Guidelines for closed circuit television (CCTV) inspection of newly constructed sewers

These guidelines outline inspection, reporting and acceptance requirements for newly constructed rigid and flexible sewers.

Closed circuit television (CCTV) inspections of newly constructed sewers are required to identify defects before newly constructed sewers are accepted by Power and Water Corporation (PWC) as these defects often shorten the life of the asset and/or lead to operational problems. CCTV inspection will be in addition to existing certification requirements and is to be completed prior to acceptance of any gifted asset.

PWC expects a newly constructed sewer to have a life in excess of 100 years.

PWC will not accept handover of a sewer if CCTV and/or visual inspection identifies that the sewer exceeds Grading Level 1 from Table E5 or Table E6 for any of the following:

- structural grading peak score;
- structural grading mean score;
- service grading peak score; or
- service grading mean score.

Where a defect is identified by CCTV and/or visual inspection to exceed any peak score or mean score limit, the defect shall be rectified or repaired and the sewer re-inspected from node to node (ie new CCTV footage taken from node to node to replace previous footage).

No report or CCTV footage showing unacceptable defects shall be submitted to PWC in conjunction with a handover request.

Prior to CCTV inspection, sewers shall be tested in accordance with PWC requirements (vacuum, air or hydrostatic testing or a combination thereof). Also, prior to any CCTV inspection, sewer lines and maintenance structures shall be thoroughly cleaned.

For new sewer lines of less than 100 metres, please confirm requirements with Services Development prior to undertaking a CCTV inspection.

PWC request the right to be present at any CCTV inspection and require at least seven (7) days notice in Darwin and Alice Springs and at least fourteen (14) days notice for all other areas.

CCTV inspection requirements

CCTV acceptance inspection of sewers shall be generally conducted in accordance with Conduit Inspection Reporting Code of Australia (CIRCA) - WSA 05-2008.

In addition, the operator shall investigate, describe, identify and report on the defects or features in accordance with the criteria.

Where required, specialised instruments, apparatus and/or software shall be used to facilitate measurement of parameters to determine acceptance. Hardware and software used in measuring the parameters shall be correctly calibrated for each application using the manufacturer's recommended methods.

Inspection report

General

The inspection report shall consist of:

a) operator's report detailing the observations;
b) a video record of the entire inspection;
c) photographs of features of interest; and
d) in addition the report may also include:
   i) brief edited video clips of features of interest; and
   ii) a preliminary grading of the structural and service condition of the sewer or maintenance structure

Electronic versions of the inspection report, including still and video images of the inspection, shall be submitted on a DVD labelled with:

a) location of the asset inspected;
b) the date(s) of inspections;
c) asset numbers, manhole numbers as required to identify the sewer(s) inspected;
d) size; and
e) material type.

Mandatory information

The following information shall be recorded in all circumstances:

a) textual description of the location (eg street address, directory reference);
b) name of the developer and constructions;
c) name of the company performing the inspection and the name of the operator;
d) date of inspection;
e) time of commencement of inspection;
f) precipitation at the time of inspection; and
g) the start and finish maintenance structures shall be defined by node references as shown on the 'as constructed' drawings.

Operator's report

The Operator shall provide a report in electronic format on the location and characteristics of reportable features including defects and features of interest together with such header details necessary to define the details of the inspection in accordance with the requirements of CIRCA Code. Unless otherwise specified in writing, all features shall be reported using CIRCA codes.

a) The report shall cover all details of reportable features and describe, identify and report on any defects or features of interest and continuous video recording of the section between access chamber to access chamber, including graph showing grade of pipe.
b) Reports shall be prepared and submitted in an electronic format with photographs and include a summary of all recorded defects and observations.
c) A clear still image of all joints, junction, defects or features of interest and grade of pipe.

Preliminary grading of internal condition

The inspection report shall include a preliminary grading of the structural and service condition of the sewer, calculated in accordance with the CIRCA scoring criteria (refer Attachment A).

Photographs

A photograph shall be taken every time one of the following defects is encountered:

a) collapsed, deformed or broken conduits or maintenance structures;
b) multiple fractures;
c) defective junction or connection; and
d) significant infiltration.

At least one image at an observation shall be a 'straight ahead view' showing the defect or feature in the context of the conduit. Images from zoomed, tilted or panned camera are considered supplementary and shall not be used alone. At least one photograph shall be captured with the defect centred in the picture.

Still photographs shall have a minimum resolution of 400,000 pixels.

Lighting, iris and focus should be adjusted to ensure a quality image. If the feature is not identifiable it may be useful to capture several images from different positions.

Video clips

Video clips provide valuable information that sometimes cannot be obtained from still images.

Video clips should be used where there is defect/feature that cannot be adequately illustrated by a still image. The report can also include edited video clips of general condition and significant features.

The clip shall be arranged to provide a minimum period of two (2) seconds 'familiarisation time' in which the field of view moves from 'straight ahead' showing the defect or feature in the context of the general sewer environment and then pans, scans, zooms onto or moves past the feature of interest.

Camera travel, panning and zooming should be slow and steady during video clips.

Work as constructed

Inspection of sewers provides supplementary information to confirm 'as constructed' records.

In particular, the distance to junctions, connections, bends and other features measured during CCTV inspection may be used to verify their correct location. The distance measurements recorded for these features must follow consistent protocols and within the accuracy limits specified by CIRCA, so that the location of the features can be cross-checked to 'as constructed' drawings and any field returns.

Camera operation

Camera position

The camera shall be positioned to reduce the risk of picture distortion whilst travelling.

The camera shall view directly along the conduit axis.

Camera speed

Unless otherwise agreed in writing, the speed shall not exceed:

a) 0.1 m/sec for conduits of less than 200 mm internal diameter;
b) 0.15 m/sec for conduits of internal diameter >200 mm but <300 mm; and
c) 0.2 m/sec for conduits with internal diameters exceeding 300 mm.

CCTV camera

General

CCTV recordings shall be provided in WinCam v8 format on CD or DVD.

PWC stores CCTV footage in its graphical information system using WinCam v8.

Capability

The camera shall be capable of traversing all non-man entry maintenance structures and curved conduits with curvature up to 300 x conduit diameter or vertical dimension.

The camera lens shall be capable of being kept clean during the inspection.

The camera shall be capable of viewing the full lateral at junctions and connections while traversing downstream.

CCTV camera will be full colour with minimum of 400,000 pixels and the image shall be captured at a rate of 25 frames per second or higher.

Steerable cameras should be used for inspections.

Picture quality

The CCTV camera shall have suitable illumination and shall be capable of providing an accurate and clear record of the conduit's internal condition.

The camera manufacturer's accredited agent shall provide a declaration, at least annually and after any necessary repairs or modifications, that the camera has been adjusted correctly for:

a) white balance for the lighting systems used;
b) linearity;
c) focus distance/range; and
d) video signal.

Qualifications of CCTV operators

CCTV operators shall hold recognised qualifications issued by a Registered Training Organisation (RTO) in:

a) Occupational health and safety;
b) Confined space entry;
c) Work safely in the construction industry (Northern Territory White Card).

Future requirements

From 1 January 2013, CCTV Operators will be required to hold a Statement of Attainment in NWP331B 'Perform conduit condition evaluation' issued by a Registered Training Organisation (RTO) and based on WSA 05.

Also from 1 January 2013, CCTV equipment will be required to record inclination/fall of sewers and inspection reports shall include a graph showing sewer grade (inclination or fall).

ATTACHMENT A

Scoring of defects and the preliminary grading of apparent condition of sewers

Tables E1 to E6 set out a scoring and grading process.

The scores apply to gravity sewers and sanitary drains.

Scores, for all defects, are notionally applied to a one metre length of the sewer. Where defects are continuous, the score is applied to each metre of sewer within the length of the continuous feature.

If more than one defect occurs within that metre of sewer, the scores are added.

The peak score indicates the worst metre in terms of defects in the sewer between the nodes. Where more than one defect occurs within a single metre of sewer, the score for each defect within that single metre of the sewer shall be summed to give a peak score.

The mean score is the total of all defect scores divided by the conduit length. The mean score is expressed as XX/metre and is used to give an indication of the overall condition of the sewer.

Peak and mean scores are determined separately for the service and structural condition of the sewer.

Structural scoring is applied differently for conduits of rigid materials, flexible materials and brick or masonry to reflect the different level of risk associated with a specific defect in sewers of that material/construction.

Rigid materials include vitrified clay pipe and concrete pipe.

Flexible materials include PVC, GRP, polypropylene, polyethylene and ABS pipes or other pipes as covered by AS/NZS 2566.1 – Buried Flexible Pipelines – Structural Design.

Table E1
Structural defect scores - Pipe sewers - Rigid materials

Defect	Code	Ch1	Ch2	Q1	Score
Displaced joint	JD	L (Longitudinal)		10 - 20 mm 21 - 30mm >30mm	0.5 2 5
		R (Radial)		5 – 10 mm 11 – 20 mm >20mm	2 5 15
Cracking	C	Any C (Circumferential) L (Longitudinal) M (Multiple) S (Simple)	S (Surface) W (Wall) W (Wall) W (Wall) W (Wall)		0.1 1 2 5 1
Fracturing	F	C(Circumferential) L (Longitudinal) M (Multiple) S (Simple)			8 15 40 8
Surface damage	S	W (Roughened) S (Spalling) AV (Aggregate visible) AP (Aggregate projects) AM (Aggregate missing) WS (Staining) CP (Visible build-up) T (Tuberculation) RC (Reo bar Corroded) H (Holes)		 <5% >5% 	2 20 2 10 40 5 20 5 30 80 100
Protective lining failure	L	B (Blisters) BU (Bulge) W (Wrinkle) WD (Defective weld) SU (Spiral joints) D (Detach/missing)		<5% >5% >50% >75%	5 30 50 60 40 40 80
Deformation*	D	Any		<5% >5%	1 10
Collapse	X				165
Soil visible	SV	These features are normally associated with some other defect. Score at this location to be the score arising from that/those other defects, or 60, whichever is the greater.			
Void visible	VV				
Soil ingress	ING				
Weld defect	W	C (Circumferential) L (Longitudinal) H (Helical)			8 15 8

Note: Rigid materials include vitrified clay pipe and concrete pipes

* A prover can assist in determining the degree of deformation (refer PWC Master Specification)

TABLE E2
Structural defect scores - Pipe sewers - Flexible materials

Defect	Code	Ch1	Ch2	Q1	Score
Displaced joint	JD	L (Longitudinal)		10 - 20 mm 21 - 30mm >30mm	0.5 2 5
		R (Radial)		5 – 10 mm 11 – 20 mm >20mm	2 5 15
Cracking	C	Any Any	S (Surface) W (Wall)		5 40
Fracturing	F	Any			80
Protective lining failure	L	B (Blisters) BU (Bulge) W (Wrinkle) WD (Defective weld) SU (Spiral joints) D (Detach/missing)		<5% >5% >50% >75%	5 30 50 60 40 40 80
Deformation*	D			<5% >5%	1 30
Collapse	X				165
Soil visible	SV	These features are normally associated with some other defect. Score at this location to be the score arising from that/those other defects, or 60, whichever is the greater			
Void visible	VV				
Soil ingress	ING				

NOTE: Flexible materials include PVC, GRP, polypropylene, polyethylene and ABS pipes

* A prover can assist in determining the degree of deformation (refer PWC Master Specification)

Table E3
Not included

Table E4
Service defect scores - All sewers

Defect	Codes	Ch1	Q1	Score1
Surface damage (corrosion products, tuberculation etc)	S	CP, T	<5% >5%	5 30
Debris (fouling, grease, silt etc)	DE	F, G, E, W S, R, C, Z	<5% >5%	5 30
Obstruction	OB	B, M, Z, I, J, C, P, S	<5% >5%	5 30
Roots	R	T F M RT RF RB	<5% >5%	10 1 5 30 5 1 10
Joint intrusion	JI	R Z		20 1
Infiltration	I	Sweating Dripping Running Gushing		0 1 2 10
Exfiltration	EX			50
Intruding connection	CI		<5% >5%	5 30
Defective connection	CX	Blockage or Roots Damaged Soil Entering	<5% >5%	5 30 30 50
Defective junction	JX	Blockage or Roots Damaged Soil Entering	<5% >5%	5 30 30 50

Table E5
Structural grading thresholds - All sewers

Grading	Description	Peak ScoreA	Mean Score1
1	Insignificant deterioration of the sewer has occurred. Appears to be in good condition.	<5	0 – 0.5
2B	Minor deterioration of the sewer has occurred. Minor defects are present.	5 – 9	>0.5 - 1.0

Notes: Rounded to the nearest whole number.

After written request, PWC may permit the use of Grading Level 2 where sewers were constructed more than 10 years prior to CCTV inspection.

Table E6
Service grading threshold - All sewers

Grading	Description	Peak ScoreA	Mean Score1
1	No or insignificant loss of hydraulic performance has occurred. Appears to be in good condition and there is little likelihood of sewer surcharge or overflow.	<5	0 – 1.0
2B	Minor defects are present causing minor loss of hydraulic performance and/or minor likelihood of sewer discharge.	5 – 9	>1.0 - 3.0

Notes: Rounded to the nearest whole number.

After written request, PWC may permit the use of Grading Level 2 where sewers were constructed more than 10 years prior to CCTV inspection.