SA Water Engineering

Technical Standard

TS 0524

CCTV Inspection of Gravity Sewer Infrastructure

Version: 1.0
Date: 31 August 2017
Status: Issued
Document ID: SAWS-ENG-0524
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Significant / Major Changes Incorporated in This Edition

This is the first issue of this Technical Standard.
Document Controls

Revision History

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<th>Date</th>
<th>Author</th>
<th>Comments</th>
</tr>
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<tr>
<td>1.0</td>
<td>11 August 2017</td>
<td>R Pearce</td>
<td>First Issue</td>
</tr>
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Template: Technical Standard Version 6.00, 10/05/2016

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1 Introduction

SA Water is responsible for operation and maintenance of an extensive amount of engineering infrastructure.

This Technical Standard has been developed to provide guidance to Constructors, CCTV Operators and SA Water personnel involved in the acceptance testing of sewer infrastructure.

In July 2014, SA Water introduced the mandatory requirement for CCTV inspection of newly constructed sewer infrastructure (in line with WSA 02-2014). At that time SA Water did not fully detail CCTV inspection acceptability criteria. In responding to the need for clarity for all stakeholders SA Water has prepared this Technical Standard.

1.1 Purpose

The purpose of this Technical Standard is to detail minimum requirements for CCTV inspection of sewer infrastructure to ensure Civil Constructors, CCTV Operators and SA Water personnel have a clear understanding of responsibilities, the Technical Requirements and SA Water’s acceptance criteria.

The aim is to detail SA Water’s requirements for CCTV inspection of sewer infrastructure to ensure that new and replacement sewerage assets covered by the scope of this standard are constructed to consistent standards and attain the required asset life.

1.2 Glossary

The following glossary items are used in this document:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS/NZS</td>
<td>Australian/New Zealand Standard</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed-circuit colour television</td>
</tr>
<tr>
<td>DAFI</td>
<td>Development Agreement Formal Instrument</td>
</tr>
<tr>
<td>DN</td>
<td>Nominal size</td>
</tr>
<tr>
<td>ID</td>
<td>Internal diameter</td>
</tr>
<tr>
<td>Inspection</td>
<td>The internal inspection of sewer infrastructure comprising the CCTV examination and resultant production of videos, photographs and report.</td>
</tr>
<tr>
<td>IO</td>
<td>Inspection opening</td>
</tr>
<tr>
<td>JPEG</td>
<td>Joint photographic experts group</td>
</tr>
<tr>
<td>MH</td>
<td>Maintenance hole</td>
</tr>
<tr>
<td>MPEG</td>
<td>Motion picture experts group</td>
</tr>
<tr>
<td>MS</td>
<td>Maintenance shaft</td>
</tr>
<tr>
<td>NATA</td>
<td>National Association of Testing Authorities</td>
</tr>
<tr>
<td>OD</td>
<td>Outside diameter</td>
</tr>
<tr>
<td>PAL</td>
<td>Phase alternate line</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable document format</td>
</tr>
</tbody>
</table>
1.3 References

This Technical Standard references other Standards and Codes but shall take precedence over these documents.

1.3.1 Australian and International

The following table identifies Australian and International standards and other similar documents referenced in this document:

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
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<tr>
<td>WSA 02-2014</td>
<td>Sewerage Code of Australia</td>
</tr>
<tr>
<td>WSA 05-2013</td>
<td>Conduit Inspection Reporting Code of Australia</td>
</tr>
<tr>
<td>AS 1260: 2017</td>
<td>PVC-U pipes and fittings for drain, waste and vent applications</td>
</tr>
</tbody>
</table>

1.3.2 SA Water Documents

The following table identifies the SA Water standards and other similar documents referenced in this document:

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
</tr>
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<tbody>
<tr>
<td>SCM</td>
<td>Sewer Construction Manual</td>
</tr>
<tr>
<td></td>
<td>SA Water Supplementary Documentation, Sewerage Code – Part 3 (Construction)</td>
</tr>
</tbody>
</table>

1.4 Definitions

The following definitions are applicable to this document:

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>SA Water’s Representative</td>
<td>The SA Water representative with delegated authority under a Contract or engagement, including (as applicable):</td>
</tr>
<tr>
<td></td>
<td>* Superintendent’s Representative (e.g. AS 4300 &amp; AS 2124 etc.)</td>
</tr>
<tr>
<td></td>
<td>* SA Water nominated contact person/s.</td>
</tr>
<tr>
<td>Constructor</td>
<td>The Civil Contractor as defined under a SA Water Contract or Specification or under the Development Agreement.</td>
</tr>
<tr>
<td>CCTV Inspector</td>
<td>The qualified assessor responsible for analysing CCTV video footage and compiling the Inspection Report detailing defects in accordance with this Technical Standard and WSA 05-2013.</td>
</tr>
<tr>
<td>CCTV Operator</td>
<td>The CCTV Operator engaged by either the Constructor or the SA Water Project Manager.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Developer</td>
<td>The Developer is responsible for completion of the Development Works in accordance with the Land Development Agreement.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>A Project Manager appointed by SA Water to oversee a SA Water project.</td>
</tr>
</tbody>
</table>
2 Scope

This Technical Standard relates to CCTV Inspection of Gravity Sewer infrastructure, both new and existing.

CCTV Inspections shall be undertaken for the purpose of confirming:

- new sewer infrastructure has been constructed in accordance with the design drawings, and SA Water’s construction requirements.
- existing sewer infrastructure has been successfully replaced/ relined or for verification of the condition of an asset.

The contractual Agreements by which the CCTV Inspection is undertaken are:

1. The Development Agreement for new infrastructure. The Developer is responsible for the provision of new sewer (and water) infrastructure to service newly created allotments, including satisfactory Inspection of the assets installed.
2. A Contract Specification for new or replacement infrastructure. SA Water will usually detail specific project requirements, contractual matters and contractual responsibilities.

This Technical Standard shall be considered together with these Agreements or Contracts.

In all instances where CCTV Inspections are undertaken they shall be:

- in accordance with this Technical Standard,
- executed by qualified Operators, (refer Clause 4.3),
- reported in accordance with Clause 7.3.3,
- certified by a qualified Inspector, (refer Clause 4.3),
- countersigned by the Constructor

3 WSAA Codes Relevance and Interpretation

3.1 New Infrastructure

The Foreword of WSA 05-2013 states ‘Acceptance testing determinations for newly constructed gravity sewers has been transferred to the Gravity Sewerage Code of Australia, WSA 02’.

Accordingly, in consideration of this statement and both Codes, SA Water has based its acceptability requirements for new infrastructure on WSA 02-2014.

Herein, in Appendix A, SA Water provides details of its acceptability requirements.

SA Water requires an Acceptance Test Report in accordance with Appendix C.

3.2 Existing Infrastructure

For existing sewer infrastructure WSA 05-2013 provides a detailed scoring system for confirmation of any defects, faults or extent of deterioration.

SA Water requires a Defect Report in accordance with WSA 05-2013.

3.3 Precedence

This Technical Standard shall have precedence over both WSA 02-2014 and WSA 05-2013.
4 Roles and Responsibilities

4.1 The Third Party undertaking the Works (Developer, DPTI, Council etc.)

The Third Party shall be responsible for:

- compliance with the Obligations stated in the Development Agreement Formal Instrument or Contract,
- the Constructor’s compliance with SA Water’s Acceptance Testing requirements for new infrastructure,
- the provision of all Acceptance Testing documentation prior to Practical Completion.

4.2 The Constructor

The Constructor shall be responsible for:

- compliance with this Technical Standard,
- the timely provision of the Inspection Report to the SA Water Representative, refer Clause 7,
- the engagement of appropriately qualified and certified operators (this includes Subcontractors) for:
  o removal of debris and cleaning of the mains, prior to the Inspection, and,
  o the CCTV Inspection/s and Reports,
- ensuring the differing responsibilities for each Subcontractor are understood and fulfilled,
- arranging any additional testing (e.g. deflection) where the original Inspection highlights a possible defect or fault,
- the retesting of any assets following rectification work,
- advice to the SA Water Representative of all unacceptable results confirmed within the Report, together with:
  o confirmation of rectification actions undertaken,
  o confirmation that additional testing has been completed for all rectification.
- new sewer infrastructure - verifying that all sewer construction works have been completed (including any service crossings and trench fill to finished surface level) prior to the CCTV Inspection commencing,
- existing assets - advice to SA Water / Allwater Operations confirming the timing of the Inspection and compliance with the required Authorisations / Permits.
- advice to the Road Authority in accordance with its notification requirements, where work may be undertaken on a public road.

4.3 The CCTV Operator/ Inspector

The CCTV Operator and CCTV Inspector shall:

- for all personnel undertaking the inspection and reporting, provide evidence of a Statement of Attainment for the following Nationally recognised qualification:
  o NWPNET016 (or an equivalent) for Operators, and,
  o NWPNET017 (or an equivalent) for Inspectors providing the Report.
- ensure all persons have the required knowledge and experience of the equipment to facilitate a detailed Report in accordance with this Technical Standard.

The CCTV Operator shall be responsible for:
- ensuring the videos, photos and details of defects are of good quality and suitable for audit and quantification by the CCTV Inspector,
- compliance with the contractual obligations imposed by SA Water or the Constructor, (e.g. WHS, inductions, timing etc.) and any other requirements as required by another Authority (e.g. Council, DPTI, SAPN etc.).

The CCTV Inspector shall be responsible for:
- the Inspection Report as defined in Clause 7,
- confirmation of all unacceptable or notifiable defects,
- advice to the Constructor of all unacceptable or notifiable defects,
- verification of measurements confirming acceptability.

4.4 SA Water

SA Water will:
- provide oversight of the Constructor’s Quality Assurance program, including testing and witness point verification,
- provide technical advice to the Constructor where requested,
- use the CCTV Inspection Report in determining compliance with the Constructor’s obligations.

5 Undertaking the CCTV Inspection

The CCTV Inspection shall be undertaken in accordance with this Technical Standard.

For new infrastructure, the Inspection Report shall be considered confirmation that all new sewer pipes and maintenance structures conform with the Design Drawings, SA Water’s Construction requirements and are fit for purpose.

For existing infrastructure, SA Water may have a Specification detailing the scope of work and contractual requirements. The Specification may reference this Technical Standard for details of the specialist and aspects of the Inspection.

5.1 Timing

The CCTV Inspection shall be undertaken:
- For new infrastructure, following raising of the maintenance structures to road level and placement of the cover and frame (but prior to placement of bitumen), or as agreed with the SA Water Representative.
- For existing infrastructure, as stated in the Specification or as agreed with the Project Manager.
5.2 Notice of Intending Works

SA Water shall have the opportunity to be present to witness the CCTV Inspection. The Constructor shall be responsible for notifications to the SA Water Representative of the CCTV Inspection/s.

Notification periods shall be:

- An approximate date to be provided in the Constructor’s initial Inspection and Test Plan,
- 15 working days for the actual CCTV Inspection,
- 3 working days for any subsequent Inspection (that may be required).

The SA Water Representative may request an alternative appointment if the required notice is not provided. Any associated impact (program or financial) will be the responsibility of the Constructor.

Where the SA Water Representative cannot witness the test and the required notifications have been provided, the Constructor may proceed with the test.

Where an Inspection is required for existing infrastructure, 15 working days’ notice shall also be provided to:

- Allwater (metropolitan areas),
- SA Water Operations (country areas),
- Superintendent or Project Manager,

for consideration of any operational requirements to be implemented, including Notifications, Authorisations and Associated Permits.

5.3 Pre Inspection Activities

5.3.1 Mains Cleaning and Placement of Water in the Mains

This Clause is relevant for new infrastructure only. Details of requirements for existing infrastructure are provided in Appendix B.

All maintenance structures shall be visually inspected by the Constructor prior to the CCTV Inspection. The cover shall be temporarily removed to enable the base of the structure to be examined.

The Constructor shall ensure that all internal surfaces of the pipes and structures are clean before the CCTV Inspection is performed.

Mains cleaning shall clear debris from the pipes and maintenance structures to achieve a standard that will facilitate the CCTV Inspection and the reporting of defects.

Objects and material fragments shall be extracted. Jet rodding (or an equivalent technique) shall be undertaken to ensure all debris, sand, stones, grit etc has been removed.

No debris or other foreign matter within in the newly constructed sewer network shall be disposed of into the existing SA Water sewer system.

Mains cleaning shall be completed a maximum of 24 hours prior to commencement of the Inspection.

Fifteen minutes prior to the Inspection of a section of pipe, clean water shall be released into the upstream maintenance structure. For DN 150 pipe the quantity of water to be inserted shall be
20 litres per 100 metres of pipe. For pipes larger than DN 150, the quantity of water to be inserted shall be increased to 50 litres per 100 metres of pipe.

The purpose of the addition of water is the detection of any reverse grade (backfall) and/or pooling of water within the pipes and structures.

5.4 New Infrastructure

5.4.1 Items to be inspected

The following assets shall be inspected:

- All sewer mains, inclusive of branch laterals,
- All maintenance structures, inclusive of the inlet pipes and shaft.

In addition, SA Water reserves the right to request an inspection for any sewer connection should it be considered there may be a potential fault or problem.

5.5 Existing Infrastructure

5.5.1 Items to be inspected

SA Water will confirm items to be inspected in a Scope of Work contained within the Specification.

Pre-cleaning, removal of debris together with flow control provides complexities for the Inspection of existing sewer infrastructure.

Generally the (CCTV) Inspection Technical Requirements will be in accordance with Clauses 5 and 6 of this Technical Standard.

5.6 New or Additional Inspection

Ultimately the Constructor is responsible for the Inspection Report.

Where:

- the videos or photographs are of unsatisfactory quality,
- the Report is inadequate or unacceptable,
- faults were identified and rectification work has been completed,

the Constructor will be responsible for additional Inspection/s.

All further Inspections shall be:

- completed with the SA Water Representative on site,
- completed at the Constructor’s cost unless otherwise agreed by SA Water
- given a different Report number.

6 Camera and Technical Requirements

6.1 Camera / Scanner

Unless otherwise specified, a CCTV camera or a 3D optical pipeline scanner shall be used. As a minimum:
- CCTV systems shall operate on the PAL standard with minimum optical resolution of 720 x 576 pixels for all points of the inspection.
- Pan and tilt cameras shall be used, capable of 360° rotation and tilt up to 90° from the horizontal.
- 3D optical scanners shall provide 100% pipe and/or maintenance structure wall coverage, virtual 360 degree pan and tilt and HD resolution.
- The camera and illumination system shall provide a clear, accurate, and in focus record of the internal condition of the pipe.

6.2 Capability
Cameras and scanners shall be capable of providing:
- a continuous video or digital record of the sewer pipes and structures,
- still images of defects and features of interest as detailed in WSA 05 – 2013,
- a record of all defects and features required to be reported,
- a clear view of the lateral at junctions and connections,
- measurements by means of a laser measurement tool.

The camera shall not move and pan simultaneously. If defects are observed, the camera shall be halted. The defect shall be recorded and included in the report.

Videos and Photographs shall be referenced. Refer Clause 7.2.

6.3 Camera Operation
The Camera / Scanner operation shall be undertaken to meet the specifications for camera position and speed outlined in WSA 05-2013, Clause 2.6.

The direction of the CCTV inspection shall be from upstream to downstream, except where this is not possible.

6.4 Measurement and Data Display
Recording of information shall be in accordance with WSA 05-2013, Clauses 2.7 and 2.8.

The camera video record of the inspection shall display in metres and tenths of metres from a nominated zero position nominally at the start of the pipe segment.

Screen text shall be coloured to contrast the background image for text clarity.

To achieve satisfactory laser profiling measurements, the camera or laser device shall be capable of producing measurements to the accuracy stated in Clause 2.9.

For validation of measurement accuracy, the Inspector shall gauge scanned measurements against an accurately marked incremental Template (mm), e.g. 5, 10, 15 etc.

6.4.1 Start Screen
The start of each Inspection shall record the following information:

<table>
<thead>
<tr>
<th>Table 6.1 Information to be displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Infrastructure</td>
</tr>
<tr>
<td>SA Water Contract Number</td>
</tr>
</tbody>
</table>
New Infrastructure | Existing Infrastructure
---|---
Pipe Line Number (refer Design Drawings) | Asset Number (pipe segment number, e.g. 123456)
Name of the Company undertaking the inspection | Name of the Company undertaking the inspection
Date and Time of Inspection | Date and Time of Inspection
Maintenance Structure, Start & Finish Chainage | Maintenance Structure Reference Number
Meterage (relative to Start Chainage) | Meterage (relative to Start Chainage)
Direction of Inspection (U = upstream, D = downstream) | Direction of Inspection (U = upstream, D = downstream)
Pipe Diameter & Material | Pipe Diameter & Material
Cleaning (‘yes’ or ‘no’) | 

### 6.4.2 Video header & footer

A header and footer shall be electronically generated and recorded on each digital video.

For each pipe segment the header and footer shall be displayed at all times preferably in a single line at the extreme top and extreme bottom of the page or where it does not obscure the video.

The Header and Footer shall include:

<table>
<thead>
<tr>
<th>Table 6.2 Header and Footer display</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Header</strong></td>
</tr>
<tr>
<td>Maintenance hole chainages or reference numbers (upstream &amp; downstream)</td>
</tr>
<tr>
<td>Pipe Line Number or segment number</td>
</tr>
</tbody>
</table>

### 6.4.3 End Screen

Where a video is abandoned the reason for ending the survey (i.e., ‘Finish survey’ or ‘Survey Abandoned’) shall be electronically generated, displayed and recorded on the digital video for each pipe segment for a minimum duration of 5 seconds. It shall be clearly visible.

### 6.4.4 Defect Measurement

In accordance with Clause 4.3, measurement / quantification of suspected or actual defects shall be confirmed by a CCTV Inspector, e.g. ovality, pooling of water etc.

Where Appendices A or B state measurement / quantification is required, all defects shall be quantified to verify compliance or not with this Technical Standard.

### 6.5 Image quality

All videos and photographs shall be colour, clear, in focus and satisfy the technical requirements stated in Clause 6.

Videos or photographs will be rejected where they are:

- of poor resolution,
- out of focus, or,
- displaying inadequate lighting

In such circumstances, the Constructor will be required to provide another Inspection.

An example of a satisfactory quality image is provided below:
(Note: Information to be displayed shall be in accordance with Clause 6.4.1).

7 The Inspection Report

7.1 Inspection Report

The Inspection Report shall be certified by the CCTV Inspector. Refer Clause 4.3.

The data to be provided shall be a detailed Inspection Report, containing:

1. digital videos in MPEG 4 or AVI format.
2. digital photographic records in JPEG format. Resolution shall be PAL (720 x 576 pixels) as a minimum, and be sufficient to allow clear identification of the feature.
3. defect coding shall be WinCan V8 format as a minimum,

Where a subsequent Inspection may be undertaken (due to rectification work), each Report shall have a separate revision number for distinguishing between the Inspections.

7.2 Data Transmission

A USB (or external hard drive for large projects) shall be provided to the SA Water Representative containing the total Inspection Report as detailed in Clause 7.1.

For some SA Water managed projects there may also be the option of utilising the SA Water Secure File Transfer System. The Project Manager should be able to confirm the suitability of this option.

7.3 Referencing Images

Each Video shall be allocated a reference number. All observed defects or features shall be assigned a separate reference number. Together with the recorded chainage these details will assist location on the Video. Should the defect involve a section of affected pipe (e.g. pooling of water), the start and finish chainages shall be recorded for confirmation of the length.
The Inspection Report shall include a reference number for each photo of each defect or feature. Should the defect involve a section of pipe and multiple photographs are required, all shall be recorded against the defect.

The Operator shall check that all defects or features listed correspond with the video footage.

### 7.4 Reportable Items Summary List

#### 7.4.1 General

Identification of Reportable Items shall be in accordance with:

- WSA 05 – 2013 (for both existing and new infrastructure),
- Appendix A of this Standard (for new infrastructure).

Summary Defect Lists shall be provided in accordance with Clauses 7.4.2.1 and 7.4.2.2.

#### 7.4.2 List Content

##### 7.4.2.1 New Infrastructure

Where a reportable defect is listed, the CCTV Inspector shall analyse it to confirm its acceptability. Each fault shall be quantified (where required).

The following Reportable Items Summary Lists shall be produced:

1. Appendix C of this Standard confirming all defects specified in Appendix A.
2. A Summary WinCan Report. All defects identified in the standard WinCan report for each Pipe Line Number shall be extracted to generate one Summary Report.

Where rectification has occurred it shall be noted against the original defect. A separate Summary Defect List is required for verification of the success of the remedial work.

##### 7.4.2.2 Existing Infrastructure

A Summary WinCan Report is required as stated in Clause 7.4.2.1. A standard WinCan report shall be generated for each Pipe Line / Asset Number. Detected faults from the Standard Report shall be integrated into the Summary WinCan Report.

The report/s and result pages shall include the SA Water Contract / Specification number, Pipe Line / Asset Number, and Street Name & Suburb.

Information to be provided in the WinCan Summary Defect List shall be:

<table>
<thead>
<tr>
<th>Table 7.4 Image Reference information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defect Number</td>
</tr>
<tr>
<td>Video reference Number</td>
</tr>
<tr>
<td>Photo reference number</td>
</tr>
<tr>
<td>Asset Line Number</td>
</tr>
<tr>
<td>Maintenance Structure, Start &amp; Finish Chainage</td>
</tr>
</tbody>
</table>

Severity & location of defects shall be recorded in accordance with WSA 05 – 2013, Appendix F.
Scoring of Defects and the Preliminary Grading of structural and serviceability condition of each segment shall be carried out in accordance with WSA 05 – 2013, Appendix C.

7.4.3 Report accuracy

All defects found during the investigations shall be recorded.

Failure to provide adequate Reports or where the Report does not correspond with the video footage may result in the Inspection being rejected. Should the Inspection Report be inadequate or unsatisfactory the Constructor shall engage another qualified Operator to perform a new Inspection at the Constructors cost.

7.5 Supply of the Inspection Report

The Constructor shall be responsible for the provision of the final Inspection Report (including any additional Report for rectification works) to the SA Water Representative within 5 working days following the Report completion for sign off of the Construction Hold Point.

8 Acceptance Criteria

The acceptance criteria for CCTV Inspection of new sewer infrastructure shall be in accordance with this Technical Specification. Refer Appendix A.

9 Rectification Work

Should the CCTV inspection reveal construction defects requiring rectification, the work shall be completed at no cost to SA Water (unless otherwise agreed by SA Water).

9.1 Proposal for Rectification Work

Where rectification is required due to a defect or failure, in accordance with the submitted Quality Plan, the Constructor will be required to make good all faults.

All products used for the rectification shall be approved by SA Water and shall be obtained from an approved manufacturer listed in the relevant Technical Standard.

Should the rectification require a product not currently listed in the Technical Standard, specific approval from SA Water will be required for use of that product.

The Constructor or Consultant shall provide the SA Water Representative with data sheets / manufacturer information to enable assessment by SA Water.

SA Water will review and advise of acceptability.

All repaired sections of pipe shall be reinspected in accordance with Clause 9.2.

9.2 Retesting of Any Assets Following Rectification Work

Where rectification has been undertaken, the Constructor shall arrange for a new Inspection. The video, photographs and a new revised Summary Defect List shall be provided to the SA Water Representative.

The Inspection shall be in accordance with Clause 5.6.

The Constructor shall also arrange for the As Constructed drawings to be amended to show details of the rectification work.
10 Loss of Equipment or Materials in Sewer

The SA Water Representative shall be notified upon loss of any equipment or materials in the sewer.

The Constructor shall confirm the equipment and materials that have been lost.

The Constructor shall advise the SA Water Representative of a plan for retrieving the items. No recovery shall be undertaken without receiving direction from the SA Water Representative.

Failure by the Constructor to report loss of equipment or materials which leads to asset damage may result in penalties being actioned against the Constructor.
Appendix A  Acceptance Criteria - New Infrastructure

In accordance with WSA 02-2014, Clause 21, Acceptance Testing of newly installed sewer infrastructure is mandatory. CCTV inspection is one component of the Acceptance Testing.

SA Water introduced CCTV inspection in 2014. Prior to CCTV inspection, pipe movements during the compaction phase or any debris left in the pipe generally went undetected.

For years, top of pipe levels were taken as a means of confirming the pipe is within tolerance (to the design grade) and backfill can occur. However, placement of backfill and subsequent compaction can impact the pipe, e.g. either a drop of the pipe level, or, a change of pipe shape (ovality).

CCTV Inspection will reveal a number of different faults within the pipes or structures. This Appendix details SA Water’s requirements and where a tolerance may be appropriate provides confirmation of the amount of latitude granted to the Constructor (Refer A12).

WSA 02-2014 Appendix L, Specification for Internal Inspection of Newly Constructed or Rehabilitated Sewers quantifies the requirements for acceptability of various types of defects. Generally, SA Water’s requirements are similar to Appendix L.

A1  Reportable Items Summary Lists

The CCTV Inspection shall result in the following Reportable Items Summary Lists being produced:

- Appendix C of this Standard
- A Summary WinCan Report

WinCan reports, videos and photographs shall all comply with Clause 6.4.

For new sewer infrastructure, in the WinCan report the pipe structural and serviceability is required to achieve a minimum rating of 1. A rating of 1 indicates that the pipe is new and in very good condition. Where the value is less than 1, a defect shall be recorded together with a comment.

Where rectification has occurred it shall be noted against the original defect. A separate Reportable Items Summary List is required for verification of the success of the remedial work.

A2  Defects or faulty workmanship

All rectification work shall be undertaken in accordance with Clause 9.

A3  Infiltration / Exfiltration

Any infiltration or exfiltration observed during the Inspection is not acceptable. Rectification shall be undertaken in accordance with Clause 9.

Constant running water in the new sewer pipe will be deemed to be infiltration. Collections of water which are not changing in size will not be considered to be infiltration.

A4  Cracked or Fractured Pipe

SA Water will not accept any crack in a new pipe or structure.

Longitudinal or circumferential cracks will shorten the asset life of the pipe and will provide the opportunity for root / groundwater / soil intrusion. Cracks may also result in external release of sewage which is in breach of environmental legislation.
Rectification work shall be undertaken in accordance with Clause 9.

An example of cracked pipe requiring rectification is presented below:

A5  Deflection (Ovality) Testing

A5.1  Requirement for Deflection Testing

Although the survey of the laid pipe may confirm it is within the acceptable tolerance, the placement of embedment / backfill materials and the compaction processes may impact the pipe shape.

Should the CCTV video demonstrate a deflection issue a Deflection Test shall be undertaken in accordance with Clause A5.2.

A5.2  Performing the Deflection Test

WSA 02-2014, Clause 21.6 provides three options for proving ovality. Options (b) and (c) are applicable to new reticulation sewers. SA Water’s preference is option (b) - CCTV light ring and measurement software.

An Ovality Proving Tool (option c) may also be used for confirmation of any pipe deflection.

A5.3  Ovality Proving Tool

The Ovality Proving Tool shall be:

- circular shaped plastic (to minimise any pipe damage),
- sized in accordance with Table A5.4,
- in accordance with WSA 02-2014, Clause 21.6.2 for the OD tolerance, pulling rings and markings

The Proving Tool shall be passed through the sewer. Should it become wedged the distance from the maintenance structure shall be recorded and it shall be removed and passed through the sewer from the other direction to confirm the affected length of pipe. The lengths from each maintenance structure shall be compared with the CCTV video and photographs.

The Operator shall record all occurrences as a defect. Further, the Operator shall inform the Inspector and the Constructor.
A5.4 Acceptable Deflection Testing Results

In WSA 02-2014, Table 21.6, WSAA has specified Permissible Pipe Deflection for three time periods, 30 days, 3 months and 1 year. The allowable deflection is listed as a differing percentage for each time period.

For simplification SA Water has adopted the 3 month value as its requirement and converted the percentage into millimetres. (The values for the other periods vary +/- 1 or 2 mm).

All deflections exceeding the values listed in Table A5.4 are unacceptable to SA Water.

All defective sections of pipe shall be rectified. The rectification work shall be undertaken in accordance with Clause 9.

**Table A5.4 Permissible Pipe Deflection (mm)**

<table>
<thead>
<tr>
<th>DN</th>
<th>Maximum allowable vertical deflection after 3 months = 5.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D min (mm)</td>
</tr>
<tr>
<td>150</td>
<td>142</td>
</tr>
<tr>
<td>225</td>
<td>213</td>
</tr>
<tr>
<td>300</td>
<td>283</td>
</tr>
</tbody>
</table>

Examples of unsatisfactory pipe ovality are presented below:
A6 Backfall

WSA 02-2014, stipulates:

- ‘reverse grades (backfall) are not permitted’, (Clause 22.2.1),
- ‘do not permit backfall at any point along the sewer. Maintain the inverts of new sewers and property connection sewers within the tolerances shown in Table 22.1 and Table 22.2’, (Clause 22.2.3) and,
- ‘Flow (Water) Level should not occur in a new sewer’, (Appendix L, Table L2).

SA Water understands that for sewers on flat grades it is difficult to achieve the designed grade. Accordingly SA Water has quantified its acceptable tolerance for backfall which is confirmed in Clause A7.

A7 Pooling (ponding) of Water

As a means of establishing backfall, SA Water has a requirement for the Constructor to pour water into maintenance structures, (refer clause 5.3). Any backfall will usually become apparent through the pooling of water in the pipe or maintenance structure.

SA Water’s guideline for assessment of the extent of a pooling problem is:

Table A7.1 Maximum Flow Level in Pipe

<table>
<thead>
<tr>
<th>DN</th>
<th>Max Flow Level</th>
<th>Flow line measurement</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>0%</td>
<td>-</td>
<td>No pooling acceptable where &lt; 50 upstream residential properties provide contributing flows to a maintenance structure.</td>
</tr>
<tr>
<td></td>
<td>5%</td>
<td>70 mm</td>
<td>Based upon contributing flow from &gt; 50 residential properties.</td>
</tr>
<tr>
<td>225</td>
<td>5%</td>
<td>110 mm</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>5%</td>
<td>140 mm</td>
<td></td>
</tr>
</tbody>
</table>
No water pooling will be accepted where less than 50 upstream residential properties provide contributing flows to the maintenance structure. For substantiation of property numbers, the Constructor shall seek confirmation by the Consultant.

Where more than 50 upstream residential properties provide contributing flows to the maintenance structure a maximum flow level of 5% of the pipe ID is deemed to be acceptable.

SA Water requires all instances of water pooling which are observed to be:

- recorded by the Operator and reported to the Inspector,
- measured by the Inspector to confirm
  - the width of the water (from wall to wall) and compliance with Table A7.1,
  - the length for each pool of water,
- reported to the Constructor for rectification of the maintenance structure or length of pipe where the flow line measurement exceeds the value shown in Table A7.1.

Examples of unsatisfactory pooling are presented below:
A8 Joint Displacement

SA Water is concerned about problems / defects as a result of unsatisfactory pipe jointing. Typical problems may be:

- Joint displacement (longitudinal), JD (L), pipe / fitting not being adequately inserted into joint,
- Defective joint weld—JDW (P), a cured pool of excess solvent cement in the pipe invert

SA Water’s guideline for assessment of acceptability of joint displacement is:

Table A8.1 Permissible Joint Displacement (mm)

<table>
<thead>
<tr>
<th>DN</th>
<th>JD (L)</th>
<th>JDW (P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>225</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>300</td>
<td>5</td>
<td>15</td>
</tr>
</tbody>
</table>

JD (L) shall be in accordance with AS 1260, Clause 4.7.

Examples of unsatisfactory joints are presented below:
A9  Dropped Invert

Where a Maintenance Structure, OB (Oblique Junction) or other fitting has been installed and the fitting has collapsed due to poor support, the drop in level shall be measured to assess the potential for collection of sewage and debris.

Table A9.1 Permissible Dropped Invert (mm)

<table>
<thead>
<tr>
<th>DN</th>
<th>Maximum allowable vertical drop (5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(mm)</td>
</tr>
<tr>
<td>150</td>
<td>8</td>
</tr>
<tr>
<td>225</td>
<td>12</td>
</tr>
<tr>
<td>300</td>
<td>15</td>
</tr>
</tbody>
</table>

All measurements exceeding the values listed in Table A9.1 are considered unacceptable to SA Water.
Rectification work shall be undertaken in accordance with Clause 9.

**A10 Surface Damage**

Surface damage should not be evident as the materials should be inspected prior to installation and rejected if not suitable.

Types of damage that may be observed during the CCTV Inspection include:

- B – blistered or flaking pipe,
- MD - mechanical damage, e.g. scoring or gouging etc
- Z – some other form of damage

Should surface damage be observed it shall be reported by the Operator who shall also advise the Constructor.

The expectation is that the Constructor shall:

- provide details of the damage to the manufacturer for quantification,
- report the issue,
  - as a Non Conformity within the Contractors Quality Management System,
  - to the SA Water Representative

**A11 Obstructions**

All obstructions shall be removed from pipes and Maintenance Structures.

Objects and material fragments shall be extracted.

General debris may be cleared by undertaking mains cleaning. (Refer Clause 5.3.1).

Where the Inspection indicates debris has not been satisfactorily removed, the Operator shall advise the Constructor. The Constructor shall remove all obstructions. All unacceptable section/s shall be recleaned at the Constructor’s cost.

Following recleaning a new CCTV Inspection shall be undertaken for confirmation that the sewer has been satisfactorily cleaned and is suitable for use.

Examples of unsatisfactory debris removal are presented below:
Image 1:

Nontruss Estate
Orsby Way N/S to Bridge Lane
H:109.2m
9:51:33:59 03/02/08

Image 2:

Holloway CR
MSJ 0.93 <= 10 22.22
PVC: Plasticised Circular 150

LC1: 009.20 m
### A12 SA Water Acceptability Criteria Summary List

**Table A12.1 Acceptability Criteria Summary List**

<table>
<thead>
<tr>
<th>Defect/Feature</th>
<th>Characterisation</th>
<th>Quantification</th>
<th>Acceptance Determination Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltration S</td>
<td></td>
<td>Refer A3</td>
<td>Not acceptable.</td>
</tr>
<tr>
<td>Exfiltration EX</td>
<td></td>
<td>Refer A3</td>
<td>Not acceptable.</td>
</tr>
<tr>
<td>Cracked or Fractured Pipe C</td>
<td>L, C, S, or M</td>
<td>Refer A4</td>
<td>Not acceptable.</td>
</tr>
<tr>
<td>Deflection Testing or Ovality D</td>
<td></td>
<td>Refer Table A5.4</td>
<td>Not acceptable above values provide in Table.</td>
</tr>
<tr>
<td>(Deformation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooling (Flow water level) WL</td>
<td></td>
<td>Refer Table A7.1</td>
<td>Not acceptable above values provided in Table.</td>
</tr>
<tr>
<td>Joint displacement JD</td>
<td>L</td>
<td>Refer Table A8.1</td>
<td>Not acceptable above values provided in Table.</td>
</tr>
<tr>
<td>Defective joint weld JDW</td>
<td>P</td>
<td>Refer Table A8.1</td>
<td>Not acceptable above values provided in Table.</td>
</tr>
<tr>
<td>Dropped Invert DI</td>
<td></td>
<td>Refer Table A9.1</td>
<td>Not acceptable above values provided in Table.</td>
</tr>
<tr>
<td>Surface damage SO</td>
<td>B</td>
<td>Refer A10</td>
<td>A defect shall be recorded.</td>
</tr>
<tr>
<td></td>
<td>MD</td>
<td>Refer A10</td>
<td>Not acceptable.</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>Refer A10</td>
<td>Type of damage to be confirmed. A defect shall be recorded.</td>
</tr>
<tr>
<td>Obstruction OB</td>
<td>C, J, M or Z</td>
<td>Refer A11</td>
<td>Not acceptable.</td>
</tr>
</tbody>
</table>
Appendix B Inspection of Existing Sewer Infrastructure

For existing sewer infrastructure SA Water utilises CCTV technology to undertake condition assessments and investigate potential blockages and damages in the sewer network. These investigations are undertaken to determine assets needing maintenance or replacement prior to the assets developing into a significant problem impacting SA Water’s customers.

SA Water requires wastewater mains to be pre-cleaned and debris removed prior to the CCTV Inspection.

A package of work is generally compiled into a Specification. Tenderers are requested to submit an offer based upon the content of the Specification.

This Technical Standard provides details of the technical requirements and deliverables to be supplied by the Constructor or CCTV Operator.

B1 Typical Scope

The Specification could have a typical Scope of Work comprising:
- Site establishment
- WHS / Quality requirements
- Pre-cleaning pipes and structures prior to the CCTV Inspection
- Performing the CCTV Inspection
- Flow control
- Traffic management
- Notifications, e.g.
  - Commercial premises,
  - Residential customers,
  - Special Needs individuals,
- Site Clean-up
- Provision of Reports

B2 Provision of Reports

Generally reporting shall be in accordance with Clause 6.

Frequency of Reports and any additional reporting requirement will be stated in the Specification.

B3 Abandonment of the CCTV Inspection

A collapsed joint, a large hole in a pipe or significant type defect may necessitate abandonment of the Inspection. Should an occurrence of this magnitude be encountered, the SA Water Representative shall be immediately notified.

Vapour and fog (or similar event) shall not be a justifiable reason for abandonment of the Inspection. The Constructor shall consider ventilation or cleaning of the lens in such circumstances. In each case, the Inspection shall be restarted at the Contractor’s expense.
B4  Pipe Types

Some older sewer pipes may be constructed of material which may be in an advanced state of deterioration or in poor condition. These may include reinforced concrete (RC), rectangular RC, Oviform RC, PVC, vitreous clay (VC), mild steel concrete lined (MSCL), some asbestos concrete (AC) and other materials.

B5  Approved Cleaning Methods

Mains cleaning shall be undertaken to achieve a standard that enables the Inspection to be undertaken.

Cleaning may include but not limited to one or more of the following techniques; jet rodding (with or without vacuum), root cutting, root saw, dragging etc.

Cleaning shall remove all foreign matter, debris, slime, fat, tree roots, sand, stones, grit etc which may prevent the passage of the CCTV camera through the pipe, and/or prevent the surface of the pipe being examined.

Internal tree root masses shall be cleared using a mechanical root cutter (or similar).

It is the Contractor’s responsibility to select the most appropriate cleaning techniques that will not adversely affect the serviceability or structural integrity of the sewer. Where the Constructor has concerns regarding the condition of the sewer and whether or not to proceed with cleaning and the CCTV Inspection, the Constructor shall consult the SA Water Representative.

SA Water has a preference for cleaning equipment to have water recycling capabilities.

B6  Debris Removal, and Record Keeping

Where cleaning of sewer infrastructure is undertaken, the Constructor shall collect, record and submit to the SA Water Representative the following information:

- the site or location,
- the pipe/s size,
- the length cleaned,
- the type and quantity of all foreign material / debris removed (for each site)

The volume (in litres) of all debris removed shall be recorded and submitted in accordance with the Specification.

B7  Disposal

Debris shall be removed by utilisation of a vacuum tanker or traps / rakes and loaded directly into appropriate storage (e.g. sealed plastic root bags).

Where root cutting or chain flail work is undertaken, the Constructor shall use a removable wire basket or trap placed in the downstream maintenance structure to catch the debris. This requirement shall be rigorously followed.

Should a downstream overflow occur due to debris passing the trap, the Constructor will be liable for all associated costs of remediation.
It shall be noted that sewer debris is contaminated and shall be deemed a ‘Regulated Waste’ as defined by the Environmental Protection Authority, South Australia. Any transport and disposal of this material shall be undertaken by an operator licensed for this purpose.

For Payment Rates and Special Conditions associated with debris disposal refer to the Specification.

### B8 Obstructions

Should an obstruction impact the progression of the CCTV unit, the unit shall be removed. It shall be inserted at the next maintenance structure to survey back towards the obstruction from the other direction. The chainages from each video shall be used to confirm the length of the obstruction.

The Contractor shall photograph the obstruction and confirm its length and approximate size.

The Constructor shall immediately advise the SA Water Representative:

- when significant debris or irregularities are found in the pipe, regardless of whether it prevents the CCTV camera passing through the full length of the line.
- of any pipe segment which cannot be cleared or cleaned due to major structural defects or immovable obstructions,

For all mains pre-cleaned where debris prevents CCTV survey and recording of 100% of the main length, the Constructor shall arrange to re-clean the main to remove the debris. The Constructor shall then have the full length of main re-inspected. The costs of re-clean and re-inspection of the main shall be borne by the Constructor.

### B9 Negotiating Solid Debris in the Sewer Pipe (‘Debris Jumping’) 

The quality of the CCTV Inspection may be adversely impacted if ‘debris jumping’ is undertaken to complete the CCTV survey.

‘Debris jumping’ is acceptable for minor sections of sewer pipe(s). Minor sections are defined as:

- short sections, not exceeding 5 metres in length, or,
- a cumulative sum of 10% of the total length of the pipe inspected

Where the pre-cleaning has been previously performed in preparation for the Inspection, the Constructor shall re-clean the pipe and undertake a new Inspection of the full length of pipe at the Contractor’s cost.

### B10 Flow Control

The Constructor shall be responsible for flow control and diversion measures to facilitate the CCTV Inspection. This may involve the assistance of SA Water or Allwater.

For details of flow control requirements and responsibilities refer to the Specification.
Appendix C  **SA Water Reportable Items Summary List Template**

For new sewer infrastructure SA Water require Appendix C to be completed. Reporting shall be in accordance with defaults included in Appendix A.
# CCTV Acceptance Test Report

<table>
<thead>
<tr>
<th>Report No.</th>
<th>123-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project</td>
<td>Seaford (St 100A)</td>
</tr>
<tr>
<td>SA Water Contract No.</td>
<td>100/17</td>
</tr>
<tr>
<td>Constructor</td>
<td>ABC Construction Services</td>
</tr>
<tr>
<td>CCTV Company</td>
<td>XYZ Inspection Services</td>
</tr>
<tr>
<td>CCTV Operator</td>
<td>John Smith Qualification : NWPNET016</td>
</tr>
<tr>
<td>CCTV Operator</td>
<td>Qualification :</td>
</tr>
<tr>
<td>Date of Inspection</td>
<td>30/09/2017</td>
</tr>
<tr>
<td>CCTV Inspector</td>
<td>Rick Green Qualification : NWPNET017</td>
</tr>
<tr>
<td>Date of Examination</td>
<td>5/10/2017</td>
</tr>
<tr>
<td>Video Nos</td>
<td>XYZ-100-V01 to V08</td>
</tr>
<tr>
<td>Photograph Nos</td>
<td>XYZ-100-P01 to P207</td>
</tr>
</tbody>
</table>

Satisfactory Compliance with SA Water TS0524, Appendix A  
Y/N - N

Inspector advised Constructor of all reportable defects:  
Y/N - Y

Constructor advised SA Water Representative :  
Y/N - Y

Signed : **Rick Green**  
**CCTV Inspector**  
Date : 1/08/2017

**Jack Thomas**  
**Constructor**  
Date : 4/08/2017
# CCTV Acceptance Test Report

**Report No.**: 123-4

**Project**: Seaford (St 100A)

**SA Water Contract No.**: 100/17

**CCTV Company**: XYZ Inspection Services

**CCTV Inspector**: Rick Green

## Legend

<table>
<thead>
<tr>
<th>Defect Code</th>
<th>Quantification</th>
<th>Measured Value</th>
<th>A/ NA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>C, L</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Rectification required</td>
</tr>
<tr>
<td>D</td>
<td>Table 5.4</td>
<td>A</td>
<td>A</td>
<td>Proving tool passed through</td>
</tr>
<tr>
<td>WL</td>
<td>70mm</td>
<td>56mm</td>
<td>A</td>
<td>&gt; 50 lots</td>
</tr>
<tr>
<td>WL</td>
<td>70mm</td>
<td>49mm</td>
<td>NA</td>
<td>&lt; 50 lots - rectification req'd</td>
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<tr>
<td>DI</td>
<td>8mm</td>
<td>6mm</td>
<td>A</td>
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## REPORTABLE ITEMS: Defect Summary List

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>V01</td>
<td>P04-06</td>
<td>3-1</td>
<td>00</td>
<td>84.75</td>
<td>8.70</td>
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<td>NA</td>
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<tr>
<td>2</td>
<td>V02</td>
<td>P39-42</td>
<td>3-2</td>
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<td>170.20</td>
<td>143.26</td>
<td>D</td>
<td>Table 5.4</td>
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<tr>
<td>3</td>
<td>V04</td>
<td>P122-124</td>
<td>4-2</td>
<td>50.29</td>
<td>204.62</td>
<td>93.55</td>
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<td>V04</td>
<td>P148, 149</td>
<td>4-3</td>
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<td>V07</td>
<td>P188</td>
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