Irish Water

Technical Standards

WASTEWATER NETWORK SEWER PIPE CCTV SURVEY STANDARD

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CONTENTS

Glossary of Terms

Agglomeration	Agglomeration, as defined in the Waste Water Discharge (Authorisation) Regulations, means an area where the population or economic activities or both are sufficiently concentrated for a waste water works to have been put in place.
Agglomeration Name	The name given to an Agglomeration as per the Waste Water Discharge (Authorisation) Regulations. See http://www.epa.ie/licensing/watwaste/wwda/search/ for all Agglomeration Names
Agglomeration Reference	The reference given to an Agglomeration as per the Waste Water Discharge (Authorisation) Regulations. See http://www.epa.ie/licensing/watwaste/wwda/search/ for all Agglomeration References
Client	The responsible department or function within Irish Water for the CCTV Survey project. The term Client shall be deemed synonymous with the term 'Employer' in the conditions of contract.
Consultant	The service provider appointed by Irish Water whose services inter alia include the administration, supervision and validation of Sewer Pipe CCTV Surveys on behalf of the Client. The term Consultant shall be deemed synonymous with the term 'Employer's Representative' or 'Engineer' in the conditions of contract.
Contractor	The supplier appointed to undertake Sewer Pipe CCTV Surveys work on behalf of Irish Water.
InfoNet	InfoNet is a purpose-built infrastructure management system, developed by Innovyze, for wastewater and water network systems.
Sewer Pipe	All conduits regardless of shape and material that convey sewage or surface water.
Survey	Each CCTV sewer pipe survey undertaken by the Contractor.

Uncharted Manhole	An Uncharted Manhole is one which is not represented in the most up to date drainage database provided by Irish Water to the Consultant or Contractor.

Abbreviations

avi, wmv, wma, mpg, mpeg, mp4 or dv	Digital video file formats
CCTV	Closed Circuit Television
CIWEM	Chartered Institute of Water and Environmental Management
GIS	Geographical Information System
ING	Irish National Grid
IW	Irish Water
MSCC	Manual of Sewer Condition Classification
PDF	Portable Document Format
SRM	Sewerage Risk Management (formerly Sewer Rehabilitation Manual)
STC Report 25	Standing Technical Committee Report 25, Department of Environment (UK), National Water Council. June 1980. Sewer and Water Main Records.
STC25	Standing Technical Committee Report 25, Department of Environment (UK), National Water Council. June 1980. Sewer and Water Main Records.
XML	Extensible Markup Language (a file format) is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable.
WRc	Water Research Centre

1.0 INTRODUCTON

This Standard is known as the '*Wastewater Network Sewer Pipe CCTV Survey Standard*' and it shall apply to all CCTV sewer pipe surveys undertaken by Contractors on behalf of Irish Water.

This Standard will support the collation, validation and storage of accurate sewer pipe condition data and asset data to support various functions within Irish Water.

1.1 ROLE OF CONSULTANT

Throughout this Standard it is assumed that a Consultant has been appointed by Irish Water whose duties include the contract administration, data quality checking and supervision of the CCTV Survey being undertaken by a Contractor. In situations where no Consultant has been appointed by Irish Water, it shall be assumed that all Consultant services referred to in this Standard shall be undertaken by Irish Water.

1.2 SUMMARY OF CONTENT

This Standard is divided into the following sections:

Section 1 provides an introduction.

Section 2 describes general standard requirements for Sewer Pipe CCTV surveys.

Section 3 details the required Survey Vehicle & Equipment.

Section 4 describes the required CCTV Surveyor Operative's Qualifications.

Section 5 details CCTV Survey technical requirements.

Section 6 details updates that may be required to the Irish Water Asset Database as a consequence of the CCTV Survey work.

Section 7 details Data Quality requirements.

Section 8 details Final Reporting and Deliverables requirements

1.3 PURPOSE OF INSPECTION

Table 1.1 lists the purposes of CCTV survey inspections as classified in the Manual of Sewer Condition Classification version 5 (refer: Field 39, Purpose of Inspection). In general, most 'purposes of inspection' may be considered as 'planned' projects (usually entailing planned investigations of a number of pipes within the sewer network) whereas some, in particular those relating to operational problems, may be considered as 'reactive' projects (usually entailing investigations of small sections of the sewer network, perhaps a single pipe).

Within this Standard there are a number of sections that shall apply to 'planned' projects only; these sections shall clearly state that they apply to 'planned' projects only; all other sections of this Standard shall apply to all CCTV Surveys undertaken on behalf of Irish Water. Table 1.1 provides a breakdown of 'purpose of inspection' into the 'planned' or 'reactive' project classifications as required for the application of this Standard only.

Table 1.1 Purpose of Survey Inspection

Purpose of Inspection (as per MSCC5)		General Classification*
A	Investigation of known structural or service defects	Planned
B	Investigation of infiltration problems	Planned
C	Post completion inspection of repairs or renovations	Generally Planned but in some cases Reactive†
D	Pre-adoption survey prior to vesting as public sewer	Planned
E	Post completion inspection of new sewers	Planned
F	Sample survey of sewers to determine asset condition of a sewer system	Planned
G	Routine inspection of condition	Planned
H	Investigation of a suspected operational problem	Reactive
I	Investment planning	Planned
J	End of warranty period	Not applicable
X	Other	Planned or Reactive

* for purpose of this Standard only

† 'Reactive' where the repair/renovation is required immediately after an Investigation (classification H) of a suspected operational problem

In the cases of 'Purpose of Inspection' C or X only, the Contractor shall be informed of the classification ('planned' or 'reactive') by the Client or Consultant prior to the commencement of the project or Survey.

In the case of all 'planned' projects, in order to fulfil the terms of this Standard the Client or Consultant shall be required to issue a copy of the relevant sections of Irish Water's below ground wastewater asset database to the Contractor in advance of the commencement of the project or Survey.

For each 'planned' project, the Contractor shall request a copy of the relevant sections of Irish Water's below ground wastewater asset database.

1.3.1 DRAINAGE AREA PLANS

All CCTV Surveys undertaken as part of Irish Water's Drainage Area Plan projects are classified as 'planned'. This Standard is one of a number of wastewater network standards developed by Irish Water to support Stage 2 of Irish Water's Drainage Area Plan (DAP) process; other such

standards include *Wastewater Network Below Ground Asset Survey Data Capture Standard* and *Wastewater Network Hydraulic Model Build and Verification Standard.*

2.0 GENERAL

2.1 LOCATION AND EXTENT OF SURVEY

Details of the location and extent of the survey required shall be specified to the Contractor by the Consultant.

Save insofar as it is physically or legally impossible the Contractor shall carry out the survey and provide the specified information relating to the whole of the defined survey area to the satisfaction of the Client within the time period specified.

The Contractor shall survey Irish Water owned assets only; except if instructed otherwise by the Client. In cases where the Contractor is uncertain of sewer pipe ownership, the Contractor shall seek clarification from the Client.

2.2 EXISTING RECORDS

The Contractor shall examine all existing network records made available by Irish Water. Existing network records do not necessarily indicate the location of all assets or the accuracy of data related to assets.

2.3 STANDARD OF PERFORMANCE

To ensure the accuracy of information provided, quality checks will be undertaken in accordance with this Standard.

2.4 DIMENSION MEASUREMENT

All measured and recorded dimensions shall be metric, otherwise known as International System of Units. For the purposes of metrification, Imperial sized sewers shall be converted on the basis of 1inch = 25.4mm. Measurement shall be on nominal diameter dimensions quoted to the nearest mm.

2.5 DATUM

All level data shall be to Malin Head Ordnance Datum.

2.6 GRID COORDINATES

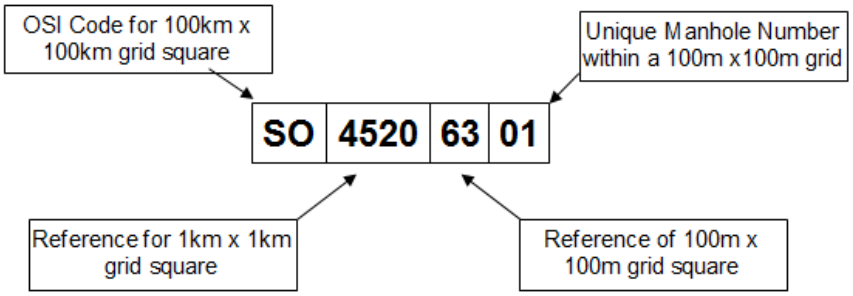
Where required, and save in so far as possible, all asset co-ordinates shall be located in accordance with ING (Irish National Grid) co-ordinate system.

2.7 NOT USED

2.8 NOT USED

2.9 NODE ID REFERENCE SYSTEM

Asset references shall follow the STC Referencing System. A typical STC25 Reference is explained below:



The first two letters - designate the Ordnance Survey Ireland (OSI) 100km (100km x 100km) grid square by a set code. (For example the 100km grid square 300000m East and 200000m North of the Ordnance Survey Ireland origin is known by the code SO.) These codes can be obtained from the Ordnance Survey Ireland.

The first four numbers – designate the 1km grid (1km x 1km) square in any given 100km x 100km grid square. The first two numbers are the Easting of the 1km grid square in thousands of metres and the second two numbers are the Northing of the 1km grid square in thousands of metres. (E.g. 4520 defines the 1km grid square 45,000m East and 20,000m North).

The next two numbers – define a specific 100m grid square (100m x 100m) within the previously defined 1km grid square. The first number is the Easting in hundreds of metres from the 1km grid square origin and the second number is the Northing in hundreds of metres. (e.g. 63 defines the 100m grid square 600m East and 300m North of the 1km grid square origin).

Last two digits - Everything but the last two digits are defined by the nodes national grid co-ordinates and relate to a specific 100m grid square (100m x 100m). The last two digits relate to the manholes unique reference number within the given 100m x 100m grid square (so this allows 01-99 manholes per 100m x 100m grid square).

The location of a node shall be identified using GPS co-ordinates within ±0.5m in both the Easting and Northing.

The Contractor shall ensure that each new asset added to the database has a unique reference and is not duplicated in the original datasets provided at the start of the project. The Contractor

shall also maintain consistent references for each asset (i.e. an asset shall not be given two different numbers).

Insofar as possible, the Contractor shall ensure that all STC References in the original database shall be retained.

The Contractor shall note that on occasion there may be problems/inconsistencies with the referencing within existing databases. The most likely problem to occur is that a node's reference will relate to the wrong 100m x 100m grid (usually one very close by). This usually occurs when a manhole was surveyed or digitised and then assigned a reference number. When the manhole was re-surveyed or digitised the location was wrong by a few metres pushing it into a different 100m grid square.

Where this occurs the Contractor shall notify the Client and then correctly re-reference the manhole. A finalised list of any re-numbered manholes shall be included in the Final Survey Report. The format required is shown in Table 2.1.

Table 2.1: Manhole Reference Updating

Original STC Reference	Updated STC Reference
SO20352011	SO20352105

Where assets are found to have been demolished or filled in, the Consultant shall request permission to delete from the final database. They shall only be deleted from the final database upon agreement from the Client.

Original STC references that are no longer in use for referencing the original asset shall not be reused to reference other assets.

2.10 SEA AND RIVER LEVELS

The Contractor should plan their surveys in relation to river and tide levels as these levels may dictate when some surveys can take place, particularly where river and tide levels impact on infiltration. The impact of pumping stations on levels within the sewerage network may also impact when surveys can take place. Relevant sources including historical flow survey data, pumping station telemetry data, operational knowledge, tide level data, flood mapping and rainfall patterns should be consulted to facilitate this planning.

2.11 OPENING MANHOLE COVERS

The location of all buried manhole covers and manhole covers that cannot be opened by reasonable means shall be notified to the Consultant, before the end of each working day.

2.12 LOCATING SEWERS

The Contractor may locate sewers by means of “Cat and Genny” to enable the line of the sewer to be marked at ground level as instructed by the Client.

2.13 LOCATION OF UNCHARTED MANHOLES

Section 2.13 applies to ‘planned’ projects only

The Contractor shall record the location co-ordinates of each accessible uncharted manhole discovered during the CCTV Survey using GPS within ± 0.5m in both Easting and Northing.

2.14 LOCATION OF BURIED MANHOLES

Section 2.14 applies to ‘planned’ projects only

The Contractor shall locate all buried manholes, where their above ground location is accessible in a legal and safe manner, by means of a probe and the ING coordinates of the buried manhole shall be identified utilising a GPS device and either recorded in the Irish Water asset database in accordance with Section 6 (for ‘planned’ surveys) or recorded in spreadsheet format as per Table 2.2.

Table 2.2 Record Details for Buried Manhole

Node Reference	Location	Easting	Northing	Survey Status
As per IW database	Address	ING coordinates	ING coordinates	Buried

No marking shall be placed on the ground surface without the express permission of the Client.

2.15 DEFECTIVE ASSETS

If during the course of the survey the Contractor or the Consultant becomes aware of assets or asset covers which are a potential hazard they shall immediately notify the Consultant and the Client. If an asset cover is damaged whilst being lifted the Contractor shall provide temporary protection for pedestrians and for vehicular traffic and shall inform the Consultant and the Client immediately so that arrangements can be made for replacement.

2.16 SEWER COLLAPSES

If during the course of the survey the Contractor becomes aware of any sewer pipe that is either collapsed or at significant risk of collapse they shall immediately notify the Consultant and the Client.

2.17 ACCESS ARRANGEMENTS TO PRIVATE PROPERTY

The Contractor shall identify all known areas where access is required to private properties, for the purposes of completing the CCTV survey, prior to commencing surveys. The Contractor shall provide a list of properties including full postal address and the date access is required to the Consultant, allowing reasonable time for advance notice to private property owners. The Consultant shall then send a copy of this list to the Client. The Contractor and Consultant shall adhere to the latest guidance available from Irish Water in relation to contacting customers and arranging access to customer's properties for planned works.

The Contractor shall be aware that in some locations there may be no vehicular access to the manhole locations, and there may also be manholes located in areas of restricted space.

2.18 ENABLING WORKS

Enabling works include inter alia sewer cleansing, root cutting, high pressure jet cutting and sewer repairs. The Contractor shall seek approval from the Consultant to undertake any enabling works deemed necessary to complete the CCTV survey. Enabling works required to complete a full CCTV Survey shall only be undertaken when instructed by the Client. All enabling works shall be carried out in accordance with Irish Water Standards for the various types of enabling works.

2.19 ABANDONED SURVEYS

The Contractor shall spend a reasonable amount of time manoeuvring CCTV equipment past obstructions including joint defects or debris; typically 2 minutes. Where the Survey is unable to proceed due to conditions within the sewer, the Contractor shall photograph and report the cause of abandonment to the Consultant. The unsurveyed portion shall be surveyed as appropriate from the other end or, if instructed by the Consultant, re-surveyed following necessary enabling works. All condition classification report digital files relating to abandoned surveys shall be retained and incorporated in a CCTV survey object in the InfoNet database. Similarly, all video files shall be retained and in accordance with section 5.6 of this Standard.

Where a Survey cannot commence due to the conditions within the sewer (e.g. a surcharged manhole), the Contractor shall include a CCTV report in accordance with the requirements of this Standard with the survey abandonment and reason for same recorded at 0.0m chainage.

2.20 EQUIPMENT RECOVERY

The Contractor shall be responsible for the recovery of equipment, where the loss of such equipment is due to bad practice, negligence or equipment failure.

Where it is deemed by the Contractor's CCTV Operative that to drive the CCTV unit beyond a certain point in a sewer pipe would entail significant damage or loss risk to the CCTV equipment the Survey should be abandoned and the following should occur:

(i) The CCTV Operative should endeavour to locate the destination manhole by all practical and safe means. Where it is possible to locate and access the destination manhole a return survey should be attempted.

or

(ii) Where it has not been possible to access the downstream/upstream manhole the Contractor shall communicate in writing to the Client and the Consultant the cause of the survey abandonment.

2.21 DAMAGE TO SERVICES

Updated mapping for all utilities should be reviewed by the Contractor prior to commencement of survey works. Such mapping will always be indicative, and Irish Water is not responsible for any variations found on site.

The Client or the Consultant, and relevant utility authority shall be notified immediately of any damage to existing utility services that has occurred or is discovered during the course of the Survey.

2.22 NOTICE

The Contractor shall notify the Client in advance of a CCTV Survey commencing in accordance with the requirements of each project. This notice is required to enable the Client to make such arrangements as may be necessary for the work to proceed, to check the work and to take account of any change in the normal operating conditions in the sewer.

2.23 WORK-AREA CLEARANCE

On completion of the survey at a work-area, all equipment shall be removed except as otherwise directed by Client and the site left in a neat tidy condition, to the satisfaction of the Client.

All aspects of waste legislation relating to the storage, transport and disposal of all waste material arising from the survey must be strictly adhered to.

2.24 NOT USED

2.25 NOT USED

2.26 NOT USED

2.27 HEALTH AND SAFETY

The data capture requirements of this Standard may require person and/or equipment entry into confined spaces within the live wastewater network. Access to the wastewater network can be from entry points in various locations including manholes located in busy urban roads.

The Contractor and Consultant must comply with all relevant legislation, all Irish Water safety procedures and requirements, carry out all works in a safe manner and comply with traffic management requirements. All individuals undertaking the Survey shall at a minimum require appropriate Confined Space training and appropriate Traffic Management training.

Confined Spaces

The General Principles of Prevention must be applied in relation to Confined Spaces and entry should be avoided where possible.

The following legislation must be taken into account prior to carrying out Confined Space Entry:

- The Safety, Health and Welfare at Work Act 2005,
- The Safety, Health and Welfare at Work (Confined Space) Regulations 2001,
- The Safety, Health and Welfare at Work (General Application) Regulations 2007
- The Code of Practice for Working in Confined Spaces 2010

Non exhaustive list of requirements:

- A specific risk assessment incorporating confined space entry must be carried out prior to entry.
- Specific Emergency Procedures should be prepared.
- The emergency equipment (harness and tripod/davit) used must be suitably designed and certified for rescuing the entrant.
- Clean chamber before entry, where required.
- A calibrated gas detector should be lowered into the chamber to monitor the air for a suitable amount of time prior to entry.
- Breathing apparatus and escape sets etc. must be certified and must be inspected before use and those using them must be trained in their use.
- All equipment must be inspected prior to entry (including PPE and rescue equipment).
- All entrants and Standby by Personnel must be competent and sufficiently trained in Confined Space Entry and associated emergency procedures.
- No combustion engines should be operating anywhere near the chamber (con saws, generators, compressors, vehicles).

- The air must be monitored at all times.

A Confined Space Permit should be filled out to ensure that the above requirements are in place.

Biological Hazards

The Safety, Health and Welfare at Work (Biological Agents) Regulations 2013 (S.I. No. 572 of 2013) apply when on or near sewage systems.

A risk assessment must be carried out where there is potential exposure to biological hazards in accordance with the above legislation.

The following must also be taken into account:

(i) Information, training and consultation of employees.
(ii) Hygiene.
(iii) Individual protection.
(iv) Vaccination.
(v) Health surveillance.
(vi) Emergency plans.

Traffic Management

The Contractor/consultant must carry out risk assessments and put controls in place to ensure the safety of their employees as well as road users.

Any works on a roadway must be carried out in accordance with Chapter 8 of the Traffic Signs Manual.

The Safety, Health and Welfare at Work (Construction) Regulations 2013 give requirements for traffic management which relate to construction works.

2.28 NOT USED

2.29 SOFTWARE VERSION

The version of InfoNet to be used throughout the asset database update process shall be fixed and agreed with the Client prior to the commencement of the Survey. Software version upgrades to the database shall only be undertaken with the prior approval of the Client. In the event that a change of software version is agreed, it is essential to follow the software supplier's version update procedure to ensure model results are consistent. Any differences should either be rectified, or if unable to do so, reported to the Client regarding their significance.

2.30 DRAWINGS

Where drawings of assets are required, as advised in sections 3 to 10, digital formats of the drawings (such as AutoCAD or as specified by the Consultant or Client) shall be provided by the Contractor to the Consultant and Client.

3.0 SURVEY VEHICLE AND EQUIPMENT

3.1 SITE AMENITIES

The Contractor shall make provision in the mobile survey vehicle to allow the Client or the Consultant, to view the monitor during CCTV survey work.

One copy of the Client's instructions or specification and this Standard will be kept within the Contractor's survey vehicle on the site and be available for inspection and use by the Client or the Consultant.

3.2 SURVEY UNITS

The Contractor shall provide sufficient survey units, including standby units in the event of breakdown, in order to complete the Survey(s) within the required period in accordance with the Client's requirements.

3.2.1 COMMUNICATION EQUIPMENT

A mobile telephone must be fitted in the survey vehicle for the duration of the survey. Email facility should be available in the survey vehicle to facilitate communication of CCTV survey reports to the Client or the Consultant in the event of identification of urgent defects. On identification of defects requiring urgent attention the Contractor shall contact the Consultant by telephone and the CCTV report shall be issued as soon as practically possible.

3.2.2 ABOVE GROUND SURVEY EQUIPMENT

For the purposes of identifying the ING coordinates of all manholes, the survey vehicle must be equipped with a suitable GPS device or other suitable alternative, to identify the easting and northing of each asset to within an accuracy of ± 0.5m for Easting and Northing.

To identify the location of buried assets the CCTV unit will be equipped with a 'sonde' and a 'CAT (Cable Avoidance Tool) and Genny' to detect the signal emitted from the sonde or other equipment to achieve same.

A metal detector must also be available in the survey vehicle unit to increase the confidence with which buried assets, specifically manhole covers and other ancillaries of metal construction, are located.

3.2.3 VEHICLE WORKING ZONES

The survey vehicle working areas shall be divided into two distinct areas:

- Viewing Area

- Working Area

The Operators working in the viewing area and working area shall be provided with a suitable means of communication at all times to ensure ease and clarity of communication between the two areas.

3.2.4 VIEWING AREA

Seating shall be provided to accommodate the Operator and two people in addition to the Operator to clearly view the monitor as the survey is being undertaken. No equipment utilised within the sewer shall be allowed to be stored in the viewing area.

3.2.5 WORKING AREA

The working area shall be reserved for equipment, both operational and stored. The working area shall be of such a design to ensure that all equipment is stored in a secure manner while in transit and or not in use.

3.3 OPERATIONAL EQUIPMENT

Each CCTV survey vehicle shall have surveying units capable of undertaking CCTV surveys of pipe sewers ranging in size from 100mm to 600mm, in either diameter or width & height. Furthermore the Contractor shall have access to a CCTV survey vehicle with a CCTV survey unit capable of surveying sewers in excess of 600mm in height.

CCTV remote crawler unit surveying equipment shall be capable of surveying a length of sewer up to 350m where entry to the sewer is possible from the upstream and downstream manhole, chamber or other access point. Where entry to the sewer is possible from one entry point only the survey equipment shall be capable of surveying a length of sewer up to 150m in length.

Where surveying can only be undertaken by means of a push rod camera system it shall be capable of surveying a length of sewer up to 100m where entry is possible from the upstream and downstream manhole, chamber or other access point. Where entry to the sewer is possible from one entry point only the survey equipment shall be capable of surveying a length of sewer up to 50m in length.

The Contractor shall have access to CCTV sewer inspection equipment with lateral navigation capability.

The Contractor shall also have access to CCTV sewer inspection equipment with the capability of inspecting a drain past the point of a ‘U-bend’.

Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the sewer under inspection. Such equipment shall ensure the maintained location of the CCTV camera as per Section 3.7.

Each CCTV camera unit shall be capable of completing a tilt of 90º and a full rotation of 360º in sewers of greater or equal to 225mm diameter or 225mm width/height.

Where the CCTV camera is towed by winch and bond through the sewer, all winches shall be stable with either lockable or ratcheted drums. All bonds shall be steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera. All winches shall be inherently stable under loaded conditions.

Each unit shall carry sufficient numbers of guides and rollers such that, when surveying, all bonds are supported away from pipe, manhole and or ancillary structures and all CCTV cables and/or lines used to measure the camera's location within the sewer are maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment.

Each survey unit shall carry a range of flow control equipment for use in controlling the flow during the survey. A minimum of one item of each size capable of controlling flow in sewers of between 100mm and 300mm diameter inclusive shall be stored within the CCTV vehicle at all times. The Contractor must notify the Client of the intention to use flow control equipment at least 2 days prior to the survey and the Contractor must receive written permission from the Client for the use of any flow control equipment prior to the survey.

The Contractor shall maintain their plant in full working order and shall satisfy the Consultant at the commencement of each working shift that all items of plant have been provided and are in full working order.

The CCTV survey vehicles shall be suitable for traversing soft ground where required.

3.4 CCTV PICTURE QUALITY – CAMERA, RECORDER & MONITOR

An approved test device(s) shall be provided on site at all times to enable practical demonstration of compliance with the requirements specified in this section.

The test card shall be the Marconi Resolution Chart No. 1 with a colour bar, clearly differentiating between colours with no tinting to show the following:

- White
- Yellow
- Cyan
- Green
- Magenta
- Red

- Blue
- Black.

At the start of each and every working shift, the camera shall be positioned centrally and at right angles to the test card at a distance where the full test card just fills the monitor screen, ensuring that the edges of the test castellation coincides with the horizontal and vertical scan (raster). The card shall be illuminated evenly and uniformly without any reflection.

The illumination shall be to the same colour temperature as the colour of the lighting that will be used on the CCTV camera in the sewer. The test specified used in section 3.5.1 below shall be recorded for a period of at least 30 seconds. The type of camera used is to be identified in the test recording. The recording shall show the camera being introduced into the test device and reaching its stop position.

3.4.1 PICTURE QUALITY TEST

The test shall establish that the shades of grey; colour; linearity; resolution; and colour constancy can be achieved, as set out below, utilising the electronic systems, closed circuit television camera and monitor display.

Shades of grey

The grey scale shall show equal changes in brightness ranging from black to white with a minimum of five clearly recognisable stages.

Colour

With the monitor control adjusted for correct saturation. The six colours plus black and white shall be clearly resolved with the primary and complementary colours in order of decreasing luminance. The grey scale shall appear in contrasting shades of grey with no limit.

Linearity

The background grid shall show squares of equal size, without convergence/divergence over the whole of the picture. The centre circle shall appear round and have the correct height/width relationship (±5%).

Resolution

The live picture shall be clearly visible on the monitor with no interference and capable of registering, a minimum number of TV lines/picture height lines. The resolution shall be checked with the monitor colour turned down. This shall be not less than the resolution in the table below:

Format	Resolution	Minimum Bit Rate
MPEG 1	260 lines	1.2 Mbs
MPEG 2	350 lines	Variable 3.5 – 8 Mbs
MPEG 2	400 lines[1]	Variable 5 – 8 Mbs

[1]The resolution selected should take into account the size of pipe, 260 lines is only likely to be suitable for smaller pipe.

Colour consistency

To ensure the camera shall provide similar results when used with its own illumination source, the lighting shall be fixed in intensity prior to commencing the Survey. In order to ensure colour constancy, generally no variation in illumination shall take place during the survey.

The contractor shall note that the Engineer may periodically check both the live and video picture colour consistency against the colour bar. Any difference will necessitate resurvey of any length affected at the Contractor's expense.

3.5 FOCUS/IRIS/ILLUMINATION

The adjustment of focus and iris shall allow optimum picture quality to be achieved and be remotely operated. The adjustment of focus and iris shall provide a focal range from 150mm in front of the camera's lens to infinity. The distance along the sewer in focus from the initial point of observation shall be a minimum of twice the vertical height of the sewer. The illumination shall be such as to allow an even distribution of the light around the sewer perimeter without the loss of contrast, flare out of picture or shadowing.

3.6 LIGHTING RING DEVICES

The Contractor shall demonstrate by means of an approved Test Device the accuracy of the "light ring" such that the projected ring appears round with height/width relationship of ±1%.

3.7 CAMERA POSITION

Wherever possible the CCTV camera shall be positioned to reduce the risk of picture distortion. In the case of circular or regular shaped sewers, the camera lens shall be positioned centrally within the sewer. In the case of egg shaped sewers, the camera lens shall be positioned vertically above the invert at a height two thirds of the vertical dimension of the sewer. In all instances the camera lens shall be positioned looking along the axis of the sewer. A positioning tolerance of ±10% of the vertical sewer dimension will be permitted.

3.8 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 the Consultant as will enable all details to be extracted from the DVD recording. Survey Team - Qualifications and Training Requirements.

4.0 SURVEY TEAM - QUALIFICATIONS AND TRAINING REQUIREMENTS

Evidence of appropriate training and qualifications of personnel shall be provided to Irish Water by the Contractor on request.

4.1 CONDITION CLASSIFICATION

All Contractor personnel responsible for classifying pipe sewer conditions, including those undertaking quality control, shall have completed training and achieved successful accreditation in the following sewer condition classification course:

- Pipe Sewer Condition Classification OS19x

All Contractor personnel responsible for classifying brick sewer conditions, including those undertaking quality control, shall have completed training and achieved successful accreditation in the following sewer condition classification course:

- Brick Sewer Condition Classification OS21x

The above courses shall have been successfully completed to enable personnel to classify pipe conditions to the level of Manual of Sewer Condition Classification 4th or 5th Editions.

Where Pipe and Brick Sewer Condition Classification training was successfully completed by Contractor personnel in accordance with the Manual of Sewer Condition Classification 3rd edition, the Contractor personnel responsible for classifying pipe and brick sewer conditions must successfully complete OS19x and OS21x respectively, or successfully complete the following conversion training:

- Pipe Sewer Condition Conversion to MSCC4 OS30x

4.2 OTHER TRAINING REQUIREMENTS

All CCTV Survey Team Operatives shall have completed certified training in the use of 'Cable Avoidance Tool' & Genny and in the use of Sonde equipment for the purposes accurately identifying the location of sewers and buried manholes.

5.0 SURVEY TECHNICAL REQUIREMENTS

5.1 CONDITION CLASSIFICATION FORMAT

Sewer condition classification for each survey shall be undertaken in accordance with either the Water Research centre (WRc) *Manual for Sewer Condition Classification (MSCC) 4th edition* or *5th edition*.

5.2 CONDITION CLASSIFICATION FILE FORMAT AND NAME

The format of the sewer condition classification report digital file delivered by the Contractor to the Client and Consultant shall be either:

- MSCC5 xml file format in accordance with the following web link:

http://srm.wrcplc.co.uk/Data/Sites/2/GalleryImages/WebImages/Background%20of%20SRM/XML%20Draft%20Specification%20for%20MSCC5%20Sewer%20Inspection%20Data_February%202014_final%20draft.pdf

or

- MSCC4 xml file format in accordance with the following web link:

http://srm.wrcplc.co.uk/Data/Sites/2/GalleryImages/WebImages/Background%20of%20SRM/Format_of_Coded_CCTV_data_Issue_1.1%20for%20MSCC4.pdf

All other formats shall not be accepted unless approved in writing by the Client.

The naming convention for the xml file shall be as follows:

IW Project Reference_Agglomeration Reference_Date

Date shall be last month of the Survey or Project in MMYYYY format.

5.3 SEWER CONDITION SCORING SCHEME

The sewer condition scoring scheme within the Interim and Final Report and Deliverables (refer section 8) shall be in accordance with the scoring scheme of the Sewerage Risk Management (SRM) Manual 5 produced by the WRc.

5.4 CAMERA CODING POSITION

For each code recorded, the camera shall be stationary within the sewer and the camera cable taut to ensure that the chainage is noted accurately.

At each connection, break, void and open joint the camera head shall undertake a recorded 90º rotation and full 360º rotation to fully inspect the defect/connection. The camera shall return to the forwarding facing position before continuing along the length of the sewer.

5.5 DISPLAY

At the start of each Survey, the length of zero chainage up to the cable calibration point shall be recorded and reported in order to obtain a full record of the sewer length.

The meter reading entered on to the data display at the cable calibration point must allow for the distance from the start of the survey to the cable calibration point, such that the metreage at the start of the Survey is zero.

In the case of surveying through a manhole where a new header sheet is required, the metreage shall be set at zero with the camera focused on the outgoing pipe entrance.

The CCTV Surveyor Operative shall ensure that the metreage counter starts to register immediately once the camera moves forward within the sewer.

At the start of each Survey a title page shall be generated, and clearly displayed on the viewing monitor and video recording, of data in alpha-numeric form containing the following information as a minimum:

- CCTV Operator full initials (use middle name initials to distinguish)
- Client
- Consultant
- Project Number
- Agglomeration reference
- Date survey started
- Time survey started
- Weather conditions at time of survey (rain light, rain steady, rain torrential, dry, snow, snow melt)
- Automatic update of the camera's metreage position in the sewer line from adjusted zero
- Sewer shape (circular, egg, rectangular etc.)
- Sewer dimensions (mm, height x width in non-circular)
- Sewer material
- Sewer lining material (if appropriate)
- Sewer pre-cleaned (Yes or No)
- Year sewer laid if known
- Pipe length reference
- Upstream and downstream reference manhole number

- Sewer use (foul, surface, overflow or combined)

While the Survey is underway the following information shall be available on screen as a minimum:

- Date
- Automatic update of the camera's metreage position in the sewer line from adjusted zero, as described at the beginning of this section
- Sewer dimension(s)
- Start Node
- Finish Node
- Direction of the Survey.

The size and position of the data display shall be such as not to interfere with the main subject of the picture.

The annotation as listed above is to be clearly visible on the recording and in contrast to the background (e.g. white text on a black background). The annotation is to be positioned horizontally in the recording view and shall not interfere with the subject of the recording.

Correct adjustment of the recording apparatus and monitor shall be demonstrated by use of a device approved by the Client or the Consultant. Satisfactory performance of the camera shall then be demonstrated by the recording of the appropriate test device at commencement of each day for a minimum period of 30 seconds.

5.6 DIGITAL CCTV VIDEO FILES

5.6.1 NAMING CONVENTION

Digital CCTV video files are required to have a consistent naming convention to enable linkage of the footage to Irish Water's asset database and GIS. The naming convention to be followed is:

Start node STC reference'_Finish Node STC reference_link suffix number_Direction of Survey (D or U)_date_Time Survey Started

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

For example, a CCTV Survey started on 10th of November 2012 at 14:23 from node SO45206301 to node SO45206314 in an upstream direction, on the pipe with a suffix of 2 would have the name:

SO45206301_SO45206314_2_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.

5.6.2 FILE FORMAT

All Survey video files shall be compatible with avi, wmv, wma, mpg, mpeg, mp4 or dv format.

5.7 PHOTOGRAPHS

Digital colour photographs shall be taken at the following points in all sewers:

- All defective junctions
- All defective connections
- Continuous defects at the beginning, at 5m intervals thereafter and at the end of the defect (unless intermediate defects are identified which require a photograph)
- General condition of the sewer at 20m intervals or each Sewer Pipe length whichever occurs most often.
- Cracks
- Fractures
- Broken pipes
- Deformation
- Open joints (Large only)
- Displaced joints (Large only)
- Collapses
- Dropped inverts
- Missing or displaced bricks
- Mortar loss
- At the point where a survey is required to be abandoned
- Other places as the Client, or the Consultant, directs.

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 metreage position in 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 (e.g. CC Crack Circumferential or survey abandoned etc.).

The annotation as listed above is to be clearly visible in printed form and in contrast to the background (e.g. white text on a black background). The annotation is to be positioned horizontally in the photograph and shall not interfere with the subject of the photograph.

6.0 UPDATING IRISH WATER'S ASSET DATABASE

Section 6 applies to 'planned' projects only.

The Contractor and Consultant shall request an InfoNet database upon their appointments. This section sets out the requirements for the Contractor to update Irish Water's wastewater network asset database, where a database is made available.

The Contractor shall be required to update Irish Water's asset database with relevant survey information as specified in this section of the Standard; this shall occur where additional or more accurate asset information is identified during a CCTV Survey.

6.1 SCENARIOS WHERE ASSET RECORD UPDATING SHALL BE REQUIRED

In the circumstances detailed below in this sub-section, the Contractor is required to update the Irish Water wastewater network asset database:

6.1.1 ALTERNATIVE SEWER LAYOUT TO ISSUED SEWER RECORDS

The Contractor shall rectify sewer layout errors in the asset database as discovered via CCTV surveys. The CCTV surveys shall be linked to the appropriate Pipe asset object in the database.

6.1.2 SURVEY DATA DIFFERENCES TO SEWER RECORD ASSET DATA

The Contractor shall rectify errors or discrepancies between the CCTV survey data and the Pipe asset data. Such errors or discrepancies may include pipe material, pipe lining material and pipe size where conflicting values exist between the survey data and the asset data.

The data flag 'SC' (refer to Section 7.7 Data Flagging) shall be applied to all changes made to the asset data arising from information in the CCTV survey.

6.1.3 UNCHARTED AND BURIED MANHOLES

The Contractor shall plot uncharted manholes into the asset database as accurately as possible using such methods as CCTV survey lengths, survey orientation or positioning where feasible in accordance with the Standard (refer sections 2.11 and 2.12). The data flag 'SC' shall be applied to both the Easting and Northing coordinate fields of these manholes in the asset database.

6.1.4 SEWER REHABILITATION PROJECTS

Upon completion of pipeline sewer rehabilitation projects the Contractor shall be required to update the asset database with the following data at a minimum:-

- CCTV Surveys for pre- and post- rehabilitation phases, undertaken in accordance with this standard, shall be linked to the appropriate asset;

- At post-rehabilitation relevant asset data shall be updated.

  For full pipe length repair/rehabilitation this shall include the following fields where appropriate:

  - Upstream and downstream Pipe Lining Material;
  - Upstream and downstream Pipe Lining Type;
  - Upstream and downstream Pipe Height and Pipe Width;
  - Upstream and downstream Pipe Shape.

7.0 DATA QUALITY

7.1 GENERAL

This section details survey data quality and validation checks required to be undertaken as part of the survey and reporting process.

7.2 ACCURACY

7.2.1 LINEAR MEASUREMENT

The CCTV monitor display shall incorporate an automatically updated record in metres and tenths of a metre of the distance of the camera position from the cable calibration point.

The Contractor shall use a suitable metering device which enables the cable length to be accurately measured. In non-man entry surveys a means of accurately locating the photographic camera chainage and any recorded defect, along the sewer shall be provided. In both cases this shall be accurate to ±1% or 0.3m whichever is the greater.

When requested by the Client, or the Consultant, at any time during the course of the Survey, the Contractor shall demonstrate that the tolerance specified above is being complied with. For CCTV one or both of the following methods shall be used in conjunction with a linear measurement audit form as the Client, or the Consultant, shall select:

- Use of a cable calibration device
- Tape measurement on the surface between manholes.

The accuracy of measured sewer length dimensions shall be ±1% or 0.3m. If the Contractor fails to meet the required standard of accuracy the Client, or the Consultant, shall instruct the Contractor to provide a new device to measure the chainage. The Client, or the Consultant, may at their discretion instruct, in writing, the Contractor to resurvey those lengths of sewer first inspected with the original measuring device.

Should the Client, or the Consultant, request any additional sewer dimensions to be recorded or re-measured, the Contractor shall provide a fully equipped and trained team to facilitate this requirement. The work shall be carried out at the Contractors cost if it is proven that any re-measurement work shows that the previous measurements were not taken in accordance with the above procedure or differ by more than the specified tolerances. In the case of additional measurements not required as part of the agreed contract, or re-measurements that agree with the original measurements the Contractor shall be due recompense under the agreed contract day work rates.

7.2.2 SEWER DIMENSIONS

The accuracy of internal sewer dimensions shall be ± 10mm.

Should the Client or Consultant request sewer dimensions to be re-measured the Contractor shall provide a fully equipped and trained team to facilitate this requirement. The work shall be carried out at the Contractors cost if it is proven that, in the absence of recorded reasonable mitigating circumstances such as abnormal flows or siltation, re-measurement work shows that the previous measurements differ by more than ± 10mm.

7.3 QUALITY CHECKS

For all 'planned' projects, the Consultant shall administer a quality checking system that effectively gauges the accuracy and consistency of the survey report produced by the CCTV Surveyor Operative for each project.

For all 'reactive' projects, Irish Water shall administer a quality checking system that effectively gauges the accuracy and consistency of the survey report produced by the Contractor, perhaps over a number of projects.

In all cases, the quality checking system shall be such that the standard of reporting shall be measured by:

- the accuracy of the Header information provided
- the accuracy of the Coding, including the number of codes omitted

Target and lowest acceptable levels of accuracy standards are given in the Table 7.1 for both sections of the CCTV Report; the Header detail section and the Coding detail section.

Table 7.1 Header and Coding Required Accuracy Levels

	Target Standard	Lowest Acceptable Accuracy Standard
Header accuracy	95%	75%
Coding accuracy	85%	75%

7.3.1 HEADER DETAIL

Header detail shall be checked to ensure that all mandatory information is provided, entries are correct, and that codes and numbers have been used appropriately. Each error or omission shall be treated equally regardless of whether it is a minor or major issue, unless otherwise stipulated in writing by the Consultant. The percentage accuracy shall be determined on the basis of the following formula:

Header Accuracy = **[{(number of entries) – (errors or omission)}*100]**

[The number of entries]

Accuracy for Header detail shall at a minimum meet the Lowest Acceptable Accuracy Standard as set out in Table 7.1.

7.3.2 CODING DETAIL

The Coding detail must be checked to ensure that all mandatory information is provided, entries are correct and that codes and numbers have been used appropriately. The following variances shall be deemed acceptable:

- ± 1 hour o'clock shall be allowed for when coding the clock position.
- ± 5% shall be allowed for when coding the defect magnitude.

Otherwise each error or omission shall be treated equally regardless of whether it is a minor or major issue, unless otherwise requested in writing by the Client.

The percentage accuracy shall be determined on the basis of the following formula:

Coding Accuracy = **[{(number of entries) – (errors or omission)}*100]**

[The number of entries]

Accuracy for Coding shall at a minimum meet the Lowest Acceptable Accuracy Standard as set out in Table 7.1.

7.3.3 HEADER AND CODING QUALITY CHECKING PROCESS

In the case where a Survey fails to achieve the specified standard the following process, as illustrated in **Figure 7.1**, shall be followed.

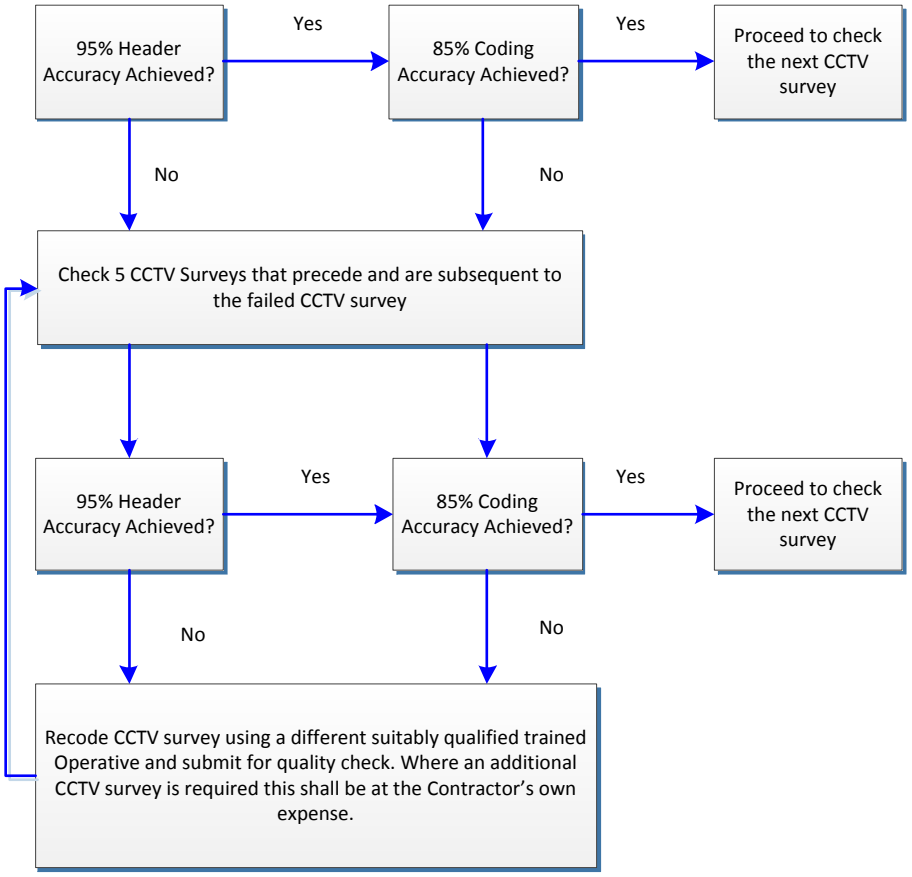


Figure 7.1 Quality Checking Process

A minimum of 5% of all Surveys shall be selected for checking. The Surveys to be checked shall be randomly selected. Using the original CCTV footage and with access to Survey coding report, the CCTV Survey Operative in the presence of the Consultant and/or Irish Water shall recode each survey selected for checking. The recoded surveys shall be checked against the results obtained by the Contractor in the initial survey.

Any CCTV Surveyor Operative whose quality control results fall below the Lowest Acceptable Accuracy Standards of either Header accuracy or Coding accuracy on more than 2 separate occasions will no longer be eligible to work on Irish Water (or its agents) contracts until such time that CCTV Surveyor Operative attends and passes a Sewer Condition Classification course recognised by Irish Water, as per Section 4.

The Consultant shall provide written confirmation to the Client of the Surveys checked, the Surveys that passed/failed the quality check and which sewer pipes were resurveyed.

7.4 DATA VALIDATION PROCESS

7.4.1 INTRODUCTION

At the outset of each data validation exercise the Contractor and Consultant shall ensure that they are in possession of the *Irish Water CCTV Validation Rules* data object; this data object has been developed by Irish Water using InfoNet software[1].

Prior to transmitting CCTV survey data to the Consultant, the Contractor, shall satisfy themselves that all data is accurate. The Contractor shall process the *Irish Water CCTV Validation Rules* and other validation checks as necessary. The Consultant, after receipt of the CCTV survey data, will also run the *Irish Water CCTV Validation Rules* to determine the status of the data in accordance with Section 7.4.2 and Section 7.4.3.

7.4.2 PRIORITY LEVELS OF VALIDATION RULES

The rules and checks within the *Irish Water CCTV Validation Rules* data object have three 'priority levels' and corresponding consequences as explained in **Table 7.2** below:

Table 7.2 Validation Priority Levels

Priority Level No.	Priority Level Title	Notes
1	Error	Errors within CCTV Survey data submitted by the Contractor shall result in the rejection and the return of the data to the Contractor. Survey data with errors shall not be valid for remuneration. The Contractor shall undertake all necessary investigative and data cleansing works to remove 'Errors'.
2	Warning	Each 'Warning' shall require a written explanation from the Contractor which shall detail the reasons behind the existence of 'Warnings' in the CCTV Survey data. Data containing Priority Level 2 'Warnings' shall only be accepted where a reasonable justification for the Warnings has been provided by the Contractor and agreed by the Client.
3	Information	For information only.

[1] In InfoNet, Validation Data objects contain a set of rules that are used during the data validation process. Any number of Validation Data Objects can be created, allowing different validation settings for different types of data checking.

7.4.3 IRISH WATER CCTV VALIDATION RULES DATA OBJECT

The *Irish Water CCTV Validation Rules* data object contains the minimum data validation rules to be applied; this data object contains the validation rules included in **Table 7.3** and **Table 7.4**.

Table 7.3 includes the Field number and name in MSCC4 and MSCC5 formats and the equivalent Field in the Irish Water wastewater network asset database. The details required to be captured in each Field, the Fields that are mandatory to satisfy the minimum requirements for this Standard and the validation priority levels are also included in Table 7.3.

Table 7.4 contains the InfoNet 'in-built' CCTV Survey validation rules and the Priority Levels applied by this Standard as included in the *Irish Water CCTV Validation Rules* data object.

Table 7.3 MSCC 5 and MSCC 4 fields, IW Standard fields and Priority Levels

MSCC 5		MSCC 4		IW Validation Rules and Sewer Pipe CCTV Standard			
Field Number	Name	Field Number	Name	Equivalent field in IW validation rules	Details	Requirement for IW standard	Priority Level
1	Client	1	Client	Customer	'Irish Water' for all Irish Water projects	Yes	2
2	Name of Surveyor	2	Name of Surveyor	Name of Inspector	Full initials (including middle) of person undertaking sewer condition coding followed by company name e.g. JBM CCTV LTD	Yes	2
3	Client's Job Reference	3	Client's Job reference	Contract No / Job Ref	IW project reference	Yes	2
4	Contractor's Job Reference	4	Contractor's Job reference	Job Number	Contractor's own job number	Yes	2
-				Consultant	Consultant where appointed with responsibility for supervision of survey works and data validation	Yes	2
5	Drainage Area	5	Drainage Area	Catchment Sewer/ Name	Agglomeration Reference as per EPAs Reg No for the agglomeration (discharge licence no.) available here: http://www.epa.ie/terminalfour/wwda/	Yes	1
6	Division/ District	6	Division / District	District	Agglomeration Name as per the EPAs Reg Name for the agglomeration available here: http://www.epa.ie/terminalfour/wwda/	Yes	1
7	Pipe Length Reference	7	Pipeline Length Reference	link suffix	.1 .2 .3	Yes	1
8	Date	8	Date	When Surveyed	DD/MM/YYYY and 24hour clock HH:MM format	Yes	1
9	Time	9	Time	Date/Time Started	DD/MM/YYYY and 24hour clock HH:MM format	Yes	1
10	Location (Street Name)	10	Location (Street Name)	Road Name	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	2
11	Location (Town or Village)	11	Location (Town or Village)	Place Name	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	2
12	Location Type Code	12	Location Type Code				
13	Land Ownership					No	
14	Start Node Reference	13	Start Node Reference	Start Manhole	Must be in accordance with section 2.7 of this Standard	Yes	1
15	Start Node Coordinate					No	
16	Node 1 Reference				Must be in accordance with section 2.7 of this Standard	Yes	1
17	Node 1 Node Coordinate					No	
18	Depth at Start Node	14	Depth at Start Node			No	
19	Finish Node or Node 2 Reference	15	Finish Node Reference	Finish Manhole	Must be in accordance with section 2.7 of this Standard	Yes	1
20	Depth at Finish Node	16	Depth at Finish Node			No	

MSCC 5		MSCC 4		IW Validation Rules and Sewer Pipe CCTV Standard			
Field Number	Name	Field Number	Name	Equivalent field in IW validation rules	Details	Requirement for IW standard	Priority Level
21	Node 2 Node Coordinate					No	
22	Node 3 Reference					Yes – laterals only	2
23	Node 3 Node Coordinate					No	
24	Lateral Inspection Start Point					No	
25	Longitudinal Location of Start of Lateral					No	
26	Circumferential Location of Start of Lateral					No	
27	Use of Drain/Sewer	17	Use of Drain/Sewer	Sewer Use	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
28	Type of Drain/Sewer	18	Type of Drain/Sewer	Pipe Type	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
29	Direction	19	Direction	Direction	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
30	Height or Diameter	20	Height or Diameter	Height	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
31	Width	21	Width	Width	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
32	Shape	22	Shape	Shape	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
33	Material	23	Material	Material	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
34	Lining Material	24	Lining Material	Lining	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	3
35	Lining Type	25	Lining Type	Lining Type	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	3
36	Pre-cleaned	26	Pre-cleaned	Pre-Clean Choice	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
37	General Remarks	27	General Remarks	Comments	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
38	Critical Drain/Sewer	28	Critical Drain/Sewer			No	
39	Purpose of Inspection	29	Purpose of Inspection	Inspection Purpose	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	2
40	Inspection Stage					No	
41	Flow Control Measures	30	Flow Control Measures	Flow Control	as per XML Specification for MSCC5 Sewer Inspection Data specified	Yes	2
42	Weather	31	Weather	Weather	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	2
43	Temperature	32	Temperature			No	
44	Pipe Unit Length	33	Pipe Unit Length	Pipe Length	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1

MSCC 5		MSCC 4		IW Validation Rules and Sewer Pipe CCTV Standard			
Field Number	Name	Field Number	Name	Equivalent field in IW validation rules	Details	Requirement for IW standard	Priority Level
45	Expected Length	34	Expected Length	total length		Yes	1
46	Year Constructed	35	Year Constructed			No	
47	Method of Inspection	36	Method of Inspection	Method of Inspection	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	3
48	Standard	37	Standard	Standard	as per XML Specification for MSCC5 Sewer Inspection Data	Yes	1
49	Video Image Storage Media	38	Video Image Storage		as per XML Specification for MSCC5 Sewer Inspection Data	No	
50	Video Image Location System	39	Video Image Location System				
51	Video Image Format	40	Video Image Volume				
52	Video Image Filename				*Refer Section 5.5.2 of this Standard for naming convention*	Yes	
53	Video Volume Reference						
54	Photographic Image Storage Format	41	Photographic Storage				
55	Photographic Volume Reference	42	Photographic Volume				
56 - 61	Client Defined	43 - 45	Client Defined				
				Surveyed Length		Yes	1

Table 7.4 InfoNet 'built-in' CCTV Validation Irish Water Validation Rules Priority Levels

Rule ID	Message	Cause	Priority Level
400	CCTV Survey data not consistent with pipe data	Start Manhole / Finish Manhole does not correspond to US Node ID / DS Node ID of associated pipe or Direction not consistent with associated pipe direction	2
401	CCTV Survey is not associated with a pipe in the network	The associated pipe described by the US Node ID, DS Node ID and Link Suffix fields does not exist in the network.	1
410	CCTV Survey upstream node is not in network	The node specified in the US Node ID field does not exist in the network	1
411	CCTV Survey downstream node is not in network	The node specified in the DS Node ID field does not exist in the network	1
420	CCTV Survey's defect distances are not in order	The values in the Distance column in the Defects grid are not in ascending order	1
422	CCTV Survey's defect video numbers are not in order	The values in the Video No. column in the Defects grid are not in ascending order	1
424	CCTV Survey's defect video times are not in order	The times in the Video Time column in the Defects grid are not in ascending order	1
426	CCTV Survey has unrecognised continuous defect text	A code entered in the CD column in the Defects grid is not recognised as a continuous defect code. This can be due to a continuous defect being entered without a number identifier. For example S or SZ has been entered where S2 should have been used.	1
428	CCTV Survey has incomplete continuous defect	This validation error can be caused by: a start code for which there is no finish code below in the CD column in the Defects grid or a finish code for which there is no start code above or a change code for which there is either no start code above or no finish code below. A continuous defect requires a start AND a finish code.	1
430	MSCC4 survey start node type (e.g. MH) should begin a survey	The first Code in the Defects grid is not a start node code.	1
432	MSCC4 survey's start node type (e.g. MH) should be followed by a water level (e.g. WL)	The start node of the survey is not followed by a water level code in the Code column of the Page grid.	1
434	Unless an MSCC4 survey is abandoned (SA), it should end with an end node type (e.g. MHF)	The survey is not abandoned (code SA) and the last Code in the Defects grid is not an end node code.	1
436	MSCC surveys should contain one (and only one) VID defect	There is no VID code or there is more than one VID code in the Code column of the Defects grid.	1
438	MSCC survey code VVR (or VID) does not contain any reference to a video file	The VID survey code has no corresponding video file reference in the Video File column in the Defects Page grid.	1
440	2nd Size should be specified for this MSCC Shape	The CCTV Shape type requires a second dimension, but a value has not been specified in the Width field of the Construction page of the CCTV Survey Property Sheet.	2
442	2nd Size not normally specified for this MSCC Shape	The CCTV Shape type does not require a second dimension, but a value has been specified in the CCTV Survey Width field.	1
444	Diameter should be specified for this MSCC Defect	Defect type requires a diameter value, but a value has not been specified in the Dimension 1 field of the Defects grid.	1
446	Diameter is not required for this MSCC Defect	Defect type does not require a diameter value, but a value has been specified in the Dimension 1 field of the Defects grid.	2
448	Clock At should be specified for this MSCC Defect	Defect type requires a Clock At value, but a value has not been specified in the Clock At field of the Defects grid.	1
450	Clock At is not required for this MSCC Defect	Defect type does not require a Clock At value, but a value has been specified in the Clock At field of the Defects grid.	2
452	Clock To should be specified for this MSCC Defect	Defect type requires a Clock To value, but a value has not been specified in the Clock To field of the Defects grid.	1
454	Clock To is not required for this MSCC Defect	Defect type does not require a Clock To value, but a value has been specified in the Clock To field of the Defects grid.	2

Rule ID	Message	Cause	Priority Level
456	Percentage should be specified for this MSCC Defect	Defect type requires a Percentage value, but a value has not been specified in the % field of the Defects grid.	1
458	Percentage is not required for this MSCC Defect	Defect type does not require a Percentage value, but a value has been specified in the % field of the Defects grid.	2
460	Intrusion should be specified for this MSCC Defect	Defect type requires an Intrusion value, but a value has not been specified in the Dimension 2 field of the Defects grid.	1
462	Intrusion is not required for this MSCC Defect	Defect type does not require an Intrusion value, but a value has been specified in the Dimension 2 field of the Defects grid.	2
464	Continuous defect already exists	A continuous defect flag has been used more than once. For example, S1 occurs more than once, or a continuous defect is being started after it is finished (e.g. F1 occurring at 5.0m, and S1 occurring at 10m) in the CD column of the Defects grid.	1
466	Continuous defect has got more than one entry at the same distance	Different continuous defect types have been set at the same distance in the CD column of the Defects grid (e.g. S1, C1 and F1 at a distance of 9.5 m).	1
468	CCTV survey's associated Connection Pipe does not exist	A connection pipe with specified Connection pipe ID does not exist in the network.	1

7.5 DATA VALIDATION SELECTION LIST

This sub-section applies to 'planned' projects only.

For the purposes of ensuring validation rules are applied only to assets and surveys within the scope of each project, a Selection List[2] shall be created by the Contractor in InfoNet for the extent of the CCTV survey undertaken on a project. The Selection List shall be called 'Selection List – IW project reference'. Selection Lists shall be supplied to the Client each time an InfoNet database is submitted to the Consultant or Client.

7.6 INTERIM QUALITY CHECKS

Interim Quality Checks shall be undertaken by the Consultant for each submission of an Interim Report and Deliverable (refer to section 8.2 for details) by the Contractor. The quality checking and the data validation process for Interim Reports and Deliverables shall be undertaken in accordance with sections 7.2 to 7.5 of this Standard i.e. the same quality checking and validation process shall apply to all data including Interim Reports and Deliverables.

7.7 DATA FLAGGING

A data flagging system will ensure transparency for auditing purposes and also act as an essential tool for estimating data confidence levels. Key fields for assessing confidence level in the historical drainage databases include 'Survey Status' and 'Survey Date'. In addition the application of data validation rules may indicate confidence levels with respect to historic data. Flagging shall also assist analysis by providing a mechanism to link the wastewater network database back to the original survey work and give due cognisance to residual risk in relation to data confidence.

The approved list of data flags to be used within the wastewater network asset database build is provided in Table 7.5. **No additional flags shall be added to this list by the Contractor or the Consultant without the prior consent of the Client.**

The flagging system is intrinsic to the assessment of confidence that can be attributed to data within the database. The default flagging system that is required to be used within all modelling activities in Irish Water is set up to enable that confidence assessment. Some of the flags will need to have some level of engineering judgement on the suitability of the data that they relate to. This assessment will need to be made by the Consultant based on the data, on a project by project basis. **The application of appropriate Data Flags shall be the responsibility of the party entering the data into the drainage database in InfoNet**. For example: field survey data entered into the drainage database by the Contractor shall be data-flagged by the Contractor;

[2] A Selection List in InfoNet is a database item that contains lists of network objects that have been saved for future reference.

data digitised into the drainage database from historic records (e.g. as-built drawings) by the Consultant shall be data-flagged by the Consultant.

The Consultant shall confirm with the Client the appropriate data flags that shall be added to the database by the Consultant prior to the issuing of the database to the Contractor for the input of any survey work.

Table 7.5 Irish Water Default Data Flags

Flag	Description
Software 'Built-in' Data Flags	
#A	"Asset Data"
#D	"Default data filled in by InfoWorks"
#G	"Data from GeoView"
#I	"Data from Model Import"
#V	"Data from CSV Import"
Data from Survey Work (Category 1)	
SA	Data from Ancillary Survey
SC	Data from CCTV Survey
SF	Data from Flow Survey
SI	Data from Impermeable Area Survey
SM	Data from Manhole Survey
ST	Data from Topographical Survey
Data from Specified Irish Water Sources (Category 2)	
DA	Data from As Built Drawings
DD	Data from Client Drainage Database
DH	Data from Client Historical Record Drawings
DO	Data from Operations

Flag	Description
DS	Data from Stakeholders (Internal)
DE	Data from Stakeholders (External)
Data from Previous Studies (Category 3)	
PM	Data from previous hydraulic model exercise
PR	Data from previous study (Preliminary Report etc.)
Data Altered by Modeller during Model Build / Verification (Category 4)	
BI	Data interpolated from other data
BF	Data Inferred using automated software routine
BE	Data Inferred by Engineering Judgement
BA	Assumed / Dummy Data
BD	Data from Desktop Analysis (e.g. Impermeable Area Take-off)
AT	ATTENTION - NEEDS TO BE CHECKED (Temporary Flag)

Note – The Data Flag AT should only be used during the data validation process. When the final data is handed over to the Client, there should be no AT flags remaining.

7.8 ASSET SURVEY DATA

Where both Wastewater Network Below Ground Asset Surveys and CCTV Surveys are undertaken by the Contractor within a project, the Contractor shall ensure that all Survey Data is validated and integrated fully into the InfoNet database. This shall include the checking and removal of inconsistencies between the Wastewater Network Below Ground Asset Survey data and the CCTV Survey data. Such inconsistencies between these data sources may occur, for example, due to incorrect asset referencing or incorrect recording of asset data such as pipe materials or pipe diameters. The Consultant shall check and validate the database received from the Contractor that contains both CCTV Survey and Wastewater Network Below Ground Asset Surveys. The Consultant may return this database to the Contractor if unexplained inconsistencies and errors remain.

7.9 DATA COLLECTED IN OTHER SURVEYS

The Consultant shall ensure that, prior to the delivery of the Final Database(refer section 8.1) to the Client, all relevant surveys undertaken in the project – and there may be many types of surveys and sources of data in a Drainage Area Plan project for example - have been integrated into the Final Database. It shall be the responsibility of the Consultant to check and validate information collected on all surveys to ensure that the highest confidence data available has been included in the final data delivered to the Client. For example with regard to data collected during flow surveys, conduit dimension data (particularly non-circular conduits) may have higher confidence value and therefore this data should be included by the Consultant in the Final Database. In all cases the Consultant shall ensure that the source of the data is reflected in the use of appropriate data flags.

8.0 REPORTS AND DELIVERABLES

This section details the content requirements for both the Final Report and Deliverables and also Interim Report(s) and Deliverables.

8.1 FINAL REPORT AND DELIVERABLES

The Final Report and Deliverables shall include the following items:

a) Sewer condition classification file in accordance with Section 5.2 of this Standard;
b) Survey footage files in accordance with this Standard;
c) [This deliverable is for 'planned' projects only] InfoNet snapshot file ('Final Database') of the asset network and surveys undertaken in the Project (refer section 8.3 for naming convention);
d) Validation rules report (excel spreadsheet) including explanations for 'Warnings';
e) Final Report including:
    i. Introduction, including dates of execution of the work, location of the works, name of Client and Consultant, the length of Surveys undertaken;
    ii. General description of the sewer inspection including details of the equipment used;
    iii. General assessment of the condition of the sewerage network and a summary of the types of defect encountered in carrying out the survey;
    iv. Description of the coding sheets and the format for the sewer condition classification;
    v. The internal diameter, pipe material, structural condition grade and service condition grade for each sewer length surveyed;
    vi. Details and results of any investigations carried out for connections to the existing sewerage system and locating of sewers;
    vii. Confirmation of the results (pass/fail) of the Survey quality checks;
    viii. Details of the additional documentation being submitted with the Report.
    ix. Printed Sewer Classification Coding Sheets. Reports to include defect scoring and condition grades, each defect and connection encountered shall include the chainage, and position on pipe circumference (e.g. 4 o'clock), the frame number and photograph number (if any) in each case
    x. List of video footage files, including an index of the sections of sewer covered.
    xi. Digital photographs, in accordance with section 8.1.1, provided by the Contractor, including an index sheet.
    xii. Drawings in accordance with section 8.1.2.

The Final Report shall be supplied in a hardcopy and digital format, initially as a 'Draft' version for Consultant and/or Client review and then following comments from the Consultant and/or Client as a 'Final' version, also in hardcopy and digital format.

It may be necessary depending on the size of the Final Report to present the Report in more than one volume and in such cases the Contractor shall agree the format of the Report with the Client, or the Consultant.

Each Final Report issued by the Contractor shall be a fully checked and edited version and shall have passed through a documented quality control procedure for approval and shall be signed off by a designated company representative with appropriate training, experience and seniority.

8.1.1 PHOTOGRAPHS

The photographs shall be presented in chronological order within the CCTV survey report. The photographs shall be shown as "thumbnails" or small images alongside the sewer plan in the CCTV report. On the following pages the photographs shall be presented in a larger format of four per A4 page.

The photographs are to be provided in jpeg format also. The folder structure and naming convention of the photographs shall be such that it is straight forward for one to identify the location of a particular jpeg from both the CCTV Survey Report; the video file and the CCTV Survey Object in InfoNet.

8.1.2 DRAWINGS

This sub-section applies to 'planned' projects only.

A1 size drawings (two sets in paper hardcopy plus one set in digital PDF) displaying manhole numbers which correspond with the coding sheets and the CCTV recordings shall be returned to the Client with each Final Report. The drawings shall be clean, clear and concise to an appropriate scale to allow for ease of interpretation of the drawing. The drawings shall be clearly annotated to show any significant changes from issued sewer records noted in the course of the Survey. Such changes to sewer records shall be brought to the attention of the Client by the Contractor during the Survey.

8.2 INTERIM REPORT AND DELIVERABLES

This sub-section applies to 'planned' projects only.

Interim Reports and Deliverables shall be delivered to the Consultant for every 5km of conduit surveyed or 100no. of Surveys, whichever is reached first, in accordance with this Standard. The purpose of the Interim Report and Deliverables is to enable the Consultant and Client to monitor the progress and quality of the project and provide feedback to the Contractor on same. In addition validated Interim Reports and Deliverables, verified by the Consultant to be in accordance with the quality requirements of this Standard, may be used as a mechanism to facilitate interim payments to the Contractor in accordance with conditions of contract for each project.

The Interim Report and Deliverables shall include the following items (in digital format only):

a) Sewer condition classification file in accordance with Section 5.2 of this Standard;

b) Survey footage files in accordance with this Standard;

c) InfoNet snapshot file of the asset network and surveys undertaken in the Project;

d) Validation rules report (excel spreadsheet) including explanations for 'Warnings'.

Each submission of an Interim Report and Deliverable shall include the previous Interim Report and Deliverable so that a 'build-up' of the project's progress can be assessed.

For projects where the scope of the surveys is less than 5km no interim reporting shall be required; instead a draft version of the Final Report and Deliverables (in accordance with section 8.1) shall be submitted for Consultant review and comments prior to issue of the Final Report and Deliverables.

8.3 FINAL DATABASE NAMING

This sub-section applies to 'planned' projects only.

To ensure the ease of identifying asset databases in the future, the following database naming convention shall be followed:

- [Agglomeration Number]-[Agglomeration Name]-[Last Survey Month in MMYYYY format]-[InfoNet Version]

The network(s) within the database and supporting data must also follow an easily identifiable structure to ensure that the appropriate data can be identified by future users. For the files associated with a new or amended asset database which have passed the data quality and validation rules the naming shall be:

- [Agglomeration Number]-[Agglomeration Name]-[File Type e.g. Network]-FINAL VALIDATED SURVEY NETWORK]

8.4 PRESENTATION

The Contractor may be required to deliver a presentation to the Client summarising the key results of the CCTV Surveys.

Document Control

Revision History

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Revision History

Revision	Date	Status	Originator/ Revision by	Checked	Approved
1.0	10/08/2016	WTEF Approved	E. Ryan	F. Finnerty	L. Spain
2.0		N/A Minor Change	E. Ryan	F. Finnerty	L. Spain
3.0	26/2/2018	Number change	F. Finnerty	N/A	WTEF

Changes (Linked to Revisions)

Summary of items changed /updated in this document.

Revision	Reason
1.0	First Issue of this Standard
2.0	Amendment to Section 8.1.1 in terms of the structure and naming of CCTV Survey stills/photographs.
3.0	Àmendment to number of document from IW-MOD-TEC-5030-002 to IW-TEC-800-10