaves shall be fitted with vandal-resistant stainless steel hinges and self-latching stays to restrain the door in the fully opened position (minimum opening angle of 90 degrees).

The kiosk shall be fitted with suitably sized weather resistant and vermin resistant ventilation grills, complete with fly screens. These grills shall be fitted at low level at one side of the kiosk and at high level at the opposite side of the kiosk so that cross ventilation is achieved. Ventilation within the kiosk shall be sufficient to restrict temperature in the kiosk, under all weather conditions, to a maximum of 40 degree Centigrade at any one time and to an average of 35 degree Centigrade over a 24 hour period.

The kiosk shall be fitted with a small opening, complete with a lockable, hinged panel, lockable from the inside. It shall be located opposite the electrical assembly to provide access for standby generator facilities.

Where additional security is required or where specified in the Planning approval, a structure for the housing of the control panel and associated equipment shall be constructed of block work, 215mm solid block to IS EN 771 – Part 3, with smooth render finish internally and externally (or alternative agreed by Irish Water subject to the requirements of Planning). The block work shall be supported on a reinforced concrete support slab finished 150mm above general finished ground level. The structure shall have a 150mm reinforced concrete roof slab, projecting 150mm outside of the wall, with drip beading, complete with asphalt to provide a weatherproof roof. The structure shall have galvanised steel security doors, twin leaf, opening outward and fitted with furnishing as outlined above for the kiosk. Appropriate ventilation, openings, etc. as described above for the kiosk shall be provided to achieve the same environmental parameters as outlined. The structure shall also be equipped with lighting, ventilation, welfare facilities, etc. to allow maintenance and monitoring to be carried out.

An additional Kiosk, to the local ESB Network's requirements, shall be provided within the pumping station site to house the panel, electricity supplier's meter, etc., complete with separate dedicated ducting for the power service provider electrical supply incoming feed. Separate security control arrangements, to the local ESB Network's requirements, shall be provided for the power supplier's access to this kiosk for meter reading.

5.23 Control Philosophy

The pumping station shall be designed to operate in the following modes:

a) Automatic mode – in this mode of operation the control system shall operate the pumping station automatically, without need for manual intervention; and
b) Manual mode – in this mode of operation, the control system is overridden and the operator can operate the pump units manually via the pushbutton switches mounted on the door of the Assembly (Form 1B) or motor starter compartments (Form 4).

The pumping station control system shall allow for auto reset in the event of a power failure. The pump units shall be operated in response to the level of effluent in the wet well. For all types of pumping station, an ultrasonic level control system shall be provided together with a separate high level float switch.

The relays within the ultrasonic level controller shall be configured to achieve the following pump unit control philosophy based on the four level set points as follows:

a) Level rising through 'snore' level – no action;
b) Level rising through duty/standby pump unit stop level – no action;

c) Level rising through duty pump unit start level – start duty pump unit;
d) Level rising to High Level - turn on duty pump or switch to standby via float switch.
e) Level falling through duty pump unit start level – no action;
g) Level falling through duty/standby pump unit stop level – stop duty pump;
h) Level falling through 'snore' level – inhibit both pump units;
i) In the event of low flow and high level – stop start duty pump and start stand-by pump unit and pump fault alarm raised.

The ultrasonic level controller shall have a facility to provide sequential rotation of pump units, to sequentially rotate the pump unit duty/standby status each time all pump units are stopped to ensure equal pump unit usage, as well as allowing individual pumps to be operated.

The ultrasonic level controller shall be configured to initiate a wet well cleaning ('snore') cycle once a day. The 'snore' level shall be chosen to be as low as possible without affecting the safe/effective operation of the pump units; the pump unit manufacturer shall be consulted to this end.

The ultrasonic level controller shall be configured so that the wet well level readings are displayed in the kiosk, and if required, transmitted via telemetry.

The ultrasonic level controller shall be configured so that the 'zero level' reading in the wet well corresponds to the level of the wet well. The span of the ultrasonic range shall be set up at. 'snore' level i.e. the level below which the pump units cannot pump anymore.

The Ultrasonic shall be configured to transmit a "Loss of Echo" alarm to telemetry if there is an interruption/loss of signal from the ultrasonic transducer in the wet well (the pumping station will be effectively under back-up level control until the fault is rectified).In the event of the above, the Ultrasonic shall de-energise all pump unit relays to remove pump unit control from the Ultrasonic Local Control (ULC).

To prevent "nuisance" switching between ULC and back-up control, the ULC shall be configured so that transmission of alarms/de-energising of pump unit relays only occurs if there is an interruption/loss of signal for a time period greater than one minute.

5.24 Testing

The pump units shall be tested on site to ensure they are capable of delivering the design flow rate under all possible operating conditions, without cavitation or excessive noise, vibration, temperature or leakage. This shall be recorded in a commissioning plan which shall also note:

- The make, model and serial number of the pump.
- Flowrate

- Amps
- Date of test.

A visual inspection of the pumping station shall be made to ensure it complies with this Specification and that it is constructed in accordance with the agreed design, and consistent with the agreed designs, specifications and site layout, including features relating to access, egress and safety assessment. The wet well shall be checked for signs of stagnation, vortices, pre-swirl and accumulation of solids. Functional checks shall be made of all installed instrumentation, including:

- Sat test of panel (confirming the panel can undertake the items as per control philosophy)
- Commissioning of flowmeter
- Commissioning of ultrasonic
- Testing of building services
- Commissioning of alarm system
- Testing of the earthing (10 Ohms or less) and bonding
- Review of the hardcopy of the Operation & Maintenance Manual (in one PVC hardback A4 folder).

These checks shall be made in the presence of Irish Water.

The Operation & Maintenance Manual, to be included in the Final Documents (as outlined in **Section 1.8.9**) is to include at a minimum:

- General description of the pump station (i.e. number of houses, size & length of rising main, discharge point etc.)
- General safety considerations of working in and near pumping stations
- As-build drawings of pump station including showing the route of the rising main and electrical ducts
- Commissioning sheets for the pumps and equipment
- Blank sheets for ongoing Operation & Maintenance duties.
- Panel drawings
- Pump curve
- Pump O&M manual (including wiring diagram)
- Exploded diagram of spare parts for the pump installed
- Details of the alarm system including instruction on how to change phone number etc.

5.25 Abnormal Operation

5.25.1 Power Failure

On the restoration of the power supply after a mains/phase failure, the control system shall automatically resume normal operation including where appropriate pump unit restart.

5.25.2 Pump Failure

The control system shall incorporate the following hard-wired pump unit protection systems:

- motor overload protection;
- motor over-temperature protection;
- pump unit mechanical seal failure protection

The pump seal leak sensor is for alarm monitoring only and shall only shut down the pump if it is installed in a hazardous area.

If the hard-wired protection system is activated, the control system shall allow the operator a maximum of three remote resets after which the drive shall be locked out.

5.26 Telemetry

The control panel shall provide for Volt Free Contacts as shown in the Table below. Should Irish Water wish to install a telemetry outstation to transfer data from the pumping station to an Irish Water control centre in future, the information will be freely available. A clear space of 450mm by 600mm is to be left on the kiosk backboard.

Site Mains Available	X					
Pump 1 Failed / Healthy	X					states are tripped/healthy
Pump 1 Control	X					states are unavailable/available
Pump 1 Running / Stopped	X					
Pump 1 Motor Temperature	X					If available
Pump 1 Water in Oil	X					If available
Pump 2 Failed / Healthy	X					states are tripped/healthy
Pump 2 control	X					states are unavailable/available
Pump 2 Running / Stopped	X					
Pump 2 Motor Temperature	X					If available
Pump 2 Water in Oil	X					If available
Wet Well High Level	X					Normal / High
Wet Well High High Level	X					Normal / High
Wet Well Level Instrumentation	X					Normal / Failed

Station Level Meter		X				
Station Output Flow		X				
Pump Power (kWh)			X			In pump stations with pumps over 11kW

The following abbreviations are used in the table:

- DI – Digital Input
- AI – Analogue Input
- PI – Pulsed Input
- DO – Digital Output
- AO – Analogue Output

5.27 Dial Out Alarm

The pump station shall be fitted with GSM dial out alarm, complete with battery backup. It shall be possible to text up to 5 numbers on the dial out alarm. The dial out alarm shall escalate the alarm message automatically if the first recipient does not respond to the alarm by acknowledging the fault. If the second person does not acknowledge the alarm message, forwarding the message to further subscribers shall occur. The escalation can be traversed any number of times by looping back to the beginning of the escalation chain until the message is acknowledged. It shall be possible to configure dial out numbers. The dial out alarm shall be configured to send the following alarms:

- Loss of Site Mains Supply Alarm
- Pump 1 Fault
- Pump 2 Fault
- Wet Well High Level
- Wet Well High High Level
- Level Instrument Fault

5.28 Meter Chambers

Flow meters shall be installed in chambers and these shall be suitably sized to accommodate the meter and allow access for maintenance. The flowmeter chamber shall be fully sealed with a drain to allow the discharge of liquid from the flowmeter chamber to the wet well. If this is not possible due to site constraints, the chamber base shall incorporate a 300mm square, 300mm deep sump.

The base and walls of the chamber shall be constructed in C30/37 concrete to IS EN 206, 20mm aggregate size to IS EN 12620, with a minimum thickness of 250mm. The chamber shall be complete with a reinforced concrete roof formed with C30/37 concrete, 20mm aggregate size concrete of minimum thickness of 225mm, reinforced with high tensile reinforcement to BS 4449.

If precast concrete units are used for meter chamber construction, they shall conform to IS EN 1917 and IS 420. Joints between the precast components shall provide equivalent water resistance as required in IS EN 1992 – Part 3. The precast units shall be surrounded with not less than 150mm thickness of Grade C20/25 to IS EN 206, 20mm aggregate size to IS EN 12620.

The roof slab shall incorporate a 900mm x 900mm opening to allow the visual inspection of the meter and the removal of the meter vertically. Cast-in recessed lifting eyes shall be provided in each corner of the concrete roof slab to allow it's positioning in place. In addition, these lifting eyes shall be used to remove the roof slab if required for access to the chamber to allow maintenance of the meter and its removal replacement if necessary.

The internal dimensions of the chamber shall be sufficient to contain the meter and any associated pipework. The bolts and joints shall be visible and accessible in order to allow for maintenance and for the possible future replacement of the meter without the need for excavation. The depth of the meter chamber shall provide a minimum of 300mm clearance beneath the meter fitting. Sufficient clearance shall be provided between the walls and the meter equipment to allow maintenance and equipment replacement activities to be carried out.

The chamber shall be fitted with Manhole steps to comply with IS EN 13101, Type D, Class 1, galvanised mild steel and plastic encapsulated. Access to the confined space within the chamber shall not generally be required but when needed this access shall be by way of a safe access plan.

The cover shall be sufficient for a 900mm by 900mm opening. It shall be capable of withstanding imposed loads and shall comply with IS EN 124, D400 if located on roadways or footways. Lower load capacity rated covers may be used if the chamber is located off road in green areas, subject to Irish Water approval. The covers and frames shall be sealed water tight where the pump stations would be subject to inundation/submergence.

The cover frames shall be supported on Class B engineering brick to IS EN 771 – Part 2. The brickwork shall be bedded in mortar, minimum M30 strength to IS EN 998-Part 2:2010. The frame and cover shall be in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing. The covers shall be set on the brick to finish in alignment with the pump station hard standing surface. Meter chamber covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete to IS EN 206, 20mm aggregate size to IS EN 12620, bedded in Clause 804 material. The plinth shall be surrounded along its external perimeter by a stainless steel metal band.

5.29 Cable Ducts and Chambers

Kiosk plinth shall incorporate appropriate ducting to connect into the power, telemetry and control ducts to facilitate cabling between the kiosk and the various plant items associated with the kiosk. Long radius bends shall be incorporated in the ducting, sharp elbows shall not be used. The ducting shall be in accordance with IS EN 61386-24. Ducts used for ESB Networks cables shall be in accordance with ESB Networks specification 16113 and IS 370 colour code.

The ducting diameter and number shall be appropriate for the cables required and the minimum duct size shall be 100mm diameter. The ducts shall be red unless otherwise specified. All ducts shall have a minimum cover of 600mm. The duct pipes shall be bedded, haunched and surrounded in sand. Clause 808 backfill granular material, in accordance with the National Road's Authority Specification for Road Works, shall be provided above the sand surround. Long radius bends may be used for direction changes up to 45 degrees, duct chambers shall be provided for changes in direction above this. Marker tape shall be provided above the duct pipe runs and shall incorporate reinforced tracing wire. The ducting shall be constructed watertight and built into the base of the kiosk and the walls of the miscellaneous chambers. All cable ducts shall be provided with draw cords/ropes to allow the pull through of the cables.

A drain shall be provided from the lowest positioned cable duct chamber to a soak away to allow any water ingress to be drained from the duct system. The ducts, or duct banks, shall be located 150mm above the floor of the duct chamber.

Ducts shall be provided between the control panels and the various units of the pumping station which require cable runs for power, telemetry and control. All power and control cable ducts between the pump chamber and the control panel shall be fully sealed to prevent ingress of gas from the pump sump and valve chamber to the kiosk containing the panels. This shall be achieved using non-degradable expandable foam or gas tight sealing glands. Spare draw wires shall be left in all ducts for future use.

Ducts shall be provided as follows:

- The ESB's incoming power cable:- one duct shall be provided, sized in accordance with the power supplier's specification (e.g., colour, size, etc.) and routed between the point of supply and the kiosk plinth in accordance with the ESB Network's requirements;
- The installation earth cable:- one duct shall be provided, 50 mm in diameter, and routed between the point of supply and the kiosk plinth;
- The pump unit cables:- two ducts shall be provided, 100 mm in diameter, and routed between the wet well, valve chamber and the kiosk plinth,
- The ultrasonic level sensor and float switch cables:- one duct shall be provided, 100 mm in diameter, and routed between the wet well, valve chamber and the kiosk plinth;

- The flow meter:- one duct shall be provided, 100 mm in diameter and routed between the flow meter sensor and the kiosk plinth;
- The minimum segregation/separation between Band 1 (ELV signal) and Band 2 (LV power) cables shall be 300 mm;
- Ducts shall terminate approximately 75 mm proud of the surface of the plinth.
- The depth of cover in soft ground shall be a minimum of 750 mm above the crown of the duct.
- On completion, all ducts shall have a swab drawn through to clear them of obstructions.
- Ducts shall be left with an excess 1 m length of draw cord in place, anchored at each end.
- Ducts shall have sufficient space to enable the installation and removal of any cable without the need to remove any other cable or component.
- Ducts shall incorporate adequate facilities to locate and support the cables.
- Conduit shall be provided for installation of the cables associated with the kiosk lighting systems, heating systems and/or socket outlets.
- Cable ducts shall be sealed using a gas-tight sealing technique (not foam).

Where deemed necessary, duct chambers shall be installed at bends and these shall have a minimum 900mm by 900mm internal dimensions. The base and walls of the cable duct chambers shall be constructed in C30/37 concrete to IS EN 206, 20mm aggregate size to IS EN 12620, with a minimum thickness of 225mm. Chambers of the above dimensions will not require a roof. A concrete roof slab shall be provided if chambers of larger dimensions are required. The roof in this instance shall be constructed of reinforced concrete formed with C30/37 concrete to IS EN 206, 20mm aggregate size to IS EN 12620, of 225mm minimum thickness, reinforced with high tensile reinforcement to BS 4449.

The opening shall be 900mm x 900mm to allow access to the cable chamber. The cover to the chamber opening shall be sufficient for a 900mm by 900mm opening. It shall be capable of withstanding imposed loads and shall comply with IS EN 124, D400 if located on roadways or footways. Lower load capacity rated covers may be used if the chamber is located off road in green areas, subject to Irish Water approval.

The cover frames shall be supported on the chamber walls, if the chamber dimension is 900mm by 900mm. It shall be supported on the chamber roof slab if such is provided. In this instance the cover frame shall be supported on Class B engineering brick to IS EN 771 – Part 2. The brickwork shall be bedded in mortar, minimum M30 strength to IS EN 998-Part 2:2010. The frame and cover shall be set in rapid hardening cementitious, epoxy resin or polyester resin mortar. The mortar shall have a minimum working time of 15 minutes and shall reach a minimum compressive strength of 30 N/mm^2 and minimum tensile strength of 5 N/mm^2 within 3 hours of mixing The covers shall be set on the brick to finish in alignment with the pump station hard standing surface.

Duct chamber covers, where located in grass areas, shall be surrounded by a concrete plinth, 200mm all round and 100mm deep formed with C20/25 concrete to IS EN 206,

20mm aggregate size to IS EN 12620, bedded in Clause 804 material. The plinth shall be complete with bull-nose finish to its perimeter and shall be provided with a mild steel reinforcement link.

5.30 Lifting Equipment

Suitable cast in davit sockets shall be provided in the roof slab of the pumping station. Davit sockets shall be designed and positioned to provide lifting equipment with a vertical pull on the pump unit lifting attachments, to enable pump units to be readily raised or lowered on their guide rails. Cover plates, flush with the top of the surrounding concrete, shall be provided to prevent the ingress of water and debris into the sockets.

The davit sockets shall be suitable to accommodate lifting davits and lifting tackle to permit the safe lifting of the pump installation. The minimum rating of the davit, lifting tackle, etc. will be 500kg, safe working load (SWL). Lifting davits, tackle and sockets will be rated to lift twice the weight of each pump unit, subject to a safe working load of 500kg. The davits sockets shall be of stainless steel or galvanised mild steel in accordance with the safety certificate requirements.

In some instances, Irish Water may require a permanent lifting gantry instead of a davit arrangement. In these situations, Irish Water shall be consulted in relation to the specific requirements. Such gantries shall be fabricated of galvanised structural steel and shall be permanently fixed on concrete support plinths, suitably sized, through base plates with anchor bolts. Such gantries shall be load tested and certified as outlined above. The manufacturer's name and the SWL of the lifting equipment shall be stamped on a stainless steel plate attached to the equipment. The lifting gantry shall be provided with a block and tackle, which shall be load-tested and rated along with the gantry assembly. Sites with such lifting equipment shall be fenced in accordance with the details outlined in **Section 5.6** above.

5.31 Wash-Down Facilities

Pumping stations shall be provided with wash-down facilities for cleaning and washing mechanical plant following its removal for routine maintenance, repair and/or replacement. This shall comprise a cold water supply with an external lockable tap, suitably insulated to prevent freezing of the supply system and a length of water hose to extend to the wet well location. A 25mm water supply shall be provided to the pumping station site and this supply shall be fitted with a water usage meter. The supply pipe shall also be provided with an approved non-return valve to prevent backflow contamination of the public water supply system.

5.32 Testing of Water Retaining Structures

After cleaning, building in of all pipework and, as far as practicable, before any earth or other filling is placed against the outside of the wall faces, liquid retaining concrete structures designed to retain an aqueous liquid (e.g. the wet well) shall be filled with

water at a uniform rate of not greater than 2m in 24 hours. A period of 21 days shall be allowed for stabilisation, after which the water level shall be recorded at 24-hour intervals for at least 7 days. During the test period, the total permissible drop, after allowing for evaporation and rainfall, shall not exceed 1/500 of the average water depth of the full tank or 10mm, whichever is the lesser.

If the requirements of the 7-day test are not met, after completion of any remedial works, the structure shall be refilled and, if necessary, left for a further stabilisation period after which the water level shall be recorded at 24-hour intervals, for a test period of 7 days.

Notwithstanding the satisfactory completion of the above test, any leakage visible on the outside faces of the structure shall be stopped. Any caulking or making good of cracks in the wall section shall, where practicable, be carried out from the inside face.

The hydraulic test of the structure shall be carried out after successful completion of the roof test and before any sealing is undertaken.

Adjacent internal chambers within the structure shall be tested separately and sequentially. Chambers adjacent to the test chamber shall be empty during the test.

After satisfactory completion of the test, the structure shall be emptied, as far as practicable, unless the water can be used as part of subsequent activities.

When testing uncovered concrete structures, the test results shall be corrected for observations of the gain in water from precipitation or the loss of water from evaporation. This difference can be measured by placing a transparent, floating, open container (calibrated and partially filled) in the structure. The container shall be positioned away from the sides and any overhead obstruction that may shield or shade the container. The container shall have sufficient freeboard to accommodate the precipitation from normal rainfall and be overtopped by waves generated by the wind.

Appendix A

Standards Referenced in the Wastewater Code of Practice

Standard Type:

IS Irish Standard
BS British Standard
IS EN European Standard adopted as an Irish Standard
BS EN European Standard adopted as a British Standard
WIS UK Water Industry Specification

Standard Type	Standard Number	Title
IS EN	124	Gully Tops, Manhole Tops for Vehicular and Pedestrian Areas – Design Requirements, Type, Testing, Marking, Quality Levels (See also BS EN 124)
IS	261	Water Services Road Furniture – Requirements for Cast Iron Cover and Frames
BS	7903	Guide to Selection and Use of Gully Tops and Manholes for Installation within Highways.
IS EN	206	Concrete Specification, Performance, Production and Conformity (See also BS EN 206:2013)
BS	8500 -1	Concrete – Complementary British Standard to BS EN 206-1, Part 1 – Method of Specifying and Guidance for Specifier.
BS	8500 -2	Concrete – Complementary British Standard to BS EN 206-1, Part 2 – Specification for Constituent Materials and Concrete.
IS EN	197	Cement Part 1:- Composition, Specification and Conformity Criteria for Common Cements. Part 2:- Conformity Evaluation
IS EN	1996	Design of Masonry Structures – General Rules for Reinforced and Unreinforced Masonry Structures (Including Irish National Index)
IS EN	13242	Aggregates for Unbound and Hydraulically Bound Material for Use in Civil Engineering Works and Road Construction
BS EN	1092-1	Flanges and Their Joints – Circular Flanges for Pipes, Valves, Fittings and Accessories – PN Designations Part 1:- Steel Flanges.
BS	4449	Steel for Reinforcement of Concrete – Bar, Coil and De-coiled Product - Specification
BS	381C	Specification for Colour for Identification, Colour and Special Purposes
BS	6076	Specification for Polymeric Film for Use as a Protective

		Sleeving for Buried Pipes and Fittings (for Site and Factory Application)
BS	9124	Specification for steel and aluminium access cover systems with over 1m clear opening
WIS	4-08-02	Specification for Pipe Bedding and Side-fill Materials for Buried Pipelines (IGN 4-08-01 Information and Guidance Note on Bedding and Side-fill Materials for Buried Pipelines.
IS EN	12620	Aggregate for Concrete (See also SR16 – Guidance for Use of IS EN 12620)
SR	16	Guidance for the Use of IS EN 12620:2002 (Aggregate for Concrete)
BS	5834	Surface Boxes, Guards and Underground Chambers for the Purposes of Utilities – Part 2 - Specification for Surface Boxes
BS	5834	Surface Boxes, Guards and Underground Chambers for the Purposes of Utilities – Part 4 - Specification for Utility Chambers
BS EN	1561	Grey Cast Iron
IS EN	771	Specification for Masonry Units Part 2:- Calcium Silicate masonry Units Part 3:- Aggregate Concrete masonry Units (Dense and Lightweight Aggregate)
BS EN	12613	Plastic Warning Devices for Underground Cables and Pipelines with Visual Characteristics
WIS	4-32-08	Specification for Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE80 and PE100 Materials
WIS	4-32-15	Specification for PE80 and PE100 Spigot Fittings and Drawn Bends for Nominal Sizes up to and including 1000.
WIS	4-32-17	Specification for PE80 and PE100 Electro Fusion Fittings for Nominal Sizes up to and including 630.
IGN	4-32-18	The Choice of pressure rating for Polyethylene Pipe Systems for Water Supply and Sewerage Duties
IGN	4-01-03	Guide to Pressure Testing of Pressure Pipes and Fittings for use by Public Water Suppliers.
WIS	4-35-01	Specification for Thermoplastics Structured Wall Pipes, Joints and Couplers with Smooth Bore for Gravity Sewers for the Size Range 150 – 900 Inclusive
IS EN	752	Drain and Sewer Systems Outside Buildings (See also BS EN 752 2008 - Drain and Sewer Systems Outside Buildings)
IS EN	1671	Pressure Sewerage Systems Outside Buildings (See also BS EN 1671:1997, Pressure Sewerage Systems Outside Buildings)
IS	6	Concrete Sewer Pipes
IS EN	1916	Concrete Pipes and Fittings, Unreinforced, Steel Fibre and Reinforced

		(See also BS EN 1916)
IS EN	1917	Concrete Manholes and Inspection Chambers, Unreinforced, Steel Fibre and Reinforced (See also BS EN 1917)
BS	5911-1	Concrete Pipes and Ancillary Concrete Products – Part 1 Specification for Unreinforced Concrete Pipes (Including Pipe Jacking Pipes) and Fittings with Flexible Joints
BS	5911-3	Concrete Pipes and Ancillary Concrete Products – Part 3 Specification for Unreinforced and Reinforced Concrete manholes and Soakways Complimentary to BS EN 1917.
BS	5911-4	Concrete Pipes and Ancillary Concrete Products – Part 4 Specification for Unreinforced and Reinforced Concrete Inspection Chambers.
BS	5911-5	Concrete Pipes and Ancillary Concrete Products – Part 5 Specification for Prestressed Non-Pressure Pipes and Fittings with Flexible Joints.
IS EN	13101	Steps for Underground Man Entry Chambers – Requirements, Markings, Testing and Evaluation of Conformance
IS EN	14396	Fixed Ladders for Manholes (See also BS EN 14396 Fixed Ladders for Manholes)
BS	4211	Specification for Permanently Fixed ladders
IS EN	10025	Hot Rolled Products of Structural Steel (Part 1 – Part 6) (See also BS EN 10025:2004 Part 1 to Part 6)
IS EN	1461	Hot Dipped Galvanised Coatings on Fabricated Iron and Steel Articles – Specifications and Test Methods (See also BS EN ISO 1461)
IS EN	10088	Part 1 – List of Stainless Steels Part 2 – Part 5 – Technical Delivery Conditions Part 3 – Stainless steels. Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes
BS	4660	Thermoplastics Ancillary Fittings of Nominal Size 110 to 160 for Below Ground Gravity Drainage and Sewerage
BS EN	1401	Plastics Piping systems for Non-Pressure Underground Drainage and Sewerage – Unplasticized Poly Vinyl – Chloride (PVC-U) – Part 1 – Specification for Pipes, Fittings and the System
IS EN	12201	Plastic Piping Systems for Water Supply Systems and Drainage and Sewerage Under Pressure. Part 1:- General, Part 2:- Pipes, Part 3:- Fittings, Part 4:- Valves for Water Supply systems, Part 5: Fitness for Purpose of the System.
IS EN	13476	Plastic Piping Systems for Non-Pressure Underground

		Drainage and Sewerage – Structural Wall Piping Systems of Unplasticized Poly Vinyl Chloride (PVC-U), Polypropylene (PP) and Polyethylene (PE) Part 1 – General Requirements and Performance Characteristics Part 2 – Specification for Pipes and Fittings for Smooth Internal and External Surfaces and the System – Part A Part 3 - Specification for Pipes and Fittings for Smooth Internal and Profiled External Surface and the System – Part B
IS EN	598	Ductile Iron Pipes, Fittings, Accessories and their Joints for Sewerage Applications, Requirements and Test Methods.
BS EN	1074	Valves for Water Supply – Fitness for Purpose and Appropriate Specification Tests Part 1 – General Requirements Part 2 – Isolating Valves Part 3 – Check Valves Part 4 - Air Valves Part 5 - Control Valves Part 6 - Hydrants
BS ISO	7121	Steel Ball Valves for General Purposes – Industrial Application
IS EN	1825	Grease Separators Part 1 Principles of Design, Performance and Testing, Marking and Quality Control Part 2 Selection of Nominal Size, Installation, Operation and Maintenance.
IS EN	60079	Explosive Atmospheres (Part 0, Part 1, Part 2, Part 5, Part 6, Part 7, Part 10-1, Part 10-2, Part 11, Part 13, Part 14, Part 15, Part 17, Part 18, part 19, Part 20-1, Part 25, Part 26, Part 27)
IS EN	1992-3	Eurocode 2 – Design of Concrete Structures - Part 3: Liquid Retaining and Containment Structures.
IS EN	13101	Steps for Man Entry Chambers – Requirements, Marking, Testing and Evaluation of Conformity.
IS EN	818-7	Short Link Chain for Lifting Purposes – Safety Part 7: Fine Tolerance Hoist Chain, Grade T (Types T, DAT and DT).
BS	476	Fire Tests for Building Materials and Structures
BS	4800	Schedule of Paint Colours for Building Purposes
BS	9295	Guide to Structural Design for Buried Pipelines.
BS	5163	Valves for Waterworks Purposes Part 1 – Predominantly key operated cast iron gate valves – Code of Practice Part 2 – Stem caps for use on isolating valves and associated water control apparatus - Specification
BS	5837	Trees in Relation to Design, Demolition and Construction - Recommendations
IS EN	1610	Construction and Testing of Drains and Sewers

IS	420	Precast Concrete Manholes
IS EN	998	Specification for Mortar for Masonry Part 1 – Rendering and plastering mortar Part 2 – Masonry mortar
BS ISO	12176	Plastic Pipes and Fittings – Equipment for Fusion Jointing of Polyethylene Systems: Part 1 – Butt Fusion Part 2 – Electro Fusion
IS EN	12842	Ductile Iron Fittings for PVC-U or PE Pipe Systems – Requirement and Test Methods
IS EN	14525	Ductile Iron Wide Tolerance Couplings and Flange Adaptors for use with Pipes of different materials: Ductile Iron, PVC-U, PE Fibre Cement.
IS EN	1401	PVC piping systems for non-pressure underground drainage and sewerage
IS EN	1074-1	Valves for water supply. Fitness for purpose requirements and appropriate verification tests. General requirements
IS EN	1074-2	Valves for water supply - Fitness for purpose requirements and appropriate verification tests - Part 2: Isolating valves
IS EN	1092-1	Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 1: Steel flanges
IS EN	1092-2	Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Part 2: Cast iron flanges
IS EN	14901	Ductile iron pipes, fittings and accessories. Epoxy coating (heavy duty) of ductile iron fittings and accessories. Requirements and test
IS EN	1563	Founding. Spheroidal graphite cast irons
IS EN	12613	Plastics warning devices for underground cables and pipelines with visual characteristics
IS EN	1722-12	Fences. Steel palisade fences. Manufacturing and installation. Specification
IS EN	1722-14	Fences. Specification for open mesh steel panel
IS EN	1722-16	Fences. Specification for powder coatings used as a plastics finish to components and mesh
BS	4320	Specification for metal washers for general engineering purposes. Metric series
BS	7874	Method of test for microbiological deterioration of elastomeric seals for joints in pipework and pipelines
BS	8545	Trees: from nursery to independence in the landscape. Recommendations
BS EN	10025	Hot rolled products of structural steels. General technical delivery conditions
BS EN	4449	Aluminium alloy AL-P7050. T76. Sheet. 0,8 mm $3L a $3L 6 mm

BS EN	1201	Chemicals used for treatment of water intended for human consumption. Potassium dihydrogen orthophosphate
WIS	4-52-01	Specification for polymeric anti- corrosion (barrier) coatings
WIS	4-52-03	Specification for anti- corrosion coatings on threaded fasteners
WIS	4-21-02	Specification for mechanical couplings and repair clamps for iron pipes for the conveyance of cold potable water (underground use) for the size range 40 to 1600mm/1.5 to 48" inclusive.
IGN	4-08-01	Bedding and sidefill materials for buried pipelines
BS 1SO	21307	Plastics pipes and fittings. Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems
IS EN 1SO	898-1	Mechanical properties of fasteners made of carbon steel and alloy steel. Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread
IS EN 1SO	898-2	Mechanical properties of fasteners made of carbon steel and alloy steel. Nuts with specified property classes. Coarse thread and fine pitch thread
BS 1SO	3506-1	Mechanical properties of corrosion-resistant stainless steel fasteners. Bolts, screws and studs Part 1
BS 1SO	3506-2	Mechanical properties of corrosion-resistant stainless steel fasteners. Part 2
IS EN ISO	1461	Hot dip galvanized coatings on iron and steel articles – specifications and test methods
lLPS	1175-SR2, SR3	The Requirements and Testing Procedures for the LPCB Approval and Listing of Intruder Resistant Building Components, Strongpoints, Security Enclosures and Free Standing Barriers"
IP	2X	Standardized measure of protection a device has against intrusions by liquid or dust**.**
DSEAR		The Dangerous Substances and Explosive Atmospheres Regulations 2002 (**DSEAR**)
BS EN	60309	Plugs, socket-outlets and couplers for industrial purposes. Dimensional interchangeability requirements for pin and contact-tube accessories of harmonized configurations
BS EN	61439-3	Low-voltage switchgear and controlgear assemblies. Distribution boards intended to be operated by ordinary persons (DBO)
BS EN	60898	Specification for circuit-breakers for overcurrent protection for household and similar installations
BS EN	61008	Specification for residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)
BS EN	61009	Residual current operated circuit-breakers with integral

		overcurrent protection for household and similar uses (RCBOs). General rules
IS EN	1627	European Standard for the burglar resistant classifications of domestic and commercial doorsets, windows, curtain walling, grilles and shutters
IS EN	622	Parts 1 – 4 Fibreboards. Specifications. General requirements
BS EN	50288-7	Multi-element metallic cables used in analogue and digital communication and control. Sectional specification for instrumentation and control cables
IS	162	Concrete marker posts, applicable to precast concrete posts fou use in marking the locations of hydrants, air valves and sluice valves
BS	3251	Indicator plates for fire hydrants and emergency water supplies
BS	476	Fire testing on building of materials
EN	13598-2	Plastics piping systems for non-pressure underground drainage and sewerage. Unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE). Specifications for manholes and inspection chambers.

Appendix B

Gravity Sewer Design Requirements

General Note

For Works in residential Developments, the sewer capacity criteria for a development are considered to be satisfied, without the need for a full ***Appendix B*** *design assessment, where the pipe size and gradient requirements for the full potential development population corresponds to those in the first Table in Section 3.6 of the main body of the Code of Practice for Wastewater Infrastructure for the number of dwellings shown. For small numbers of housing units, the use of higher peak flow multipliers may be used for design purposes to reflect the proximity to source and the attenuation that naturally occurs in the Sewerage system.*

Otherwise, the gravity sewer systems in residential and commercial developments are to comply fully with Appendix B.

1 DESIGN CRITERIA

1.1 Internal Flooding from Wastewater Sewers

Designs shall prevent internal flooding from an event with a 1 in 30 year return period. This is subject to (a) the 1 in 30 year return event requirement being applied to surface water or other flooding modes so that foul/combined sewers designed to the appropriate performance level are not inundated at more frequent return periods, and (b) the 1 in 30 year return event level of service is a long term objective and a higher level of service for the new design may have to be provided to achieve the long term objective.

On a project by project basis flood protection shall be evaluated for a 1 in 50 year return period event. If there is marginal difference between the 1 in 30 year return period event period and 1 in 50 year solution, the higher return period solution shall be offered as the preferred solution.

A definition of Internal Sewer Flooding is provided in Section 1.8.1 below.

For new or upgraded sewer networks the design shall incorporate a target freeboard between the predicted design top water level and the lowest ground level adjacent to the perimeter of the building being considered of 500mm. Where target freeboard cannot be achieved, Irish Water's Connections and Developer Services shall be consulted.

1.2 External Flooding from Wastewater sewers

Designs shall prevent external flooding from an event with a 1 in 20 year return period. This is subject to (a) the 1 in 20 year return period event requirement being applied to surface water or other flooding modes so that foul/combined sewers designed to the appropriate performance level are not inundated at more frequent return periods, and (b) the 1 in 20 year event period level of service is a long term objective and a higher level of service for the new design may have to be provided to achieve the long term objective.

On a project by project basis flood protection shall be evaluated for a 1 in 30 year return period event. If there is only a marginal difference between the 20 year return period event and 30 year return period event solution, the higher return period solution shall be offered as the preferred solution.

A definition of External Sewer Flooding is provided in Section 1.8.2 below.

For new or upgraded sewer networks the design shall incorporate a target freeboard between the predicted design top water level and the cover level of 500mm. Where target freeboard cannot be achieved Wastewater Asset Planning shall be consulted.

1.3 External Surface Water Flooding

Surface water shall be managed to allow it pass around premises and buildings without harm. This may involve working with Local Authorities, Transport Infrastructure Ireland (TII) and the Office of Public Works (OPW) to make use of existing features.

No external property flooding shall arise from a 1 in 20 year return period event. Surface water flooding may be allowed to occur in a controlled manner in specified locations with only minor detriment to property and people without the need for extensive underground systems to contain it. The emphasis of a surface water design shall be to manage flood water.

On a project by project basis flood protection shall be evaluated for a 1 in 30 year event. If there is marginal difference between the 1 in 20 year return period event and 1 in 30 year return period event solution, the higher return period solution shall be offered as the preferred solution.

1.4 Protection Against Surcharging

New sewers shall be designed such that they do not surcharge under the relevant design rainfall event taking account of site and location factors. The most appropriate design return period listed in Table 1, which is based on IS EN 752 Table 2- “Examples of design rainfall frequencies for pipes to run just full without surcharge”, will be applied. The same approach shall also be applied to existing systems being considered for upgrading.

Site Factors	Location Factors	Design Return Period
Sites with average surface gradient greater than 1%	Rural Areas	1 year
Sites with average surface gradient of less than 1%	Residential Areas	2 years
Sites where consequence of flooding is severe; e.g. existing basements adjacent to new developments.	City Centres / Industrial/Commercial Areas	5 years
Sites where consequence of flooding is severe with risk to general public and critical services;	Underpasses	10 years

Table 1.1: Surcharge Design Return Periods

1.5 Downstream Conditions

The following shall be identified and taken into account in the design:

(a) Any downstream water level restrictions (tidal or river levels), in particular maximum flood levels in the receiving water bodies.
(b) Backing up from downstream hydraulic constraints such as network throttles, pumping stations, WWTPs etc.

1.6 Flow Velocities

Sewers should be designed achieve velocities that:

1. Transport fine particles in suspension;

2. Transport coarser granular material as bed load;
3. Erode cohesive particles from a deposited bed.

In order to minimise the maintenance requirements of any given length of sewer, it is normal to design the sewer to be “self-cleansing”. This means that the sewer is designed to achieve a velocity at least once per day that will carry all solid deposited material along the pipe and not leave any materials deposits in the invert of the sewer.

Separate wastewater and combined sewers should be designed to ensure that a flow velocity within the sewer is exceeded daily at the appropriate multiple of the Dry Weather Flow (DWF) for the initial development flows. Where self-cleansing velocities cannot be achieved due to constraints, Irish Water shall be consulted in detail concerning alternative procedures to address the requirements outlined in Items 1, 2 and 3 above. The table below is based on the simplified CIRIA method of assessing self-cleansing velocities in separate wastewater sewers and should be considered as the minimum design velocities. Storm and surface water sewers require generally higher self-cleansing velocities because of the higher particle densities and should be designed to ensure that the velocity of 1.0 m/s is achieved. Oversizing the pipe to achieve suitable full bore velocities at lesser gradients will not be accepted.

Pipe Size (mm)	Approximate self cleansing velocity (m/sec)
200-300	0.75
400	0.77
500	0.82
600	0.86
900	0.88
1200	1.03

Table 1.2: Self-cleansing Velocities Separate Wastewater Sewers

Where large diameter sewers over 900mm diameter are laid to steep gradients, very high flow velocities occur. For example, a 1050mm pipe laid to 1:100 gradient with a depth of flow of 750mm will have a flow velocity approaching 3.4m/sec, which is unacceptable in wastewater sewers. The designer should implement energy dissipation measures in such cases. It should be emphasised that scour in pipes at these velocities is not a significant problem with modern materials, but if velocities become very high, odour emissions can be increased and noise can become a problem.

As a general rule, it is preferable to aim to achieve self-cleansing velocity in the pipe system at least once per day. The designer should aim to achieve a flow velocity at the design flow (i.e. peak flow) of between the required self-cleansing velocity and a velocity of 2.0m/s, with 2.5m/s as an upper limit.

In small sewers, below 375mm it is not necessary to include measures to limit flow velocity. The use of backdrop Manholes in this case may be justified where there is a significant difference in level between branch sewers and trunk sewers. In this case, the economics may justify the construction of a backdrop to minimise excavation for the branch sewer trenches. The discharge from a backdrop into a Manhole requires careful design to prevent flows from washing over the benching. Backdrops for large diameter sewers are complex structures that may involve the creation of vortices to dissipate energy, for which specialist design is required.

The governing flow to achieve minimum design velocities shall be as follows:

Sewer Type	Governing Flows[1]
Separate Wastewater	2 x Eqn. 1 with a peaking factor set to 1.0
Combined	Eqn. 2 with 1 in 1 year storm and 2 x Eqn.1 with peaking factors set to 1.0
Surface	1 in 1 year rainfall event

Table 1.3: Governing Flow for Minimum Design Velocities

[1] Refer Section 2.2 for Equations

1.7 Hydraulic Equations

The Colebrook-White Equation shall be used for pipe and channel flow calculations.

1.8 Pipe Roughness

Typical roughness coefficient values for the pipes shall be as follows:

Type	Concrete	uPVC
Separate Wastewater	1.5 mm	O.15
Surface	0.6 mm	0.15
Combined	1.5 mm	0.15

Table 1.4: Typical Roughness Coefficient Values

1.8 Internal and External Sewer Flooding

1.8.1 Internal Sewer Flooding

A property can be deemed affected by an internal flooding incident when foul, combined flows escape from the public sewerage system into a property and enters a building or passes below a suspended floor.

Internal flooding refers to buildings which are normally occupied and used for residential, public, commercial, business or industrial purposes. For clarity the list below gives examples of what should be included in the internal flooding category.

- Conservatories
- Basements and cellars (even if unoccupied)
- Stairwell/lobby area of flats (to be counted as 1 flooded property)
- Studios and workshops

- Porches
- Garages which are an integral part of the house with adjoining door to the occupied building

Buildings where the prime purpose is not for habitation or occupied business premises falls under external flooding.

The list below gives examples of what should be included in the external flooding category:

- buildings where the prime purpose is for storage or installation of domestic appliances and is not accessed from the house by means of an adjoining door to the habitable building;
- detached garages (whether situated inside the boundary of the property and separated from the main building or outside the boundary but with common access as in a garage block); and
- linked detached garages (i.e. garages which are attached to a property but separated from it by an external passageway);
- sheds and outbuildings (e.g. stables, kennels, coal houses, outside toilets); summer houses; and
- swimming pools/heated external pools
- temporary buildings

Back flow of wastewater into sanitary ware and other appliances is classed as internal flooding in the following circumstances:

- Wastewater back flow into sinks, showers and onto wet room floors;
- Wastewater back flow into washing machines, dishwasher and other appliances.

Back flow of wastewater in toilet bowls, which does not overspill the toilet bowl shall not be classed as flooding. Where the toilet overspills due to blockage and flushing more than once this shall not be classified as internal flooding.

Restricted Toilet Use (RTU) occurs where there is no internal flooding but where the customer is unable to flush their toilet without a risk of causing internal flooding of the property.

1.8.2 External Sewer Flooding

External flooding is defined as flooding which is not classed as internal. External areas is split into the following:

- Curtilages flooding
- Roads flooding, and;
- Other External Areas flooding

Examples of external flooding within the allocations are:

“curtilage flooding”- any flooding (except internal flooding) within the curtilage of a residential building – this includes detached garages, linked detached garages, sheds, summer houses, swimming pools as these are not included in the definition of internal flooding;

“Roads flooding” – including footpaths; and

“Other External Areas flooding” - external flooding to the external areas of non-residential buildings and areas e.g. schools, offices, commercial premises and public buildings; public open space; agricultural land; car parks.

For “Other External Areas flooding” the external areas of offices, commercial premises, public buildings, car parks and agricultural land.

2 GRAVITY SEWER DESIGN FLOWS

2.1 Existing Networks

The design of Existing Networks will be the responsibility of Irish Water or its Agents. The Developer’s designer will not be required to be involved in the design of existing Networks.

2.2 Wastewater flows – New Networks

The design parameters that are outlined below set out the design flow requirements in terms of growth, infiltration, peaking factors and misconnection allowances to ensure performance is maintained over the design life of the new wastewater collection system.

Wastewater sewer capacity shall be designed with allowance for some possible surface water connection (misconnections), even where separate wastewater and surface water sewer networks exist. Allowance for the delayed flow from slow response run off due to rainfall induced infiltration shall be ignored for the purpose of design of new wastewater sewers.

Dry Weather Flow = PG + I + E

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

Design Flow = [Eqn 1] + $[SW + SW_E]$ (Eqn2)

DWF = Dry Weather Flow

P = Population

G = Water Consumption / Capita

P_E = Commercial/Industrial Population

G_E = Commercial / Industrial Water Consumption per Capita

I = Infiltration

E = Trade Flow

Pf_{Dom} = Peaking factor Domestic

$Pf_{Dom,Ind}$ = Peaking factor for Domestic element of Industrial

Pf_{Trade} = Peaking factor for Trade Flow

SW = Surface Water Allowance (Domestic)

SW_E = Surface Water Allowance (Commercial/Industrial)

The wastewater network shall be designed to meet all of the following design flow scenarios:

No.	Design Flow Scenario Criteria	Applicable Section	Calculation Method
1	Design Foul Flow	2.2	Eqn. 1
2	Surcharge (Return Period ≤ 2 years)	1.4	Eqn. 2
	or		
	Surcharge (Return Period > 2 years)	1.4	Eqn. 2[2]
4	Internal & External Flooding	1.1, 1.2 & 1.3	Eqn. 2[3]
5	Low Flow – Minimum Velocity	1.6	Table 1.3

Table 2.2: Design Flow Criteria

2.2.1 Housing Density & Occupancy (P)

The following approach should be taken in determining Housing Density and Occupancy:

[2] Peaking factors applied may be reduced based on review by IW
[3] Peaking factors applied may be reduced based on review by IW

	Housing Density
New Domestic Housing (known)	Housing Densities as per Local Authority Development Plans.
New Domestic Housing (unknown)	Use 30 units/ha
Existing Housing	Actual Housing Densities

Table 2.3: Housing Density

Population estimate shall be based on **2.7 persons per unit**.

2.2.2 Water Consumption (G)/Return to Sewer Flow

For the basis of design the per capita (ca) water consumption shall be used to equate for general domestic wastewater flow contributions where site specific data is unavailable: Water Consumption (G) 0.15 m^3/ca/day (i.e. **150 l/ca/day**)

2.2.3 Growth Rates

Where applicable the design shall consider expected growth rates over the design horizon for the wastewater collection infrastructure. Growth rates may vary geographically depending on potential scale and location of future development that is anticipated.

The application of growth rates shall be agreed with Irish Water prior to solution development.

2.2.4 Infiltration (I)

Rates of infiltration vary greatly from agglomeration to sub-catchment level. Infiltration can be very high. This can be due to incorrect connection of land drainage to the wastewater sewerage system, high groundwater inflow into the sewerage system and deteriorated infrastructure giving rise to infiltration to the sewerage network from the

surrounding water table. Infiltration should be determined where possible based on actual flow surveys/measurements due to the considerable variability across different networks. Due to seasonal variation survey/measurement should be preferably undertaken during winter months. The design of sewers in areas there is knowledge of high levels of infiltration shall be based on measured infiltration rates.

Development[4]	Infiltration Rates
Existing Development	Rates obtained from measurement and/or evidenced by in-sewer survey
Existing Property[5] [without measurement or survey data]	20% of Unit Consumption (20% PG)
New Property	10% of Unit Consumption (10% PG)
Existing Industrial[6] [without measurement or survey data]	20% of Water Consumption (20% $P_E G_E$)
New Industrial	10% of Water Consumption of the Industry (10% $P_E G_E$)

Table 2.4: Infiltration Rates

Design solutions for the wastewater network and flow quantities to WWTP should take account of the specific nature of the catchment. At sites where infiltration (I) is recorded as greater than 200% of the domestic wastewater contribution (PG), the Designer should undertake a Cost Benefit Analysis to demonstrate the best way to balance capital spend between network flow management (infiltration reduction) , the provision of hydraulic capacity in the sewer network and/or at the WWTPs. This analysis should

[4] Infiltration Rates may be higher with deeper sewers or sewers that are near to watercourses or tidal areas due to hydrostatic head.
[5] Infiltration to be determined where possible based on flow surveys/measurements
[6] Infiltration to be determined where possible based on flow surveys/measurements

take into account the ability of biological treatment process at the WWTP to treat very weak wastewater as well as the implications of high hydraulic loading of the wastewater treatment plant units and processes.

2.2.5 Domestic Wastewater Peaking Factors

For the design of new or upgraded wastewater networks, the peaking factors applied to domestic wastewater flows (Pf_{Dom}) are to be in accordance with the Table below. Where the population overlaps two bands, a combination of the two peaking factors shall be used.

Population	Peaking Factor (Pf_{Dom})
0 to 750	6
751 to 1,000	4.5
1001 to 5,000	3.0
5,001 to 10,000	2.5

Table 2.5: Peaking Factor

2.2.6 Domestic Wastewater Element of Commercial & Industrial Flows ($P_E G_E$)

For the design of new wastewater networks, the rates for commercial wastewater flows are to be in accordance with the Table below:

Element	Flow Rates
Existing Premises	Based on flow rates on water consumption
Known Population of Commercial	Flow rates per head from Appendix D.
Known Domestic Population of Catchment	Flow rates for Light Commercial estimated as being 16% of Domestic Wastewater Flow Rates
Unknown Population / Known Development Type	Flow rates as per Appendix D below.
Unknown Development Type	0.15 l/s/ha of Gross Land Area

Table 2.6: Domestic Element of Commercial & Industrial Flows

2.2.7 Commercial Wastewater Peaking Factors

For the design of new wastewater networks, the peaking factors applied to commercial wastewater flows are to be in accordance with the Table below:

Area (ha)	Peaking Factor ($Pf_{Dom,Ind}$)
0 - 5.5	4.5
5.5 - 11	3.5
11 - 22	**3.0**
22 - 55	2.5
> 55	**2.0**

Table 2.7: Commercial Peaking Factors

2.2.8 Trade Wastewater Flows (E)

Different wastewater flows will apply to industrial and commercial source contributions. In addition, tourist populations will have a varying effect. These loads can be obtained from **Appendix D**, below. In the absence of specific wastewater source contributions, the commercial/industrial trade wastewater flows may be taken from the Table below.

Trade Flow Data	Flow Derivation	
Existing Trade Flows	From Trade (Section 16 Wastewater Licence or IPPC Licence) Discharge Licences Values	
Proposed Trade Flows	Proposed Discharge Licences	
No available Data	Dry Industry: Wet Industry:	Low = 14: High = 20 (m3/ha/day) Low = 20: High = 42 (m3/ha/day)

Table 2.8: Trade Flows

2.2.9 Trade Wastewater Flow Peaking Factor

For the design of new wastewater networks, the peaking factors applied to trade wastewater flows are to be in accordance with the Table below:

Data	Factor (Pf_{Trade})
Measured flow data or Peak Licenced Flow[7]	Most Onerous of Available Data
No measured data	3.0

Table 2.9: Trade Peaking Factor

[7] Licenced flow may be much greater than measured flow - a review of historic measured flow v licence flow limit may be required to confirm likelihood of the allowable maximum licenced flow being discharged.

2.2.10 Misconnection Allowance & Urban Creep

2.2.10.1 Urban Creep

Urban Creep is the loss of permeable area within urban areas creating increased run-off from new impermeable areas which contributes to reduced sewer capacity, increased potential flooding and occurrence of pollution incidents due to overflows from SWOs or hydraulic overloading of WWTPs. Urban creep principally impacts combined sewers, storm water sewers and the downstream natural drainage systems.The UKWIR Report: “Impact of Urban Creep On Sewerage Systems. Report Ref. No. 10/WM/07/14” provides guidance on urban creep.It should be noted that urban creep tends to increase over time and may be negligible early on in the asset life.

In areas served by combined sewer systems, the growth in impermeable area, or ‘ urban creep’, causes increases in surface water run-off being conveyed to the combined sewers and storm water sewers, thus reducing capacity, increasing frequency of storm water overflow spills and increasing the risk of sewer flooding.

Allowance for urban creep shall be in accordance with Irish Water Guidance Note on the Application of Urban Creep Allowances and Misconnections for Future Scenarios in Wastewater Modelling.

2.2.10 2 Misconnection Allowance

Where there are separate wastewater and storm water sewer networks, the rainfall response in wastewater networks due to storm water inflow is principally caused by misconnections of storm water drains/sewers to the separate wastewater sewer, i.e. storm water drains being connected to the wastewater drain/sewer either unintentionally or intentionally as a convenient method of dealing with storm water runoff on premises. However, rainfall response can also be due to direct inflow through defective covers, or indirectly via rainfall induced infiltration.

Misconnections can occur at the outset of a new development due to poor construction practice either within the building, around the curtilage of the building or in the public road due to the connection of the service pipe or gully to the incorrect public sewer system, i.e. a storm water source being connected to a wastewater sewer system.

The misconnection conveys storm surface water run-off from the impermeable area via the storm drain or sewer to the wastewater sewer. Rainfall response in wastewater sewers can be many multiples of orders of magnitude greater than wastewater flow.

This increased inflow response can utilise significant capacity, can significantly reduce the design horizon and can cause pollution incidents and sewer flooding.

Most public wastewater sewers have misconnections and over time some wastewater sewers will exhibit flow response of partially separate sewers, i.e. a wastewater sewer which also carries some storm water flow. While removing the misconnection is preferred, finding and addressing the problem is not always feasible, even with extensive intrusive sewer surveys, CCTV surveys, flow & rainfall surveys, which will employ substantial resources and result in significant expenditure outlay. It is considered, therefore, far more cost-effective to minimise its occurrence in the first place.

To preserve capacity in public wastewater sewers an increased flow allowance for misconnections should be provided for in the design of public sewers. This would also apply to new wastewater sewerage system of a certain scale in new developments that will be connected to public sewerage systems.

2.2 10.2.1 Misconnection Allowance Domestic (SW)

The increased allowance for residential areas is outlined in the Table hereunder:

	Allowance (SW)
Impermeable survey and /or flow survey data, existing area	Use areas derived from surveys
Where no data is available for existing areas and for New Development areas	3.0% of Gross Site Area.
Existing Combined Sewer Area	Use areas derived from surveys

Table 2.10: Misconnection Allowance Residential Areas

2.2.10.2.2 Misconnection Allowance in Commercial & Industrial Foul Flows (SWe)

The increased allowance for commercial/industrial areas is outlined in the Table hereunder:

	Allowance (SW_E)
Impermeable survey and /or flow survey data, existing areas	Use areas derived from survey
Where no data for existing areas and for new areas	2.0% of Gross Site Area.

Table 2.11: Misconnection Allowance Commercial/Industrial Areas

2.2 11 Surface Water Flows

As a general guide, the hydraulic flow load arising from storm water impacting on the capacity of the wastewater sewerage systems should be based on the Design Method outlined in the Table below as follows:

Development Size	Method of Design8
Small Development (<150 ha)	Modified Rational Method
Large New Development (>150 ha)	Modified Rational Method[9] or Hydraulic Simulation (Preferred)
Existing Networks	Hydraulic Simulation

Table 2.12: Method of Design

[8] Where connections are to be made to an existing combined system, computer simulation using a hydraulic model shall be undertaken with a model built in accordance with the IW Wastewater Network Hydraulic Model Build and Verification Standard (IW-TEC-800-06)

[9] Where pipes will have less than 1.0m cover the need for Computer Simulation shall be considered to check the adequacy of the design against flood risk.

The Modified Rational Method is detailed in Volume 4 of the Wallingford Procedure and a summary of it is outlined below. The Modified Rational Method was developed as part of the Wallingford procedure. It is used to derive a peak flow rate and then this is used to select a pipe size based on pipe-full flow. The Modified Rational method equation to determine peak flow rates is: **Q = 2.78 C Ai.** Where:

Q = design event peak rate of runoff (I/s)

A = contributing area (ha)

C = non-dimensional runoff coefficient which is dependent on the catchment characteristics

i = rainfall intensity for the design return period (in mm/hr) and for a duration equal to the "time of concentration" of the network.

Note: 2.78 is a conversion factor to address the rainfall unit being in mm/hr

2.2.12 Contributing Area (A)

Surface Type	Impermeability
Roofs, roads and paved areas	100%
Other areas	Nil[10]

Table 2.13: Impermeablility of Contributing Areas (A)

2.2.13 Rainfall Intensity (i)

For selection of the appropriate rainfall return period and rainfall intensity refer to Appendix B - Section 1.

[10] Where appropriate, allowance should be made for run-off from exposed rock surfaces, derelict land and/or run-off from saturated non-hard surfaces (following prolonged wet weather).

2.2.14 Time of Entry

Return Period	Subcatchment <200m2, Slope > 3%	Subcatchment >400m2, Slope < 2%
1 year	4 min	8 min
2 years	4 min	7 min
5 years	3 min	6 min
>5 years	3 min	3 min

Table 2.14: Time of Entry

2.2 15 Time of Flow

The time of flow is the time taken for flow at the point of entry to reach a particular point (the design point) in a sewer. The velocity of the flow in the sewers can be calculated from the hydraulic properties of the pipe based on Colebrook White equation. Pipe-full velocity is normally used as a good approximation over a range of proportional depths. If sewer length is known or assumed, time of flow can be calculated.

2.2.16 Time of Concentration

The time of concentration is the time taken for runoff from the most distant part in terms of travel time of the catchment to reach a particular point (the design point) in the sewer. The Time of Concentration being the summation of the Time of Entry and the Time of Flow.

2.2.17 Dimensionless Coefficient (C)

Dimensionless Coefficient (C)[11]:

$C = C_V C_R$

C_V = Volumetric Run-off Coefficient

C_R = Routing Coefficient

Soil Type /Surface Quality	C_V	C_R
Rapid draining soils /low quality surface	0.6	1.3
Heavy soils / high quality surface	0.9	1.3

Table 2.15: Run Off and Routing Coefficient

2.2.18 Design Rainfall

The design rainfall storm used in the modelling process shall be in accordance with guidance provided in '*Guidance on Rainfall for Wastewater Modelling in Ireland, H.R. Wallingford, February 2017*'; this guidance addresses the following topics:

- Areal Reduction Factor
- Seasonal Correction Factor
- Parameters in the New UK Runoff Equation
- FSU Rainfall Data
- Time Series Rainfall
- Climate Change

[11] A value of C= 1.0 is suggested for most circumstances but where there are large areas of connected impervious area and soil type and/or condition of the surface is considered to be a factor C_v may be adjusted as indicated to calculate C.

2.2 Land Drainage, Run-Off from Permeable Areas & Derelict Land

Land drainage flows shall not be connected into wastewater, or combined drains or sewers.

It is a matter for the Local Authority of the area as to whether it would allow land drainage flows to be discharged into the storm water sewerage that is under its control. The method of design, in that instance, will be dictated by the Local Authority.

The existence of flows in existing sewers that convey land drainage shall be assessed in terms of available head and governing topography. When assessing the capacity of the connected existing land drainage systems care shall be taken to use appropriate roughness values. For small streams and ditches flow estimation shall be in accordance with the Flood Studies Update (FSU) by the Office of Public Works (OPW).

Appendix C

Wastewater Flow Rates for Design

Flow Rates for Design

Per person / activity / day (unless otherwise specified)	FLOW (Litres)
DOMESTIC DWELLINGS	
Standard residential	**150**
Mobile home type caravans with full services	**150**
INDUSTRIAL	
Office / Factory without canteen	**50**
Office / Factory with canteen	**100**
Open industrial site, e.g. construction, quarry, without canteen	**60**
*Full-time Day Staff	**90**
*Part-time Staff (4 hr shift)	**45**
SCHOOLS	
Non-residential with canteen cooking on site	**90**
Non-residential without a canteen	**50**
Boarding school (i) residents	**175**
Boarding school (ii) day staff (including mid-day meal)	**90**
HOTELS, PUBS & CLUBS	
Hotel Guests	**250**
Residential Training/Conference Guest (inclusive all meals)	**350**
Non residential Conference Guest	**60**
Public House Patrons	**12**

Holiday Camp Chalet Residents	**227**
Resident Staff	**180**
Restaurants - Full Meals	**30**
Restaurants - pre-prepared catering	**25**
Restaurants - Snack Bars & bar meals	**15**
Restaurants - Function Rooms including buffets	**15**
Restaurants - Fast Food i.e. (roadside restaurants)	**12**
Restaurants - Fast Food Meal (burger chain and similar)	**12**
Students (Accommodation only)	**100**
AMENITY SITES	
Toilet Blocks (per use)	**10**
Toilet (WC) (per use)	**10**
Toilet (Urinal) (per use)	**5**
Toilet Blocks in long stay car parks/lorry parks (per use)	**10**
Shower (per use)	**40**
Golf Club	**20**
Local community sports club, e.g. squash, rugby & football	**40**
Swimming (where a separate pool exists without an associated sports centre)	**10**
Health Club/Sports Centre	**50**
Tent Sites	**75**
Caravan Sites (i) Touring not serviced	**100**
Caravan Sites (ii) Static not serviced	**100**
Caravan Sites (iii) Static fully serviced	**150**

HOSPITALS & RESIDENTIAL CARE HOMES	
Residential old people / nursing	**350**
Small Hospitals	**450**
Large Hospitals	**Assess Individually**
*Staff figures also apply to other applications	

Where the Table above does not include flow rates for the type of activity, the trade wastewater flow should be based on the EPA Wastewater Treatment Manuals – Treatment Systems for Small Communities, Business, Leisure Centres and Hotels (1999) or on a metered water supply from Premises similar to that of the proposed development. If the trade wastewater flow is still unknown, appropriate flow rates should be chosen from **Section 2.2.8** of **Appendix B**.

Appendix D

Amendments Associated with change from Revision 1 (December 2017) to Revision 2 (July 2020)

Amendment Location	Description of Change for Revision 2
General Amendments	The Code of Practice has been amended in a significant number of areas. These amendments are listed below in relation to the location of the amendment (Section, Sub-Section, etc.). There are a number of amendments arising from high level changes and these are referred to a "General Amendments" as opposed to "particular amendments". A general amendment is applied to align the terminology within the Code of Practice with the terminology used in the Self-lay Connection Agreement where applicable. Examples of this are listed below and examples are as follows: • "development(s)" is changed to "Development(s)" as this is a defined term; • "Customer" has been changed to "Developer"; • A new term of "Water and Wastewater Services Infrastructure" has been included; • A new term of "Self-Lay Works" has been included; • Etc. As a consequence, minor amendments are included in many Sections to reflect new defined terms. It is not deemed necessary to list all of the Sections and Sub-Section affected by the terminology changes as these changes are non material in most instances. Other general amendments relate to the following: - The use of IS 420 and IS EN 1917 as standards for pre-cast concrete manhole units, - An amended specification for the bedding of chamber cover frames seated with rapid hardening cementitious, epoxy or polyester resin mortar, with a minimum working time of 15 minutes, a minimum compressive strength of 30 N/mm^2 and 5 N/mm^2 within 3 hours of mixing. - An amendment specifying the bedding and setting mortar for Class B engineering brick under chamber covers/frames should be of minimum M30 strength mortar to IS EN 998 – Part 2. - Changes to IW maintenance responsibility, - Standard for compliance of PE Pipe joints revised, - Sampling and testing of PE pipes updated, - Specification for pipe surround and bedding material amended to reflect IS EN 13242 requirements for 14 to 5mm (d/D 2/14) and 10mm (d/D 4/10),

	- Revised requirement for protection of shallow depth pipework, - Requirements for torque blocks revised, - Clarification on telemetry requirements, - Amendments for PE Auditing/Standards and Test Acceptance. The particular changes to the various Sections and Sub-Sections of the Code of Practice are outlined below in this list of amendments.
Particular Amendments	**Description of Change for Revision 2**
Background	Minor changes have been included as well as an amendment to the 4th to change "should" to "shall" in the 2nd sentence.
Table of Contents	Sections 1.9.1 to 1.9.3 have been included. Section 3.12, Manholes, has been expanded to list the Sub-Section 3.12.1 to 3.12.11. Section 3.17.4 has been retitled to read "Wastewater Air Valve". Section 3.26, Warning Tape, and Section 3.27, Indicator Marker Plates and Posts, have been included. New Sections have been included in part 5 Pumping Stations, i.e. Section 5.17 to Section 5.21, Section 5.23 to Section 5.27 and Section 5.32. Previous Appendix B, "Selection of Typical Standard Details" ahs been omitted. . Previous Appendix C, "Gravity Sewer Design Requirements" has been changed to Appendix B and expanded. . Previous Appendix D, "Wastewater Flow Rates for Design" has been changed to "Appendix C". Appendix D List of Amendments Associated with Revision 2 has been included
Glossary of Terms and Definitions	New definitions for the following have been included: "Building Regulations", "Business Day", "Connection Application", "Connection Point(s)", "Connection Works", "Construction Regulations", "Developer", "Developments", "Network(s)", "PRA Compliant Map", "Relevant Standards", "Self-Lay Works", "Sewage and Sewage Effluent", "Water and Wastewater Services Infrastructure", Revised definition of the following have been included: "Backfill", "Boundary", "Completion Certificate", "Conformance Certificate", "Connection Offer", "Connection Works", "Customer", Curtilage", "Deed of Grant of Easement", "Irish Water", "Local Authority", "Manhole", "Premises", "Security", "Service Connection", "Trade Effluent", "Wastewater", "Wastewater Connection Point", and "Works".

Section 1.1	The 1st sentence has been amended to outline what the "Works" covers. Two new paragraphs have been included at the end of the Section.
Section 1.2	Minor changes made to the 2nd paragraph making reference to "Bord Gais" and the "Commission of Regulation of Utilities".
Section 1.4	Amendment to Section 1.4.1 to clarify that a Pre-connection Enquiry is mandatory for Developments using the planning procedures of the Strategic Housing Development Regulations.
Section 1.5	Minor text changes made to refer to new defined terms.
Section 1.7	Amendments have been included to reflect that Irish Water is responsible for the maintenance of the wastewater service connection in public areas and Figure 1 has been amended accordingly.
Section 1.8	Amendments as follows: - 2nd paragraph has been amended to refer to the "Quality Assurance Field Inspection Requirements" Manual. - Additional paragraph included after Sub-Section 1.8.2 to indicate that the issuing of the Conformance Certificate marks the commencement of the Defects Liability Period. - Sub-Sections 1.8.3, 1.8.4 and 1.8.5 amended to require the Chartered Engineer confirmation to be provided in writing. - Minor amendment to Sub-Section 1.8.7. - Sub-section 1.8.9 to expand the information to be included in Operation and Maintenance Manual of Pump Stations. - Minor amendment to Sub-Section 1.8.10. - Sub-Section 1.8.14.2 amended to change the accuracy tolerance to +/- 40mm. - Additional paragraphs included at end of Section requiring the submission of details of the Storm Water Collection System to IW. In the case of Storm Water connections to IW's Networks, a Conformance Certificate will not be issued unless details of the Storm Water system is submitted with the Final Documents.
Section 1.9	Amended as follows: - Amended requirements for Asset Naming included. - Amended requirements for CCTV Video Files included. - Amended requirements for Sewer Record Information included. - Amended requirements for Recording and Deliverables included. - Section 1.9.3 has been expanded to require information on "Sewer Record Information" and "Channel Layout Orientation".
Section 1.10	Amended to indicate that an additional CCTV survey may be required following the completion of remedial works. Amended included to require corrections to be addressed by the Developer within a reasonable timeframe in advance of the connection being made.
Section 1.11	Amended as follows:

	- New sentence included at end of 1st paragraph indication that Irish water will undertake investigation of the Works during the Defects Liability Period. - Clarification provided in second paragraph in relation to development of subsequent phases of an overall Development.
Section 1.12	Minor amendments to reflect new defined terms. Last paragraph amended to indicate that the Developer is responsible for the operation and maintenance of the infrastructure until the end of the Defects Liability Period.
Section 1.13	Minor amendments to reflect new defined terms.
Section 1.14	Minor amendments to reflect new defined terms.
Section 1.15	Minor amendments to reflect new defined terms. The 2nd paragraph is amended to indicate that the cost of additional CCTV surveys and investigations to identify defects will be carried by the Developer.
Section 1.17	Amended to indicate that the liaison with the Fire Officer is to be submitted in the Design Submission.
Section 1.19	The 3rd paragraph has been amended in respect of the use of newly developed products and indicating that Irish water is not obliged to accept such products.
Section 2.1	Amendment of the 2nd paragraph to indicate that the Developer's designer is to be competent.
Section 2.2	Amendment of the 2nd paragraph to in relation to the continued responsibility of the Developer's designer and the retention of Professional Indemnity Insurance for a period of 6 years after the issue of the Completion Certificate.
Section 2.3	Amended as follows: - Sub-Section 2.3.13 expanded to require the submission of Fire Authority approvals for the development. - Sub-Section 2.3.17 expanded to required identification of the manufacturers of pipelines and accessory materials. - A new Sub-Section 2.3.18 included to require the submission of certification of fittings and materials used in the Works. - Section 2.3.22 expanded to require a report on separation distances. - New Section 2.3.26 included to require the submission of information where construction of the Works is to be carried out on made ground, engineered ground or in fill zones and the submission of geotechnical reports and method statements for the construction of the Works. - New Sub-Section 2.3.27 requiring the submission of a Flood Risk Assessment confirming compliance with Section 5.5 of the Code of Practice along with layout plans of where these occur and method statements for construction. - New Sub-Section 2.3.28 requiring the submission of anti-floatation calculations for pump station structures.

Section 2.4	Amended as follows: - The 3rd paragraph has been amended to indicate revised arrangements for the submission of drawings. - Sub-section 2.4.2 expanded to require the submission of an overall development plan layout of the units intended to be constructed and delivered in phases indicating phase lines and control breaks - Sub-Section 2.4.4 expanded to require the submission of information of above ground structures that rae to be vested by Irish Water - Sub-Section 2.4.6 expanded to require the submission of details of existing services crossing the Works and details of thrust blocks, etc. - Sub-Section 2.4.8 expanded to require the submission of details made ground, engineered ground or fill zones. - The seventh paragraph has been expanded to require the submission of manufacturer's data sheets and certificates for the long with the schedule of materials required for the proposed Works. .
Section 2.5	Amended as follows: - 1st paragraph amended to require submission of hydraulic models for developments of more that 330 units. - A new 2nd paragraph included to require the submission of a hydraulic model of all Storm Sewer systems in new developments where intended to be connected to the Irish Water combined sewer system. - The 3rd paragraph has been amended likewise. - The last paragraph is amended to facilitate Irish Water's observations of the verification of "as-constructed" hydraulic models.
Section 3.1	The 1st paragraph is expanded to require compliance with the Standard Details as well as Codes of Practice. Sub-Section 3.1.3 expanded and reference made to compliance with Appendix C.
Section 3.2	The word "should" has been replaced with "shall" in the first sentence.
Section 3.3	Amended as follows: - A new 1st paragraph has been included to require the Developer to be responsible for the provision of all materials and to have an auditable system in place to trace these materials. - Sub-section 3.3.2 expanded to qualify what is meant by "watertight". - New Sub-Section 3.3.5 requiring that the Works do not have a negative impact on the environment.
Section 3.4	Amended as follows: - Sub-Section 3.4.4 amended to outline a range of protection measures for pipes installed at shallow depths.

	- New Sub-Section 3.4.8 requiring the Works to be watertight. - New Sub-Clause 3.4.9 requiring that no trees or large shrubs be located over the Works.
Section 3.5	Amended as follows: - Sub-Section 3.5.2 expanded to include location of infrastructure is separated from trees, shrubs, also. - Sub-Section 3.5.3 expanded to include renewal, replacement and upgrading, - Sub-Clause 3.5.5 expanded to indicate that the infrastructure can be safely accessed. - Sub-Section 3.5.6 expanded to require service connection lengths to be minimised. - Sub-Section 3.5.7 clarified. - Sub-Section 3.5.8 expanded to outline the maximum distances between manholes for 150mm sewers and for 225mm and greater sewer sizes (clarification). - Sub-Section 3.5.9 has been amended to outline clarification on separation distances between new sewers and existing/new structures, with the guidance now limited to 375mm diameter pipework. Specific guidance from IW is required for infrastructure above these limits. - Sub-Section 3.5.10 amended to replace “should” with “shall”. - Sub-Section 3.5.11 amended to replace “should” with “shall” and to require infrastructure location in public areas, or areas to become public, where possible. - Sub-Section 3.5.12 amended to replace “should” with “shall” in relation to pipes being in straight lined between manholes and to indicate that 45 deg. long radius bends are allowed on service connections to transition from horizontal to vertical to the connection point. - A new Sub-Section 3.5.13 included to outline requirements for profiling manhole benching to direct inlet flows smoothly to the outlet. - Sub-Section 3.5.14 amended to replace “should” with “shall” in relation to staggering of storm and wastewater manholes and to ensure clear separation between the manhole structures and the pipework. - Sub-Section 3.5.15 amended to replace “should” with “shall” in relation to the coincidental design of asset infrastructure and landscaping. - Sub-Section 3.5.16 amended to clarify separation distances and to refer to Sub-Section 3.5.9. - Sub-Section 3.5.17 amended to clarify requirements in relation to installing sewerage works crossing over and under existing water mains. - A new Sub-Section 3.5.19 included in relation to separation

	distances for wastewater service connections. - Sub-Section 3.5.20 amended to outline revised horizontal separation distances from the pipe external face for Gravity Sewers/Rising Mains to other infrastructure. - Sub-Section 3.5.22 reinforces the need for the provision of Deeds of Grant of Easements. - Sub-Section 3.5.23 outlines requirements for rising main profiles, straight lines or gentle curves, in accordance with manufacturer requirements. - Sub-Section 3.5.24 amended to outline requirements in relation to the provision of rodding points on rising mains. - Sub-Section 3.5.25 amended to replace “should” with “shall” in relation to rising mains being evenly graded, and if not possible, requiring the provision of air valves, or scour valves, complete with marker plates. - Sub-Section 3.5.26 amended to outline requirements for the ease of pigging, scouring, rodding and cleaning of rising mains. - Sub-Section 3.5.27 amended to require inclusion of marker plates associated with fittings for rising mains. - Sub-Section 3.5.28 amended to reinforce the need for a trace wire in marker tape for rising mains and indicating the colour of the marker tape. - A new Table and text is included at the end of Section 3.5 to clarify requirements for vertical separation distances for wastewater service connections in trafficked and non-trafficked areas as set out in Sub-Section 3.5.19.
Section 3.6	Section 3.6 has been significantly amended in relation to the design of Gravity Sewers and it refers to Appendix B, Gravity Sewer Design. Criteria have now been included to obviate the need for a full design to be undertaken in the case where proposed sewer infrastructure complies with pipe sizes shown in the Table (Sewer Size/Gradient for Multiple Properties). Section 3.6 has also been expanded to include maximum pipe gradients for different size sewers and a Table (Maximum sewer gradients) has been included in relation to this.
Section 3.7	Amended as follows: - Section 3.7 has been amended to include “shall” instead of “should” in advance of all of the Sub-Sections. - Sub-Section 3.7.9 has been amended to include a separation distance of 200m between rodding points instead of 500m. - Sub-Section 3.7.14 has been amended to exclude the use of saddle connections at connection points and required the provision of Y branch connections. - A new Sub-Section 3.7.15 has been included to refer back to Sub-Section 3.5.25 in relation to scouring requirements for rising mains. .

Section 3.9	Amended to clarify a hierarchy of protection measures for sewers at that are proposed where depths are not in accordance with Sub-Section 3.9.1 to Sub-Section 3.9.6. In addition, an absolute minimum depth of cover of 500mm in un-trafficked areas and 750mm in trafficked areas is now required when protection measures are used.
Section 3.11	Amended as follows: - The 1st paragraph has been amended to clarify that Sewers are accessed by either manholes generally and access chambers where the sewer is of small size and shallow depth, with the size of public side access chamber nominated (900mm by 900mm). - Sub-Section 3.11.3 amended to included “opening” after “access”. - Sub-Section 3.11.4 amended to outline the internal dimensions of an access shaft. - A new Sub-Section 3.11.5 included to describe the requirement for a smooth flow invert/channel. - Sub-Section 3.11.14 amended to outline the requirement for a private side inspection chamber and that plastic approved proprietary chambers may be used. - Sub-Section 3.11.15 has been qualified to indicate that the renewal, maintenance and repair of Drains and associated access accessories upstream of the boundary of the Premises is the responsibility of the property owner. - Additional requirements are provided at the end of Section 3.11 dealing with requirements for the private side inspection chamber as well as issues in relation to their location, size, their reduction in size in confined spaces, their location in high density developments, etc., and flexibility that will be allowed in these situations.
Section 3.12	Amended as follows: - The 2nd paragraph amended to include the dimensions of public side head inspection chamber. - The 3rd paragraph amended to include inspection chambers. - The 4th paragraph has been amended in relation to locating manholes and inspection chambers in high use carriageways. - The 6th paragraph has been amended to require the provision of safe access around the manhole and inspection chamber. - The 7th paragraph has been amended to outline the requirements for a backdrop manhole and conditions where a cascade manhole would be acceptable. - Sub-Section 3.12.1.5 has been amended to clarify and expand where the use of pre-cast manhole units are not allowed, i.e. where the water table is high or where there is a perched water table, where the manhole is located near a river, lake or water

	body, etc. Additional requirements are included also on the depth of pre-cast roof slabs, base units, etc. It is also required that the omission of the concrete surround is only allowed up to a maximum depth of 4.0m. In addition, the omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised. - Sub-Section 3.12.1.6 has been amended to outline requirements for blockwork manholes, strength of block, mortar, etc. - Sub-Section 3.12.2 (Manhole Dimensions) has been amended in relation to the listed “minimum” manhole sizes and the need for increased dimensions to accommodate bends, multiple inlets, etc. - Sub-Section 3.12.3 (Manhole Bases) has been amended to include for the provision of a 75mm depth of concrete blinding layer under the base. The minimum thickness of a pre-cast base beneath the channel invert is set at 150mm. - Sub-Section 3.12.4 (Manhole Walls) is amended to outline the requirements for use of cast-in-situ manholes in areas where the water table is high or likely to be high. Pre-cast manholes units are to be in accordance with IS 420 and IS EN 1917. The bedding mortar for blockwork is also outlined. It is also required that the omission of the concrete surround is only allowed up to a maximum depth of 4.0m. In addition, the omission of the concrete surround shall only apply if the wall unit is not penetrated through with proprietary fixings which could result in the water tightness of the unit being compromised. - Sub-Section 3.12.5 (Manhole Roofs) is amended to require pre-cast manholes units are to be in accordance with IS 420 and IS EN 1917. - Sub-Section 3.12.6 title has been amended to read “Manhole Invert and Benching” and has also been amended to address the blanking of redundant channels in pre-cast bases. - Sub-Section 3.12.7 (Manhole Shaft) is amended to require pre-cast manholes units are to be in accordance with IS 420 and IS EN 1917. - Sub-Section 3.12.8 (Rocker Pipes) is amended to limit the description of rocker pipes to the size of Works covered by the Code of Practice, - Sub-Section 3.12.9 (Manhole Covers and Frames) amended to indicate that a 600mm clear opening is required (600mm square or circular). A clarification on the number of keyways is provided for double triangular covers. A description of the requirement for hinged covers is provided. The width of the engineering brick beneath the frame is to be 215mm. Revised requirements are

	provided for the bedding and seating the frames and for the bedding of the brickwork under the frames. - Sub-Section 3.12.10 (Manhole Steps) is clarified in relation to the depth of chambers where steps are allowed. - Sub-Section 3.12.11 (Ladders) has been amended outlining that manholes in excess of 6m deep shall require a detailed design submission to Irish Water. Clarification is provided on the thickness of galvanising for ladders, complying with IS EN ISO 1461, with at lease 100 micron galvanise thickness.
Section 3.13	Amended as follows: - Sub-Section 3.13.2 (Thermoplastic Structured Wall Pipes) fittings may be supplied with a Stiffness Class 4kN/m^2 (SN4) complying with IS EN 13476. - Sub-Section 3.13.3 (Unplasticised PVC) fittings may be supplied with a Stiffness Class 4kN/m^2 (SN4) complying with IS EN1401.
Section 3.15	Amended as follows: - The first paragraph is amended to indicate that a “branch connection” is required rather than a “saddle connection”. - The 2nd paragraph has been amended to require the provision of a rocker pipe assembly connection between the rising main and the header manhole. - The header chamber to be provided with a sealed manhole cover and frame. - The vent stack to be fitted with a passive activated carbon unit in all cases.
Section 3.16	Significant changes have been carried out to Section 3.16. These are generally covering the following: - The Section has been sub-divided into Sub-Sections. - Revised Standards and requirements have been included in Sub-Section 3.16.1 for fusion welding, welding equipment, etc. - Revised requirement are included in Sub-Section 3.16.2 for jointing of polyethylene pipes. - Revised requirement are included in Sub-Section 3.16.3 for auditing and testing of polyethylene pipe joints. - Additional requirement are included in Sub-Section 3.16.4 for jointing of polyethylene pipe coils.
Section 3.17	Amended as follows: - 3rd paragraph of Sub-Section 3.17.2 has been amended to set limits (max and min) for the location of the sluice valve stem cap. - Sub-Section 3.17.4 title has been amended to “Wastewater Air Valve”. - Sub-Section 3.17.4 has also been amended to allow greater flexibility for the use of non-metallic pipework. - Sub-Section 3.17.5 included Standards for flange adaptor end restraints for polyethylene in the 5th and 6th paragraphs.

Section 3.18	Amended as follows: - All chamber cover/frames to be bedded with rapid hardening cementitious, epoxy or polyester resin mortar, with a minimum working time of 15 minutes, a minimum compressive strength of 30 N/mm^2 and 5 N/mm^2 within 3 hours of mixing. - All chambers cover/frames to be seated on Class B engineering brick in minimum M30 strength mortar to IS EN 998 – Part 2. - Sub-Section 3.18.1, 3rd paragraph, is amended to allow the use of pre-cast concrete floor slabs. Free draining granular material is required beneath the drain hole in the base slab to allow free drainage of liquid from the chamber. The 4th paragraph is amended to refer to TII Specification, instead of the NRA Specification. - Sub-Section 3.18.2, 3rd paragraph, is amended to allow the use of precast roof slab units to IS 420 and IS EN 1917. The 4th paragraph has been amended in relation to the seating of the cover and frame and the requirement for bricks and bedding mortar are clarified, as outlined above. - Sub-Section 3.18.3, 5th paragraph, has been amended to outline as specification for the seating of manhole frames, support bricks, bedding mortar, etc. as outlined above.
Section 3.20	Amended as follows: - The title of the section has been amended to “Working Near Existing Pipes (Notifications and Separation Distances” - 1st paragraph amended to indicate that works in the vicinity of Irish Water assets of 400mm diameter and more require written agreement from the utility prior to undertaking the work. - 2nd paragraph amended to limit the application of Sub-Section 3.20.1 to 3.20.8 to situations where the asset is not exceeding 1.5m deep. - 3rd paragraph amended to require specific written agreement in relation to assets greater than 1.5m deep or where the separation distances are less than set out in Sub-Section 3.20.1 to 3.20.8. - A new paragraph (4th paragraph) is included to require minimum separation distances as outlined in Section 3.5.18 and Section 3.5.19. - Sub-Section 3.20.9 to Sub-Section 3.20.11 amended to include “pipe” rather than “main”.
Section 3.21	The acronyms in the first paragraph are expanded.
Section 3.22	Amended to call in to play the conditions of the Trade Effluent Licence. In addition, it is indicated that the use of degreasing agents and enzymes is not permitted.
Section 3.23	Amended to outline the requirement for compliance with conditions in the Trade Effluent Licence.
Section 3.26	A new Section is included outlining the requirements for Warning

	Tape when installing Sewers and Rising Mains.
Section 3.27	A new Section is included outlining the requirements for Indicator Plates and Posts for fittings associated with Rising Mains.
Section 4.1	Amended as follows: - The 3rd paragraph is amended to call in the requirements of the Code of Practice. - The 3rd paragraph is expanded. Item (f) is included requiring protection of the environment. - The term “leak tight” is explained as passing the requirement of Section 4.10, Testing of Gravity Sewers and Manholes.
Section 4.2	The 4th paragraph is expanded to require pipes and fittings to be kept clear of fuel oils and any material that might contaminate the material.
Section 4.3	Expanded to require the use of trial holes to locate existing services.
Section 4.5	Transport Infrastructure Ireland is nominated instead of National Roads Authority.
Section 4.7	Amended as follows: - The 1st paragraph has been amended to nominate pipe bedding and surround material in accordance with the nominations in IS EN 13242. - The 2nd paragraph is expanded to describe the fill below the pipe invert in the event that over excavation is required in trenches with rock formation. - The 5th paragraph is clarified to in relation to the requirement to granular surround for both rigid and flexible pipes. - The 6th paragraph is amended to include a clarification for the backfill material required in trenches along green field areas, “acceptable material” in accordance with the TII’s Specification for Roadworks. - New requirements (8th and 9th paragraphs) are included to outline protection measures for pipes that do not have the required depth of cover. - The 10th paragraph is amended to indicate the thickness of the pipe concrete, 150mm. - A new 11th paragraph is included to describe the protection measure relating to the provision of ductile iron pipe where the depth of cover is inadequate. - The last paragraph is amended to call out Transport Infrastructure Ireland is nominated instead of National Roads Authority.
Section 4.8	Amendments have been included in 3rd paragraph which allow alternative Backfill material, other than Clause 804 and Clause 808 granular material, to be used in pipe trenches within developments subject to a written statement from the Roads Authority of the functional area where the development is located being made

	available to Irish Water in the Design Submission. This is to comprise “acceptable material” in accordance with Clause 601 of the TII “Specification for Roadworks, Series 600 – Earthworks”, Table 6/1 and the Local Authority is to clearly nominate the Class of “acceptable material” in the written approval. Amendments included in 7th paragraph outlining a specification for Backfill material in green field areas.
Clause 4.9	Amendments are included as follows: - The 1st sentence of the 3rd paragraph has been amended to replace “The blocks” with “Anchor and support blocks”. - The 3rd sentence of the 3rd paragraph is amended to indicate that thrust blocks are required for bends of 11.25 deg. and greater. The last sentence of the 3rd paragraph has bene expanded to indicate that compressible filler board and plastic sheeting is required around polyethylene pipes cast against the concrete of thrust and anchor blocks. - The 4th paragraph is clarified in relation to the provision of torque blocks. - The 6th paragraph is clarified in relation to the provision of information by the Developer when specialised pipe support systems are proposed. - The last paragraph is amended to outline that anchorage for fully integrated PE pipe systems may not require anchorage supports. - The last paragraph has been further expanded to indicate that where supports are required, compressible filler board, in accordance with the provisions of IS EN 622, Part 1 to Part 4, wrapped in plastic sheeting having a composition in accordance with BS 6076, shall be provided for protection between the concrete and the polyethylene pipe.
Section 4.10	Amended as follows: - The 1st paragraph is amended to nominate IS EN 1610 for pressure testing of gravity sewers in addition to IS EN 752. - The 3rd paragraph is amended to describe in greater detail the air test requirements for gravity sewer systems, in particular LA or LC test requirements. - The 5th paragraph is amended to describe the requirements for water test and stage testing for steep graded sewer systems. - The 6th paragraph is amended to outline the water test procedure and the test acceptance criteria. - The 7th paragraph outlines that manhole infiltration and exfiltration tests are to be carried out and the proportion of manholes tested will be at the discretion of the IW Field Engineer. - The 8th paragraph has been amended to indicate that the water

	level is to be to the underside of the roof slab rather than to ground level. - The 9th paragraph is amended to outline the test procedures and acceptance criteria for manhole infiltration tests. - The 10th paragraph has been amended to outline requirements for disposal of water following testing of manholes and pipelines. - The 11th paragraph outlines test criteria relating to testing of pipes and accessories that will not vest in Irish water. - The last paragraph is amended to outline requirements for undertaking dye surveys to check for misconnections.
Section 4.11	Amended as follows: - Section 4.11.1 has been amended to indicate that pressure testing is to be carried out in the presence of Irish Water's field engineer or agent. - Section 4.11.2 (Ductile Iron Pressure Testing) has been amended to outline revised criteria and settlement time for DI pipe testing. - Section 4.11.3 (Polyethylene Pipe Pressure Testing) has been amended to outline revised criteria for PE pipe testing.
Section 4.12	Amended as follows: - The 1st paragraph is expanded to outline the requirement for the provision of the private side inspection chamber, in accordance with Section 3.11.14 of the Code of Practice. - The 3rd paragraph and been amended to outline that the vertical angle between the service connecting pipe and the horizontal shall be between 30° degrees and 90°. - The 4th paragraph has been amended to indicate that where a connection is being made to a Sewer with a nominal internal diameter of 300mm diameter or less, connections is to be made using 45° angle Y branch junctions. - The 5th paragraph ahd been amended to indicate that retrospective connections made with junction fittings are to be made by cutting the existing pipe, inserting the junction fitting, and jointing with flexible repair couplings or slip couplers. - The 6th paragraph is amended in relation to the connection to a Sewer with an internal diameter greater than 300mm and the requirement for long radius bends. - A new 8th paragraph is included to outline criteria for the use of 90o branch or saddle connections. - The last paragraph is amended to outline the criteria in respect of providing bends in the wastewater service connection.
Part 5 (General amendment)	Part 5 describes requirements for Wastewater Pump Station. Previously, this Part included "should" when describing the requirement to comply. The word "shall" has now been included where "should" was previously included as a general amendment

	in Part 5.
Section 5.1	The 2nd paragraph has been amended to indicate that Part 5 describes requirements for pump stations up to 20kW installed power.
Section 5.2	Amended as follows: - The 4th paragraph has been amended to include requirement for interim provisions for remote monitoring of the asset. - The 7th paragraph has been amended to outline requirements for vesting of the pump station in Irish Water and how the associated site will be covered by the Deed of Grant of Easement with the access covered by a Right of Way Agreement. - The 8th paragraph has been amended to outline that emergency storage volumes are now to be in accordance with the requirements of Section 5.11 of the Code of practice. - The previous last paragraph of this Section, relating to allowing emergency overflows from pump stations, has been omitted.
Section 5.3	Amended as follows: - The “specific Minimum Requirements” have been amended. Welfare facilities and security fencing are no longer required at pump stations. - Sub-section 5.3.2 included specifying the pipework shall be in accordance with IS EN 598 with appropriate colour markings. - Sub-section 5.3.5 included to require telemetry to be to the requirements of Section 5.16 to Section 5.27. - Sub-Section 5.3.7 requires the provision of self cleansing wash down facilities in the storage tank. - Sub-section 5.3.8 expanded to require access for vacuum tanker vehicles. - A new Sub-Section 5.3.9 is included to require a dedicated, metered, power supply to be provided to the pump station serving only the pump station equipment and associated plant - A new Sub-Section 5.3.10 is included to require the pump station to be made ready to facilitate the installation of telemetry plant for data reporting to Irish Water central facility. - Sub-Section 5.3.12 has been amended in relation to the flow metering facilities, which is now required to be provided on the Rising Main as appropriate, complete with meter chamber, isolating sluice valves, etc. - Sub-Section 5.3.13 has been expanded to require the odour control equipment to be provided to eliminate the risk of odour nuisance arising, comprising a vent-column, complete with passive odour control. - Sub-section 5.3.14 expanded to require lifting equipment to be in accordance with Section 5.30. - A new Sub-section 5.3.17 is included to indicate that safe

	access is to be provided to all components for operating, maintaining and possible future replacement,. - A new Sub-section 5.3.18 is included to indicate that safe working areas are required around all components of the pumping station.
Section 5.4	Amended as follows: - Sub-section 5.4.1 expanded to include “vacuum tanker” instead of “tanker”. - Sub-section 5.4.2 expanded to include equipment replacement. - Sub-section 5.4.7 is expanded to outline the location of the inlet sewer relative to the pump delivery pipework and that a stainless steel baffle plate, complete with stainless steel fixings, is to be provided. - Sub-section 5.4.9 is expanded to require access to be suitable to accommodate safe sight distances. - Sub-section 5.4.13 is included to indicate that security fencing is not required at pump stations except in exceptional circumstances as outlined in Section 5.6. - The 3rd paragraph is amended to require the Developer to carry out a GMS signal strength survey rather than a radio signal strength survey. - The last paragraph provides requirements for the inlet manhole upstream of the wet well and the requirement to provide a hand operated penstock.
Section 5.5	Amended as follows: - The 1st paragraph is amended to outline that the separation distances relate to “habitable, commercial, industrial and mixed use properties”. It is also expanded to require that the site layout is to include and indicate the requisite dimensional requirements from adjoining property boundaries, location of odour control unit/vent stack. - The 2nd paragraph is expanded to cover “renewal, replacement and upgrade” activities as well as “maintenance” activities. - The 3rd paragraph is expanded to cover access for “Heavy Goods Vehicle”, such as vacuum tankers. - The last paragraph is expanded to require a Flood Risk Assessment to be provided with the Design Submission.
Section 5.6	Amended to indicate that fencing of pump station sites is not required, and will only be necessary in exceptional cases. If fencing is required, the preferred fence type is nominated as palisade fencing and a specification for this is provided. Wire mesh fencing, if set as a requirement, is also specified.
Section 5.7	Amended as follows: - The 1st paragraph is expanded to indicate that the maintenance vehicle should be capable of getting a close as possible to the wet well chamber and that this should be achieved without

	undertaking unsafe movements. - The second paragraph is expanded to nominate the type of kerbing required around the hard-standing area. - The 3rd and 4th paragraphs are expanded to increase the depth of compacted Clause 804 material to 500mm. - The 5th paragraph is expanded to indicate that the hard-standing areas should be designed to carry heavy vehicles that access the site. - A new 6th paragraph is included setting out requirements for backfilling over-excavated areas that are located beneath hard-standing areas.
Section 5.8	Amended as follows: - The first paragraph has been expanded to outline requirements for the VSD control panel, where a VDS is provided. - A new 3rd paragraph is included requiring the submission of hydraulic calculation in the Design Submission outlined in Section 2.3. - The 4th paragraph has been amended in relation to the requirement for emergency storage at a pump station. - A new 5th paragraph is included which covers situations where balance storage may be required if there are restrictions in the downstream network. - The 6th paragraph is amended to outline the emergency storage requirements are to be provided in accordance with Section 5.11 of the Code of Practice, 10 to 24 hour storage, with 24 hour storage required for developments up to 250 units. - The last paragraph is amended to require a hard wired level float switch in each pump station.
Section 5.9	Amended as follows: - Sub-Section 5.9.7 has been amended to outline the minimum pumping requirements of 3DWF to 6DWF. - Sub-Section 5.9.8 has been amended to indicate that the minimum rising main diameter is 80mm. - Sub-Section 5.9.10 has been amended to require the ultrasonic head to be installed in an accessible location, while not impeding access to the wet well. - A new Sub-Section 5.9.11 has been included outlining the requirements of the ultrasonic unit. - A new Sub-Section 5.9.19 has been included to outline the requirement for statutory testing during the Defects Liability Period. - Sub-Section 5.9.29 has been expanded to require seal leak protection. - Sub-Section 5.9.31 has been expanded to require a duplicate steel indicator plate to be installed in the kiosk or control structure, rather than in the control panel.

	- A new Sub-Section 5.9.32 has been included outlining the requirements for the provision of cables with the pump plant. - A new Sub-Section 5.9.33 is included to require the provision of a spare name plate for the pump in the kiosk.
Section 5.10	Amended as follows: - The 1st paragraph is amended to outline revised minimum dimensions and to indicate that benching of the well is required. - The 2nd paragraph is expanded to limit the maximum depth of the wet well to 6m and specific approval of Irish Water is required for deeper units. - The 3rd paragraph has been amended to outline requirements for a combined inlet manhole upstream of the wet well chamber, which is to include a flow control penstock. - A new 4th paragraph is included to outline the requirements of the overflow pipe and return pipe between the emergency storage tank and the wet well. - The 7th paragraph is expanded to indicate the requirement for the submission of anti-floatation calculation in the Design Submission. - The 8th and 9th and 10th (new) paragraphs have been amended to outline requirements for the design of cast in situ, pre-cast composite and proprietary pre-cast concrete wet well units to comply with IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2). - The 11th paragraph has been expanded to outline a requirement for puddle flanges in the pipework passing through the walls of structures. In addition, the designer is to provide details of the method of sealing pipes openings in pre-cast units. - The 13th paragraph has been amended to set the minimum rising main size as 80mm. - A new last paragraph has been inserted to outline that backfill around the wet well is to incorporate a 500mm width of Clause 808 material under any structural surrounds and a 500mm width of free draining around the wet well close to ground level of the unit.
Section 5.11	Amended as follows: - The 1st paragraph has been amended to indicate that emergency overflows to watercourses of Storm Sewers are not allowed, unless specified by Irish Water. - A new 2nd paragraph is included to address the factor of safety of the storage structure against flotation. This also indicates the requirement for the submission of anti-floatation calculation in the Design Submission. - The 3rd paragraph has been amended in relation to the requirement for emergency storage at a pump station. The need

	for 24 hour storage of DWF has been changed for developments of more than 250 units and a Table is now included outlining the storage requirements. - The 4th paragraph has been amended to outline requirements for the overflow pipe from the storage tank to the wet well. - A new 6th paragraph is included to require the submission of appropriate consents from relevant authorities for the allowance of an emergency storage. - The 7th paragraph, outlining the requirement for aperture size overflow screens and requiring compliance with the requirements of the "Urban Wastewater Treatment Directive Procedures and Criteria in relation to Storm Water Overflows", as published by the Department of Environment, has been expanded to provide the date of this publication. - New paragraphs (8th to 12th) have been included to outline requirements for the construction of the emergency storage tank and particularly compliance with IS EN 1992 – Part 3, Design of Concrete Structures - Part 3: (Liquid retaining and containment structures, Tightness Class 2) and requirements for sealing the pipework passing through the walls of structures. In addition, the designer is to provide details of the method of sealing pipes openings in pre-cast units. - A new last paragraph has been inserted to outline that backfill around the wet well is to incorporate a 500mm width of Clause 808 material under any structural surrounds and a 500mm width of free draining around the wet well close to ground level of the unit.
Section 5.12	Amended as follows - The 1st paragraph has been amende4d to indicate that the valve chamber is to be sized to adequately house all equipment and provide adequate space for maintenance and plant replacement. - Sub-Section 5.12.1 has been expanded to outline the pipework required. - The 4th paragraph outlines the requirement for the submission of anti-floatation calculation in the Design Submission. - The 5th, 6th and 7th paragraphs have been expanded to outline the requirements for the structural design of the valve chamber. - The 9th and 10th paragraphs have been included to outline requirements for building in pipes in the walls of the valve chamber. - A new 11th paragraph has been inserted to outline that backfill around the wet well is to incorporate a 500mm width of Clause 808 material under any structural surrounds and a 500mm width of free draining around the wet well close to ground level of the unit.

Section 5.13	The 1st paragraph has been amended to require "no-flow" protection of the pumps and the provision of a controller for the meter in the kiosk. The last paragraph has been amended to require the provision of a valve in the meter chamber.
Section 5.14	Amended as follows: - The 1st and 2nd paragraphs are amended to require the roof of chambers to be flush with the surrounding finished ground level. The 1st paragraph also includes additional requirements in relation to flush mounting of chamber covers in pre-cast concrete roof slabs. - Sub-Section 5.14.2 has been amended to outline that the covers are to be fabricate in durbar plate and outlines the thickness of galvanising for the covers. - A new Sub-Section 5.14.3 is included to outline that the covers can be single or multi leafed. - A new Sub-Section 5.14.4 is included to outline that the covers are to be provided with seals. - Sub-Section 5.14.8 is included to indicate that the cover is to include a recessed facility securing the cover with an approved padlock. - Sub-Section 5.14.9 outlines that security rating of the lock. - Sub-Section 5.14.10 outlies that the padlock recess is to have a cover plate. - Sub-Section 5.14.11 outlines that the cover leaf is to incorporate a safety stay. - Sub-Section 5.14.12 outlines that requirement for a torsion spring assisted lifting system. - Sub-Section 5.14.13 requires that the hinges and lift assistance sets should not impinge on the safe entry of the chamber. - Sub-Section 5.14.14 outlines requirements for the fall protection grid. - Sub-Section 5.14.15 outlines that the covers should be capable of withstanding an imposed load of 6 tonne. - A new Sub-Section 5.14.18 has been included outlining that segmental units will be required for large openings. - A new Sub-Section 5.14.19 is included outlining the requirements for support beams for segmental units. - A new 4th paragraph is included outlining the requirements for meter chamber access covers. - The last paragraph has been amended to outline that proprietary rungs are required in meter chambers and valve chambers less than 3.0m deep and ladders are required for deeper chambers.
Section 5.15	An amendment has been included to require the emergency storage tank to be vented along with the wet well structure. It has also been expanded to cover mechanical ventilation of the units.

Section 5.16	This Section has been retitled “General Electrical Requirements” and has been expanded to outline general electrical requirements.
Section 5.17	A new Section 5.17 “Cables” has been included outlining the requirements for electrical cables.
Section 5.18	A new Section 5.18 “Cables Installation” has been included outlining the requirements for electrical cable installation.
Section 5.19	A new Section 5.19 “Control Panel General Requirements” has been included outlining the requirements for pump control panels.
Section 5.20	A new Section 5.20 “Form 4 Control Panel Components - Additional Requirements” has been included outlining the requirements for Form 4 pump control panels.
Section 5.21	A new Section 5.21 is included outlining requirements for earthing and bonding.
Section 5.22	Previously Section 5.17, the retitled Section 5.22, it has been amended as follows: - The 1st paragraph as been amended to indicate that a separate power supply kiosk will be to the power supplier requirements. - The 2nd paragraph is amended to include revised dimensions for the control kiosks. - The 5th paragraph is amended to outline the minimum thickness of the plate for the fabrication of kiosks is reduced to 3mm from 4mm. - The 9th paragraph has been amended to outline the requirements for security rating of the kiosk doors. - The 12th paragraph has been amended to outline that where additional security is required or where specified in the Planning approval, a structure to house the control panels and associated equipment shall be provided.
Section 5.23	A new Section 5.23 is included outlining the control philosophy for pump stations.
Section 5.24	A new Section 5.24 is included to outline the requirements for abnormal operation for pump stations.
Section 5.25	A new Section 5.25 is included to outline the testing requirements for pump stations.
Section 5.26	A new Section 5.26 is included to outline the requirements for telemetry signalling for pump stations.
Section 5.27	A new Section 5.27 is included to outline the requirements for dial out alarms at pump stations.
Section 5.28	Previously Section 5.18, the retitled Section 5.28 has been amended as follows: - The 1st paragraph has been amended to indicate that the chamber shall be fully sealed. - A new 3rd paragraph is included to outline the requirement of pre-cast concrete meter chambers units. - The 7th paragraph has been expanded to include the provision of sealed cover unit for the chamber.

	- The 8th paragraph has been amended to describe the revised requirements for the bedding and seating of the frames and for the bedding of the brickwork under the frames.
Section 5.29	Previously Section 5.19, the retitled Section 5.29 has been amended as follows: - The 1st paragraph has been amended to outline the requirement that ducting is to be in accordance with IS EN 61386-24. In addition ducts used for ESB Networks cables are to be in accordance with ESB Networks specification 16113 and IS 370 colour code. - A new 3rd paragraph has been added to indicate that the lowest positioned chamber is to incorporate a drain to a soak away. In addition the duct or duct banks shall be located 150mm above the floor level of the duct chamber. - A new 5th paragraph is provided to set out the requirements for the provision of ducts. - The 8th paragraph has been amended to describe the revised requirements for the bedding and seating of the frames and for the bedding of the brickwork under the frames. - The 9th paragraph has been amended to outline that the plinth for chambers on grassed areas is to have a bull-nosed edge finish.
Section 5.30	Previously Section 5.20, the retitled Section 5.30 has been amended to require the provision of a lifting davit socket rather than a davit and socket. The last paragraph has bene amended to outline that consultation with Irish Water is required in relation to the provision of permanent lifting equipment. Where such permanent lifting equipment is provided, fencing of the site is required.
Section 5.31	Previously Section 5.21, the retitled Section 5.31 has been amended to omit the need for a separate wash down area.
Section 5.32	A new Section is included to outline the testing requirements for liquid retaining structures.
Appendix A	Additional Standards referred to in the Code of Practice, Revision 2, are included in Appendix A.
Previous Appendix B	The previous Appendix B, titled “Selection of Typical Details”, has been omitted
Appendix B	Previously Appendix C, Appendix B, “Gravity Sewer Design” has been included outlining revised design requirements for design. .
Appendix C	The previous Appendix D – Wastewater Flow Rates for Design – has been included as Appendix C.
Appendix D	New Appendix D - List of Amendments Associated with Revision 2 has been included.