

**CHRISTCHURCH CITY COUNCIL
SPECIFICATION**

**CCTV FOR CHRISTCHURCH CITY COUNCIL
EARTHQUAKE RECOVERY**

Version: 9.0

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Revision History

Version	Date	Name	Brief Description of Change
1.0	3 June 2011	D. Murugesh	Draft
2.0	13 Mar 2012	B. Pritchard	Final Draft
3.0	1 August 2012	L. Dowdle	Updates to Section 3.8, 3.1, 3.11, & 3.14
4.0	24 October 2012	M. Tate	Update to 3.14
5.0	14 December 2012	M. Tate	Revision to Screen Header and As Built section and update to Header Information Requirement
6.0	16 April 2013	D. Murugesh	Revision of as-built section and several other clauses. Addition of as-built requirements for lined pipes.
7.0	3 September 2013	D. Murugesh	Revision of as-built section and several other clauses.
8.0	15 April 2014	D. Murugesh	Incorporating ' <i>Guidelines for As-Built Inspection of Lined/Rehabilitated Pipes</i> ', guidance on asset naming and other minor updates.
9.0	13 June 2016	D. Murugesh	Update to section 3.20.3, 3.23.3, 3.23.4 (refer to markup)

1. Introduction

This document covers:

1. Technical Specification for carrying out CCTV inspections (for condition assessment and as-built CCTV surveys)
2. Technical requirements for asset assessment
3. Deliverables to CCC

1.1. Definitions

Asset Owner – Christchurch City Council (“**CCC**”)

Contractor – party responsible for the CCTV operation (including all traffic management, site inspections, pipe cleaning, flow control, notification and CCTV documentation). For example: For asset assessment CCTV, City Care Ltd is the Contractor. For As-Built CCTV, the SCIRT Delivery Team is the Contractor. For operations and maintenance inspections, the city’s area catchment managers are the Contractor.

CCTV Sub Contractor – specialist CCTV company undertaking the CCTV survey on behalf of the Contractor.

CCTV Operator – the qualified and competent individual that operates the CCTV camera (working for the CCTV Sub Contractor)

SCIRT IST (Stronger Christchurch Infrastructure Integrated Services Team) – The team responsible for managing damage assessment of pipe network and reporting back to Christchurch City Council on the status of the network rebuild.

Designer – SCIRT Designer or Asset Assessment team member that has made the CCTV request (Requested by person on the CCTV request Pro forma).

Training Provider – CCTV operator and reviewer training provider agreed with Christchurch City Council.

2. CCC Technical Specifications

1. All gravity pipelines shall pass a CCTV inspection, carried out after completion of all construction works. All CCTV inspections are to be carried out in accordance with all clauses in this document (CCTV for CCC Earthquake Recovery) and the New Zealand Pipe Inspection Manual 3rd Edition (NZPIM).

The order of precedence shall be:

1. CCC Specification: CCTV for CCC Earthquake Recovery
2. NZPIM General Specification
3. Other provisions in NZPIM

This document is the Particular Specification as per section 5 of the NZPIM.

2. Specific requirements for the CCTV inspection of lined/rehabilitated pipe can be found in the appended document '*Guidelines for As-Built Inspections of Lined/Rehabilitated Pipe*', prepared by ProjectMax Ltd, 8/11/2013 and 'Specification for Pipe Lining' SCIRT Document N^o 10001-DE-GE-SP-004
3. Specific requirements for the CCTV inspection of private WW laterals in vacuum and pressure sewer areas are provided in the document '*Private Gravity Lateral Sewers to be Connected to Vacuum and Pressure Wastewater Systems – Survey Requirements*', SCIRT Document N^o 10001-CN-WW-SP-0001'.
4. Specific requirements for the CCTV inspection of public WW laterals will be provided in the document '*Public Gravity Lateral Condition Survey Specification*'.

3. Particular Specification

3.1. Purpose

The purpose of the CCTV work is to identify defects and classify the general structural condition of the pipelines inspected and / or to provide an as-built condition record for repaired, renewed or relined pipes. Note that there are slightly different requirements for asset assessment (damage) inspection and as-built inspections.

3.2. Scope

The scope involves:

- CCTV inspection of pipelines including verification of pipe diameter and pipe material on site.
- Condition coding and recording of inspection data.
- Locating and reporting major defects requiring immediate repair.
- Locating and marking the position of buried manholes.
- Reporting the position of manholes or pipeline networks that are incorrectly positioned on CCC plans.

The inspections to be carried out are located in:

- Public roads with different levels of traffic management (refer to CCC Road Level Classification)
- Private land
- Council reserves
- Both flat and hill areas

Issues that the CCTV Subcontractor and Contractor needs to be aware of and may encounter during survey include:

- Pump Stations: when pipelines downstream from pump stations are to be inspected, the Contractor shall contact the Shift Controller on duty at the City Water & Waste Control Room (ph: 941 5727) well in advance to make arrangements for the control of pump stations during the inspections
- Heavy Flows
- Pipes that contain debris
- Traffic
- Difficult Access
- Hot water discharges
- Aggressive industrial discharges
- Wastewater blowback or surcharge to properties

3.3. Health & Safety Hazards

The following health and safety hazards may be encountered during survey, this list is not exhaustive. Contractors should be aware of their obligations under the Health and Safety in Employment Act 1992.

- Access and egress: manholes are considered confined spaces
- Hazardous biological substances
- Environmental conditions (hot, cold)
- Contact and contamination with sewage or other harmful substances
- Dogs
- Traffic (vehicular and pedestrian)
- Electrical and power tools
- Exposure to sunshine, stings, bites and infectious environment
- Eye strain from CCTV viewing
- Flooding and overflow
- Gas, fumes and foul air
- Handling fuels and chemicals
- High pressure water cleaning
- Manual handling
- Exposure to hazardous noise levels
- Use of plant and machinery
- Slip, trip and fall hazards
- Handling of waste
- Working at height or above deep holes (e.g. manholes)
- Working at pipe inlets 450 mm diameter and larger
- Working downstream of a sewer discharge
- Working in confined spaces
- Working in low light conditions
- Negative pressures (suction) at suction hose inlets
- Dust, for example; within the CBD cordon; around liquefaction ejecta and demolition works

3.4. Cleaning and Root Removal

Prior to the CCTV inspections being undertaken pipes are to be:

- Initially light cleaned as per NZPIM Standard Specification. If after light cleaning, deposits or roots still remain in the pipe that prevent CCTV, the inspection is to be attempted from the other manhole. If the full length of the pipeline cannot be inspected then heavy cleaning is required to remove all foreign material and roots.
- For heavy cleaning, as defined in the NZPIM, a site risk management protocol or standard operating procedure is to be documented, and provided to the Contractor.

A site specific risk assessment and method statement is required for any heavy cleaning where the following applies:

- Adjacent to structures that lie within a 45 degree envelope, measured from the pipe invert to the ground surface
- Through private property

- On 'level 2' or 'city' category roads with evidence of tomo formation
- Within brick barrels.

Risk management is to include, but not be limited to:

- Risk of damage to trench backfill or fragile pipes
- Consideration of pipe material
- Consideration of pipe depth
- Risk due to depressions or asphalt patches indicating damaged pipes along the pipe alignment
- The measures required to avoid 'Toilet Blowbacks' during cleaning

Certain properties are at higher risk of 'toilet blow-back' and are listed on the 'Toilet Blowback List'. The Contractor shall update (or send an update request to the owner of the 'Toilet Blowback List') and check the list prior to cleaning any sewer line. Where a house is listed on the 'Toilet Blowback List' cleaning shall not proceed until the resident has been notified of the proposed cleaning activity. The affected resident shall be advised to take precautionary measures to protect the household from surcharge, including sealing toilet seats down.

The Contractor shall take care during high pressure cleaning to minimise the build-up of debris and risk of causing a full or partial blockage. This includes minimising the pressure being used and conducting regular retrievals of the jetting nozzle.

If a 'blow-back' or surcharge occurs, the Contractor shall clean-up and update the 'Toilet Blowback List'. Clean-up is to include disinfecting the property using professional cleaners to the satisfaction of the owner or residents. This clean-up is to occur 'as soon as practical' and no later than 6 hours after notification of the event. Any blowbacks are to be advised to the Contractor, SCIRT IST and the CCC operations team (03 941 8999) within 48 hours of the blowback occurring.

If water from fire hydrants is required for cleaning operations, the Contractor shall only use CCC approved standpipes with built-in backflow prevention devices.

3.5. Maximum Depth of Water Flow

The maximum depth of water flow permitted during Asset Assessment inspection does not apply to the as-built CCTV – refer 3.20.2 for as-built requirements:

- The depth of water is not to exceed 25% of the pipe diameter. Where the contractor is unable to manage the flow to reduce the water below 25%, the Designer is to be notified. The Designer may approve alternative inspection methods such as 'boat surveys' where the flow conditions are difficult to manage.

- Following of the jetter head to obtain CCTV is NOT permissible unless technically valid comments for the reason are made in the comments section.
- Where there are pump stations upstream of the inspections, the Contractor shall contact City Water & Waste Pumping Control Room (03 941 5727) to make arrangements for the control of pump stations during the inspections.

3.6. Slope Correction

Slope corrections are not required.

3.7. Still Images

The still images required for each condition code differ between general and as-built CCTV inspections. The required still images for each type of inspection are set out in this section.

3.7.1. General Inspection Still Images

Still images of the defects listed in Table 1 are to be captured and linked to the relevant electronic log sheet. No more than 2 photos are to be taken per 1.0m of pipe length.

Table 1 – Condition Codes identified during general inspections requiring still images

Condition Code	Still Image Required?		
	Severity Small	Severity Medium	Severity Large
CM	N	Y	Y
CL	N	Y	Y
CC	N	N	Y
DF	n/a	Y	Y
DP	N	N	N
IP	N	Y	Y
JD	N	N	Y
JF	N	N	Y
JO	N	N	Y
LF	N	N	Y
LP	N	N	Y
LX	N	N	Y
OP	N ¹	N ¹	Y
OT	N	N	N ²
PB	N	Y	Y
PF	N	Y	Y
PH	N	N	Y
PL	N	Y	Y
PX	n/a	n/a	Y

Condition Code	Still Image Required?		
	Severity Small	Severity Medium	Severity Large
SD	N	N	Y
RI	N	N	Y
TM	n/a	n/a	Y

¹ Still images are required for any instance where another service authority's asset has compromised the pipe wall (ducts drilled through pipe wall).

² Still images are required where a temporary obstruction is unable to be removed by high pressure cleaning.

3.7.2. As Built Still Images

All condition codes require still images unless otherwise excluded in Section 3.21 of this specification.

3.8. Additional Codes

- Lateral Problem, Large severity (LX,L – IP,L). Where large infiltration is observed from a lateral connection but no defect is visible the code LX,L shall be used with IP,L recorded in the comments column.
- For wastewater pipes, laterals with grease, silt or other forms of obstruction (excluding encrustation) shall be coded as Lateral OK (LO) with coding and comments relating to the service fault. This does not apply to stormwater pipes.

3.9. Major Defects Requiring Immediate Attention

Unless agreed otherwise and where there is no immediate risk to people or property, the Contractor must immediately notify CCC Operations Unit or a delegated authority <Wastewater – 03 941 8327; Stormwater – 03 941 8308> if any of the following Condition Codes are identified:

- Pipe broken, large severity (PB, L)
- Pipe Collapsed (PX, L).
- Deformed Pipe, large severity (DF, L or PF, L).
- Tomo (TM, L).
- Any instance where another service authority's asset has compromised the pipe wall (ducts drilled through pipe wall etc)
- Obstruction Permanent, large (OP, L) and Obstruction Temporary, Large severity (OT, L) where the temporary obstruction is unable to be removed by high pressure cleaning.
- Pipe holed large (PH, L)

3.10. Quality Assurance

3.10.1. CCTV Sub Contractor Quality Assurance

The CCTV Sub Contractor is to audit the quality of the CCTV footage and log sheet data entry prior to submitting to the Contractor. Audit methods and

frequency should be agreed with the Contractor. Documents describing the audit method shall be submitted to the Contractor. Only CCTV operators deemed 'competent' by a CCC approved training provider are to be used.

3.10.2. Contractor Quality Assurance

The Contractor will nominate an experienced and approved auditor to undertake on-going auditing of the works at the following frequency, utilising the audit procedure outlined on pages 2-19 to 2-20 of NZPIM.

- For a CCTV request, either 20% of assets or one asset (whichever is the greater) is to be audited by a 'competent' person, deemed independent by CCC of the CCTV Sub Contractor who undertook the inspection.
- A register of 'competent' operators shall be maintained by the Contractor and Training Provider.
- Untrained operators are not to be used.

3.10.3. SCIRT IST Quality Assurance

The SCIRT IST will undertake on-going auditing of 5% of all CCTV inspections. If the accuracy level for a work package sample is less than 90%, then another 5% will be audited. If the subsequent audit shows an accuracy level of less than 90% for the work package sample then the Contractor will be required to repeat the CCTV work package. The extent of the re-work will depend on the nature of errors identified in the audit.

For asset assessment purposes if a work package fails the larger 10% audit and the failure is not due to over-scoring of defects, pipes with a mean structural score of greater or equal to six will not be re-coded by the Contractor, as this score indicates a pipe with a high degree of damage requiring renewal. If the audit does highlight over-scoring of defects, all pipes in the work package will need to be re-coded by the Contractor.

For as built purposes if a work package fails the larger audit the entire package will need to be re-coded by the Contractor.

Audit results are to be provided on request to the Christchurch City Council.

3.11. Deliverables (CCTV Sub Contractor)

The CCTV Sub Contractor is required to provide the following deliverables to the Contractor:

- Computer generated log sheets.
- Video footage:

The CCTV footage shall be initially recorded utilizing a good quality digital video recorder and provided electronically or on a DVD. The video capture system must be agreed by CCC prior to submitting any footage. No video compression shall be applied by the CCTV Sub Contractor.

Where a DVD is to be supplied it is to be labelled showing the following fields as a minimum:

- Pipe asset number / WwPipeId (number only)
- Date of CCTV inspection (ddmmyy)
- CCTV Sub Contractor and Contractor it is being done for.
- Asset type – sewer main, sewer lateral, stormwater main
- A unique video record number (survey ID)
- All DVD's / video files are to be labelled with a unique number. The unique number is to be also recorded on the electronic survey form in the field 'Video Rec No' or similar.
- The Contractor is to ensure that all CCTV Sub Contractors use the same methodology when naming video files and ensure that there are no double-ups

This information shall be printed onto the actual DVD.

In addition the following fields shall be recorded on the DVD or DVD cover:

- Street address including property street number
- Direction of CCTV inspection (downstream DS or upstream US)
- Upstream and downstream manhole numbers
- The work package or contract number

3.12. Deliverables (Contractor)

The Contractor is to provide to the SCIRT IST Electronic data of the inspection, in a format compatible with SCIRT InfoNet (by either export or access to an online repository) on a twice weekly basis unless specified otherwise. Refer to Section 3.14 for required header details. This is to include:

- CCTV Log
- Still images in the following format:
 - Electronic snapshots (linked to the relevant inspection).
- The Contractor shall, on a weekly basis, update and provide a current catalogue in database format. The catalogue is to record, as a minimum the following fields, for each asset surveyed:
 - CCTV Sub Contractor
 - The unique DVD 'Video Record Number' (Survey ID / Catalogue Number)
 - Asset Type (wastewater / stormwater)
 - Asset ID
 - Upstream node ID
 - Downstream node ID
 - Upstream node street address (include property street number)
 - Survey date
 - CCTV Operator
 - Client contract or request number
 - Comments, including; if the asset data does not match GIS or has been changed to reflect GIS; if the asset is a sewer lateral; if the

- survey is a 'reverse' survey; where the catalogue differs from the raw log sheet or video 'header' information to conform with GIS etc.
- Video file present
- Log sheet present
- Marked-Up drawings of manholes and pipelines incorrectly shown on the CCC's plans as per section 3.17 herein:
 - When a manhole is found to be buried or damaged, CCC operations team is to be contacted on 941 8999.
 - Where a manhole or pipeline is found to be in a noticeably different location than what is shown on plans (e.g. in another lane, on the footpath not the berm, opposite a different address), the process in section 3.17 is to be followed.
 - Hard copies (submitted with DVD) or
 - Electronic (*.pdf attached to each relevant inspection)
- The Contractor shall provide CCTV inspection footage:
 - In a 'one video file for one pipe asset' format agreed with CCC and SCIRT IST. Where inspections are carried out from both ends of a pipeline section and each part terminates at a common feature or defect, the resulting two video files will require editing to create one video file for the pipe asset.
 - Compressed to meet at a minimum DVD video quality (MPEG-2 Part 2 video, 720 x 576 pixels 9.8Mbit/sec).
 - There shall be no audio embedded with the Video footage.
 - Stored on a secure hard drive. The hard drive shall be 'backed up' off site and tested on a regular basis.
 - Compatible with InfoNet
 - With "live access" to quality controlled video footage for damage assessment inspections.
 - As built footage and associated data shall be made available to SCIRT and CCC to fulfil auditing and other requirements, until 1 January 2018 by one of the following means:
 1. Live remote access; or
 2. A hard drive delivered to SCIRT (1 Magdala Place) or CCC (53 Hereford Street) within 48hrs of request. There will be no limit on the number of requests.
 - Refer to Section 3.24 for specific requirements around the naming of pipe and node assets associated with as-built CCTV.
 - Refer to section 3.25 for specific requirements around the naming of footage associated with as-built CCTV
 - Video footage must be provided using the following file naming convention:

AAAAAA_BBCCCCC_DDDDD_EEEE_FF_GGGG

Code	Description	No. of Characters	Example
AAAAAA	Request #	Up to 10	RN300
BB	Network Type	2	SW WW

CCCCCC	Principle asset # (If a temporary asset is used it must have a unique ID and a mark-up map must be included)	Up to 20	12548 765489 RN898201401291424
DDDDDD	Date of Inspection	6	150413 (ddmmyy)
EEEE	Cleaning Stage	4	PRCL (precleaning) POCL (postcleaning)
FF	Abandoned inspection direction (only applies if inspection is abandoned from both directions.)	2	US DS
GGGGG	Survey using method other than standard CCTV Tractor unit (this method must be approved by the principal before inspection).	UP to 7	Boat Polecam Pushcam

A few examples include:

- § RN456_SW78564_210713_POCL (inspection for a stormwater asset using standard NZPIM methodology)
- § RN456_SW78564_210713_POCL_US (inspection from the us node of a stormwater asset using standard NZPIM methodology that was abandoned.
- § RN456_SW78564_210713_POCL_PUSHCAM (inspection of a stormwater asset that wasn't cleaned and was inspected using a pushcam.

3.13. SCIRT IST

The SCIRT IST is required to maintain and make available the following deliverables to the CCC from a single source for all SCIRT CCTV inspections:

- Electronic CCTV inspection data in an InfoNet format including:
 - log sheets (providing all information required under the NZPIM and this specification)
 - assessments (based on the agreed standards set out in the Infrastructure Recovery Technical Standards and Guidelines)
 - still images linked to the relevant inspection and associated Condition Code
- CCTV summary spreadsheet including the information as per Section 3.12.
- Access to quality controlled CCTV inspection footage in a format as set out in Section 3.12
- Marked-up drawings of manholes and pipelines incorrectly shown on the CCC's plans as per Section 3.17 herein.

The SCIRT IST is responsible for managing the collation of CCTV documentation of all SCIRT inspections in a standard format as agreed with CCC.

3.14. Header Information Required

In addition to the mandatory fields specified in the General Specification of the NZPIM the following log sheet header information is to be included (descriptions of these items are included in Section 2 of the NZPIM):

- Name of CCTV contractor.
- Work Package number.
- Upstream & Downstream Manhole Street No.
- Upstream & Downstream Manhole Street Name.
- Video Recorder Run-time Finish.
- DVD/Video reference number.
- Weather.
- Comments.
- Depth to the invert of the pipe measured down from manhole lid where there is more than one pipe between the same two nodes ('under / over' configurations such as collector sewers and main sewer lines).

3.15. Screen Header Information Required

In addition to the mandatory fields specified in the General Specification the following screen header information shall be displayed at the start of the recording.

- Depth to the invert of the pipe measured down from manhole lid level where there is more than one pipe between the same two nodes ('under / over' configurations such as collector sewers and main sewer lines).

3.16. Survey/Review of Severely Damaged Assets

If greater or equal to 10 large defects are identified in a pipe asset during CCTV survey or when reviewing footage for a review only request, then only large defects need to be subsequently coded (excluding PB, IP, PH and RI which should always be coded). CCTV survey should continue along the entire length of the asset irrespective of the number of defects. Where coding for M and S defects is not completed for pipe assets after 10 large defects have been found, the following comment is to be included in the log sheet:

- >=10 L defects, no S + M coding

Additional Clauses to Particular Specification

3.17. Manholes and Pipe Layout

The location or general layout of the drainage network may differ from that shown in Councils Geographic Information System (GIS). The Contractor is required to provide a sketch showing where manhole locations and pipe network layout differ from GIS in PDF format. A unique asset ID is to be temporarily assigned to the pipe and/or manhole and comments specifying the difference noted in the log sheet 'comments' section.

Updated asset information is to be sketched onto a map and supplied in hardcopy with any DVD files and/or electronic log sheet as part of a completed survey. The Contractor is to produce a plan showing the features that are missing or classified incorrectly and advise the CCC GIS team as follows:

- Show the position of the missing details according to Section 12 of the CCC Infrastructure Design Standard (IDS).
- Record material and diameter on the marked up plan.
- Email informationservices@ccc.govt.nz at CCC with the details and cc abigail.walsh@scirt.co.nz.

When buried manholes are located the Contractor is required to mark the position of the manhole on the ground surface and inform CCC. The manhole will be raised by CCC operations or a delegated authority <Wastewater – 03 941 8327; Stormwater – 03 941 8308>.

3.18. Existing CCTV Records

During the earthquake recovery operation CCTV was used to assess the service performance of the pipe network. A proportion of this CCTV video footage does not comply with the NZ Pipe Inspection Manual. This footage is a record of pipe condition at a point in time. A log sheet is required detailing what information is able to be reasonably documented from this footage.

Where requested by the Designer, the Contractor shall provide a 'reduced quality video footage' log sheet. The 'reduced quality video footage' reasons and designation shall be clearly annotated on the log sheet header comments and status.

Additional comments are required to describe why the historical video footage is considered to be low quality. For example where the pipe condition is partially obscured for particular sections or the entire length, comments stating 'defects noted may not be a complete record' should be noted. Where the camera travels too fast and/or doesn't pan at defects, comments stating 'defect type or severity is an approximation due to video quality' should be noted. If this applies to the entire pipe length, the description is to be recorded in the comments section in the log sheet header. Where individual defects or

particular sections of pipe are obscured, the description shall be entered in the remarks section for the individual defect. Any visible defect shall be documented, so far as is practical, for non-NZPIM compliant video footage, where requested by the Designer.

Where more than 50% of the pipe, by length, is obscured the survey shall be recorded as an incomplete inspection (UI).

3.19. Data Management - CCTV Electronic Data

3.19.1. Data Management Plan (DMP)

The Data Management Plan (DMP) is to be produced by the Contractor to document the CCTV storage system and data management/transfer method and processes. It is to be agreed and documented collaboratively with the CCC and SCIRT IST. This applies to both pipe condition assessment and as-built CCTV surveys.

The DMP is to specify:

- Data storage obligations for CCTV Sub Contractors and the Contractor (what video, log sheets, electronic data, project plans to be kept, how and for what duration)
- The method and timeframe for communicating each form of stored data between CCC, the SCIRT IST and Contractor (video, log sheets, other electronic information)
- The process to verify that the summary catalogue is correct and matches GIS
- The process to verify that the stored data is a complete and accurate record
- The data architecture (folder structure and location etc)
- Organisational, team and individual responsibilities
- A disaster recovery and system monitoring method statement
- What software is to be used and how it interfaces with existing software
- What other deliverables are required
- The level of resilience of any data storage array
- Communication plan including data transfer frequency and delivery timeframe (between SCIRT IST and CCC for conditional assessment and between the Contractor and SCIRT IST for as built assessment)
- The induction and support process for new technicians

3.19.2. Disaster recovery

The data shall be 'backed up' incrementally daily, with weekly full backups as a minimum. The backup/media is to be stored offsite. Ownership and accountability for the backups and their location is to be specified in the Data Management Plan. The process for system recovery is to be documented and with an individual allocated responsibility. The position description and a 'Curriculum Vitae' of the nominated person is to be provided to the SCIRT IST and Christchurch City Council for approval. A test restoration of data and

recovery process is to be carried out upon commissioning and monthly thereafter, prior to a recovery event occurring. Backups shall be structured to allow for recovery of accidentally deleted data. The recovery process for accidental deletion shall be tested on a biannual basis.

3.19.3. Location of Storage

The storage array is to be located in an environmentally controlled cabinet, free of dust. Regular cleaning shall be completed and an appropriate temperature monitored and maintained. The storage location, cleaning schedule and temperature monitoring shall be agreed and documented in the Data Management Plan.

3.19.4. Failure notification and system monitoring

The method for failure notification and system monitoring is to be detailed in the Data Management Plan.

System wide pro-active monitoring and predictive failure analysis shall be completed to minimise failure due to component wear. The hard drive's reporting capability shall be supported to enable pre-failure error statistic logging. A monitoring regime of these statistics shall be documented and implemented. The replacement criterion is to be defined for components prior to failure.

In the event of a hard drive in the array failing, the ability to rebuild the array in a timely manner requires one or more of the following:

- A spare drive being available onsite.
- A 'hot spare' being provisioned, such that in the event of a hard drive failure, the system will automatically utilize the 'hot spare' and rebuild the array.
- A well-documented and tested supply chain involvement

3.20. As Built Survey Requirements for Newly Constructed Pipes

In addition to the inspection requirement and coding set out in the *New Zealand Pipe Inspection manual* the methodology outlined in this section must be applied when carrying out an As Built CCTV inspection (i.e. CCTV of newly constructed pipeline).

Refer to Appendix A for As Built CCTV process.

Note that pipelines that have undergone repairs to less than 10% of their length do not require an as-built CCTV. Refer Section 3.20.3.

Prior to the as-built CCTV inspection all works within the manholes must be complete and manhole benching reinstated (where a new manhole was installed or benching in an existing manhole was removed / partially removed to facilitate the works).

3.20.1. New Construction Pipe Cleaning and Charging.

All new pipelines should be cleaned with a high pressure cleaner no more than 24 hrs prior to inspection. Pipes must be free of all construction debris (e.g. offcuts, dirt gravel) before the survey is undertaken. Small quantities of debris infiltrating from laterals is not considered construction debris, provided coding to the NZPIM can take place.

Following cleaning, a charge of water must be sent through the pipe prior to CCTV inspection. This will allow the operator to identify dips based on standing water which may otherwise be missing following jetting.

3.20.2. New Construction Flow Control

Base flows must be plugged or diverted so that there is no flow coming from the upstream manhole. Flows from live laterals into the pipe being surveyed should result in a flow in the pipe no more than 10mm deep. If flow cannot be controlled due to infiltration from laterals, CCTV can be carried out provided:

- There is no risk to personnel, property or equipment.
- The CCTV as built inspection is marked as being out of specification by the operator in the comments section and a general comment is included as soon as base flow exceeds 10mm in depth.
- Upstream flow is controlled such that there is no base flow coming from the upstream manhole.
- The flow does not exceed half pipe flow minus 30mm and the camera lens is at all times clear of water flow (eg 45mm for a 150mm diameter pipe)
- The entire pipe can be seen and the flow is clear.
- It is not permissible under any circumstance to follow the jetter for as-built CCTV surveys.

3.20.3. New Construction Inspection

Where pipes are being repaired for less than 10% of the manhole to manhole pipe length, the pre-repair CCTV record ~~may be~~ **must be** adjusted according to the NZPIM to reflect the repair work undertaken to the pipe (as an alternative to undertaking an as-built CCTV inspection). This needs to be completed by the City Care CCTV team as they hold all pre-repair CCTV records. The Contractor must email CCTVAsBuilts@citycare.co.nz a one-page repair report. The pre-repair CCTV record must be updated by the following process:

- Change the condition code where the repair has been made to a general comment (GC);
- Include the original condition code in the remark for the GC including a comment that it has been repaired;
- Attach the one-page repair summary report (**photographic evidence of the repair must be included in the report**) to the GC in either a PNG or JPEG format, and delete the original photo (if one existed)
- Re-export the data to InfoNet (in accordance with Section 3.12)
Change the 'task status' to 'AsBuilt' to show that it is an as-built record.

For **as-built CCTV inspections surveys** where more than 10% of the pipe has been repaired, the CCTV shall be undertaken **following as-built requirements (with the operator panning every joint) for the repaired section. The CCTV inspection for the length of the pipe outside of the repaired section can be undertaken** in accordance with a standard asset assessment survey, ~~with the operator panning every joint.~~

In order to identify the defects within the dig up/patch repair, The reviewer must record in the LC/MC "remarks" field of the code, a comment specifying "SCIRT repair starts" where the repair starts and "SCIRT repair finishes" at the end of the repair.

The CCTV Operator must note any non-manufactured joints in the pipe line (e.g. non-standard joints such as solvent welded). Any non-manufactured joints are to be coded using GC and include the comments "non-manufactured joint".

Refer to Section 3.24 for pipe and node asset naming for as-built surveys.

A small dipped pipe (**DP S**) as defined for As Built survey is a dip in a pipe that is greater than 20mm of depth and less than 25% of the pipe diameter. Dips in pipes that are 20mm or less are not to be coded as a defect. The dip depth can be estimated using a variety of methods and different aids such as but not limited to: laser measurement, and transparent screen overlays on a photographic reference. If there is a disagreement around the depth of a dip, the comparison/measurement should be carried out using the cord/sagitta geometrical calculation (Puddle depth = radius - $\sqrt{(\text{radius}^2 - (\text{cord length}/2)^2)}$).

Table 2 includes dip percentages above which a dipped pipe should be coded. Photographs 1, 2 and 3 also provide a visual reference of pipes with approximately 20mm dips. The base flow level should be considered when determining the depth of a dip. That is, if there is a base flow of less than or equal to 10mm then this can be added to the 20mm dip allowance and the dip would not be coded as a defect.

Table 2 20mm Dip Depth Correlation

Internal Pipe Diameter (mm)	Diameter % indicating a small dip	Water depth greater than
150	13 – 25%	Photo 1
225	9 – 25%	Photo 2
300	7 – 25%	Photo 3
400	5 – 25%	No Photo

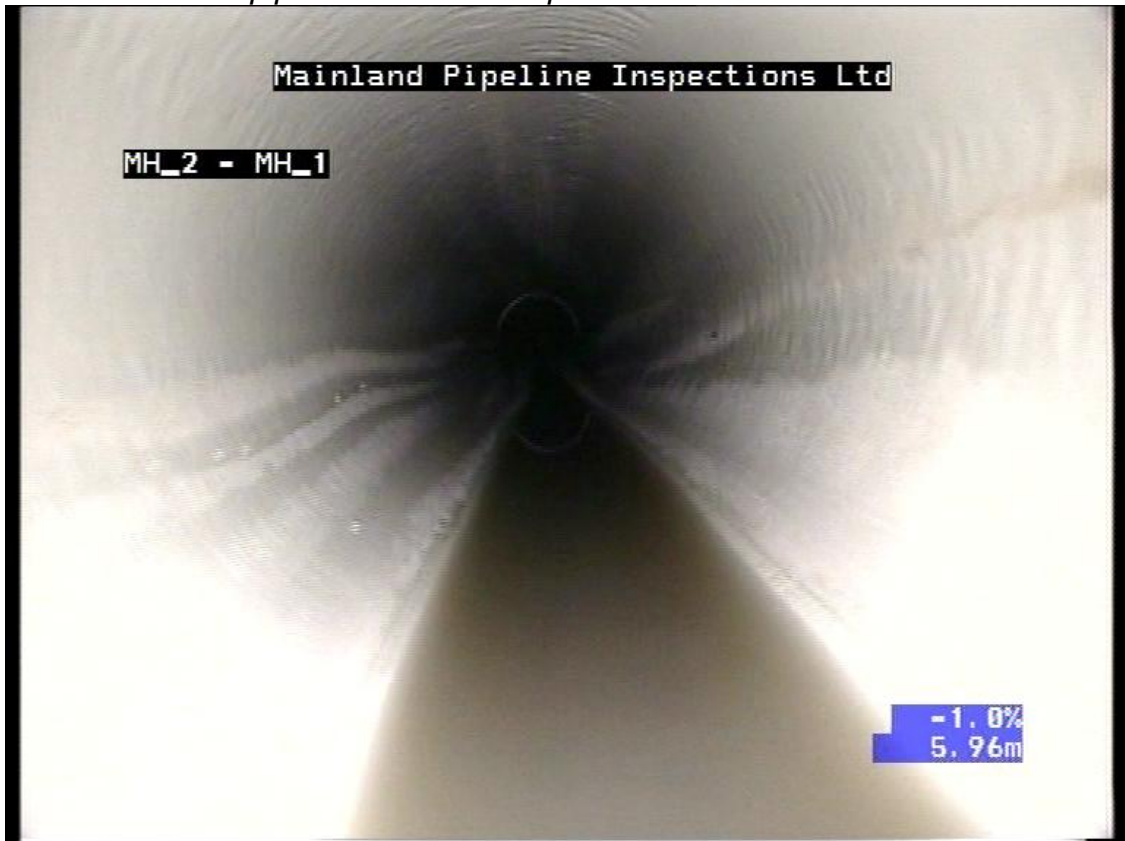
Photograph 1: 150mm pipe with a 20mm Dip



Photo 2: 225 mm pipe with a 20mm Dip



Photo 3: 300mm pipe with a 20 mm Dip



A Debris Greasy Small (DG S) in as-built surveys is defined as follows:

Debris Greasy Small refers to the presence of grease, fat, scale and any other materials adhered to the pipe wall (with the exception of encrustation deposits) that covers more than 25% of the circumference of the pipe and where the clear diameter is reduced by less than 10%.

Examples of how the above criterion is applied are shown on Photo 4 and Photo 5.

Photo 4: DG covers 10 to 15% of the circumference so not a DG,S

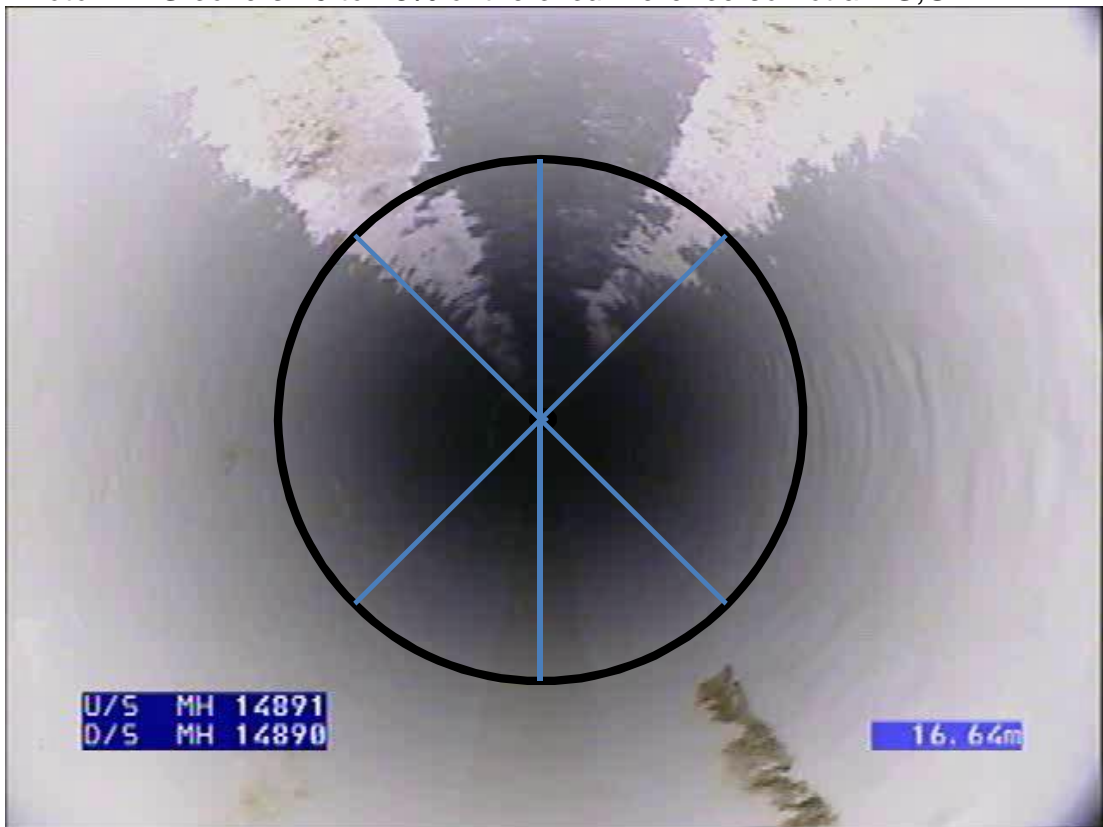


Photo 5: DG covers just over 25% of the circumference so is a DG,S



Debris Greasy Medium and Large definitions will remain unchanged from the current definition in the New Zealand Pipe Inspection Manual.

If the pipe passes the ovality test a Deformed Plastic Pipe Small (**PF S**) can be removed from the logsheet without involving CCC by the following process:

- Delivery Team to provide ovality test to the Data Management Provider..
- Change the PF S code to a general comment GC;
- Include the original condition code in the remarks;
- Attach the one-page ovality test in either PNG or JPEG format

Note that if the PF S is due to external pressure the defect will remain and a decision by CCC has to be made.

3.21. As Built Defect Code Interpretation for Newly Constructed Pipes

This section relates to condition code assessment undertaken by SCIRT. The condition codes and associated severity set out in Table 3 are not considered by CCC to be pipe defects that require further action.

Table 3 Acceptable Condition Codes

PVC and PE Pipes		Concrete Pipes	
Condition Code	Severity	Condition Code	Severity
SD	S	SD	S
JD	S	JD	S
JO	S	JO	S
JO	M	CM	S
DE	S	CL	S
OT	S	CC	S
*Only applies to concrete laterals connected to a concrete main. No LX accepted on PVC/PE laterals connected to a concrete main.		PH	S
		JD	S
		JF	S
		LP	S
		LX	S*
		DE	S
		OT	S

All other condition codes recorded in as-built surveys require a still image.

3.22. As-Built Defect Repair or Acceptance

If a defect has been confirmed in an as-built inspection, the Delivery Team must repair it or seek acceptance to leave the defect in place. If a repair is made to less than 10% of the pipe length or the defect is accepted by CCC, the Contractor is responsible for amending and reporting the updated data as outlined in the following sections.

3.22.1. Repair(s) less than 10% of pipe length

Where pipes are being repaired for less than 10% of the manhole to manhole pipe length to repair a defect found in an as-built inspection, the Contractor is not required to re-survey the pipe but must instruct their as-built CCTV provider to update the as-built CCTV record as follows:

- Change the condition code where the repair has been made to a general comment (GC);
- Include the original condition code in the remark field for the GC and add a comment that it has been repaired;
- Delete the original photo (if one existed) and replacing it with a one page repair summary to the GC in either a PNG or JPEG format, and
- Re-export the data to InfoNet (in accordance with Section 3.12) with the same unique IDs.

3.22.2. Defect accepted by CCC

If the defect is reviewed and accepted to remain by CCC, the Contractor must instruct their as-built CCTV provider to update the as-built CCTV record as follows:

- Leave the condition code as is;

- Add the following phrase to the defect remark: "Defect Accepted By CCC";
- Insert a new GC code at the same distance with the remark "Evidence of defect acceptance". Attach a one page approval (copy of e-mail from CCC is sufficient) to the GC condition code in either a PNG or JPEG format, and
- Re-export the data to InfoNet.

3.22.3. Repair(s) greater than 10% of pipe length

If a repair(s) is required for more than 10% of the pipe length the entire asset (from manhole to manhole) must be completely re-CCTV'd following repair.

3.23. As-Built CCTV Requirements for Newly Lined Pipes

Refer to the below section and the current version of the document '*Guidelines for As-built CCTV Inspections of Lined/Rehabilitated Pipe*' for guidance on the inspection and coding of defects in newly lined pipe.

3.23.1. Newly Lined Pipe Cleaning and Charging

Prior to CCTV inspection all pipe lining and liner sealing works within the manhole must be complete and manhole benching reinstated (where removed / partially removed to facilitate liner installation). This includes the opening of all laterals, the installation of all LJR's and the completing of all lateral lining (if required).

All pipelines must be cleaned with a high pressure cleaner no more than 24 hrs. prior to inspection. Pipes must be free of all construction debris (e.g. offcuts, dirt gravel) before the survey is undertaken. Small quantities of debris infiltrating from laterals is not considered construction debris, provided coding to the NZPIM can take place.

Following cleaning, a charge of water must be sent through the pipe prior to CCTV inspection. This will allow the operator to identify dips based on standing water which may otherwise be missing following jetting.

3.23.2. Newly Lined Pipe Flow Control

Base flows must be plugged or diverted so that there is no flow coming from the upstream manhole. Flows from live laterals into the pipe being surveyed should result in a flow in the pipe no more than 10mm deep. If flow cannot be controlled due to infiltration from laterals CCTV can be carried out, provided:

- There is no risk to personnel, property or equipment.
- The CCTV as-built inspection is marked as 'out of specification' by the operator in the comments section and a general comment is included as soon as base flow exceeds 10mm in depth.
- Upstream flow is controlled such that there is no base flow coming from the upstream manhole.

- Flow is only due to infiltration in laterals and does not include private or commercial discharges (e.g. washing machine, shower or trade waste discharges).
- The flow does not exceed half pipe flow minus 30mm and the camera lens is at all times clear of water flow. (e.g. 150mm Pipe = 45mm)
- The entire pipe can be seen and the flow is clear.
- It is not permissible under any circumstance to follow the jetter for as-built CCTV surveys.

3.23.3. Newly Lined Pipe Inspection

The operator shall clearly inspect the seal of the liner at both the upstream and downstream manholes **or chambers**. **If, and only if, the camera is not able to rotate backwards to view the downstream manhole or chamber connection, a photograph that clearly shows the sealing of the end termination is acceptable. Include in the photograph a notice that clearly shows the lined pipe asset ID and manhole ID.**

~~If the camera is not able to rotate backwards to view the downstream manhole connection the camera should be re-launched from the downstream manhole.~~

If more than 10% of the pipe asset is lined, the as-built CCTV inspection must be completed for the entire asset, not just the lined portion. Refer to 3.20.3 for further information on how to complete as-built inspection records for pipes where less than 10% of the pipe length has been lined.

3.23.4. As-Built Defect Code Interpretation for Newly Lined Pipes

Refer to the appended document '*Guidelines for As-built CCTV Inspections of Lined/Rehabilitated Pipe*' for guidance on the coding of defects in newly lined pipe.

The condition codes and associated severity set out in Table 4 are not considered by CCC to be pipe defects that require further action.

Table 4 Acceptable Condition Codes

Newly Lined Pipes	
Defect Code	Severity
DE	S
OT	S
PL	S

Care is required in regard to acceptable defect codes for post lining surveys. Latent defects (defects that existed in the host pipe prior to lining) may appear like defects in the liner. These, when identified, need to be compared with the pre-lining CCTV, to confirm if a lining defect or latent defect in the pipe is a lining defect or not. **Photographic evidence of the defect in the pre-lining CCTV must be provided by the Delivery Team to the Data Management Provider. ~~These should be referenced against the lining design notes.~~**

Typical latent defects that may be appear as liner defects (typically coded as PF) include:

- Deformed pipe
- Displaced Joints
- Open Joints
- Holes in the pipe (PH, PB, TM & blank laterals)
- Dipped Pipes

3.23.5. As-Built defect(s) repair or acceptance for newly lined pipes

If a defect(s) identified in the as-built inspection is either less than 10% of the pipe diameter and has been repaired or has been accepted by CCC to remain, these details must be documented by the CCTV Contractor and exported to InfoNet as per Sections 3.22.1 and 3.22.2 of this specification.

3.24. Pipe and Node Asset Naming for As-Built Surveys

This section specifies how to name pipe and node assets (typically MHs) on CCTV surveys of newly laid, lined or repaired pipes (as-builts).

3.24.1. Construction drawings issued to the CCTV Sub-Contractor

The CCTV Sub-Contractor needs to be issued construction drawings marked up with any nodes added during the construction phase by the Contractor's Site Engineer before they undertake as-built CCTV. This is to ensure that nodes given on the as-built drawings are used to name assets associated with the CCTV survey. This allows the as-built survey to be matched back to the correct as-built assets within InfoNet and GIS databases at SCIRT.

3.24.2. Node asset naming for all as-built CCTV surveys

The Contractor should record node IDs (at either end of the pipe asset) exactly as they appear on the construction drawings, regardless of whether the pipe is new, has been lined or has been repaired. This is to ensure a naming cross-over with other as-built data collection.

eg. If MH-4321 is given on the construction drawings, this should be recorded as MH-4321

If WWMH-1234(NEW) is given on the construction drawing, this should be recorded as WWMH-1234(NEW)

3.24.3. Pipe asset survey naming for new pipe

Where a new pipe asset has been constructed, the pipeline asset survey ID shall be created with the format:

AAXBBCCCCZZZZZZZZZZZZ

Code	Description	No. of Characters	Examples
AA	Network Type	2	SW WW
XX	Delivery Team abbreviation	2	FC = Fletcher MC = McConnell Dowell CC = City Care DN = Downer FH = Fulton Hogan
BB	Identifies Data management provider.	2	AB=Citycare HT=Hydrotech
CCCCC	CCTV Sub-Contractors Request #	5 (include 0's in front if required to make up to a 5 digit number)	00045 12345
<u>ZZZZZZZZZZZZ</u>	YearMonthDayTime (yyyymmddttt) Time using 24hr clock	12	Eg. survey at 1pm on 25 March 2014 would be recorded as 201403251300

Eg: A CCTV survey of a wastewater pipe for Fletcher, which is part of CCTV package 513 that is taken at 3pm on 9 March 2014 should be recorded as:

WWFCAB00513201403091500
WWFCHT00008201405151659

Note: Request Number= XBBCCCCC (9 characters)

3.24.4. Pipe asset survey naming for lined or repaired pipe

Where the pipe asset has been lined (full asset renewal by lining) or has had discrete repair (dig-up or patch), the existing pipe asset ID will be retained as the survey ID. The Contractor will need to obtain the existing unique pipe asset ID off SCIRT GIS as this is typically not listed on the construction drawings.

e.g. WWpipe123456

3.24.5. Pipe or Node asset naming for assets constructed outside of construction drawings

If assets are installed/constructed outside of construction drawings (such as where a new MH is added during construction in order to cross an unforeseen service clash) these need to be marked onto the construction drawing working set by Contractor's Site Engineer and used by the Sub-Contractor. The Contractor should have used the following convention in giving the name for the assets (as per the 'Survey As-Built Guideline'):

Prefix_DT_ProjectNumber_UniqueID

e.g. WWMH_DT_10569_01
WWPI_DT_10569_01

3.25. File naming convention for as-built CCTV

3.25.1. File naming convention for new pipe as-built CCTV

AAXBBCCCCCZZZZZZZZZZZZ_DDDDDD_EEEE_FF_GGGGGGG

Code	Description	No. of Characters	Examples
AAXBBCCCCCZZZZZZZZZZZZ	Refer to 3.24.3	23	WWFCAB00513201403091500
DDDDDD	Date of Inspection	6	150413 (ddmmyy)
EEEE	Cleaning Stage	4	PRCL (precleaning) POCL (postcleaning)
FF	Abandoned inspection direction (only applies if inspection is abandoned from both directions.)	2	US DS
GGGGGGG	Survey using method other than standard CCTV	UP to 7	Boat Polecam Pushcam

	Tractor unit (this method must be approved by the principal before inspection).		
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3.25.2. File naming convention for lined or repaired pipe as-built CCTV

AAAAAAAA_BBpipe_CCCCCC_DDDDDD_EEEE_FF_GGGGGG

Code	Description	No. of Characters	Example
AAAAAAAA	Request #	9	FCAB00512 FHHT00008
BBpipe	Network Type	2	SWpipe WWpipe
CCCCCC	Principle asset #	Up to 6	12548 765489
DDDDD	Date of Inspection	6	150413 (ddmmyy)
EEEE	Cleaning Stage	4	PRCL (precleaning) POCL (postcleaning)
FF	Abandoned inspection direction (only applies if inspection is abandoned from both directions.)	2	US DS
GGGGG	Survey using method other than standard CCTV Tractor unit (this method must be approved by the principal before inspection).	UP to 7	Boat Polecam Pushcam

Appendix A- CCTV As Built Process

