

	OPTIONS	TYPE/ DESCRIPTION	LENGTH (m)	LINING SIZE (mm)	LINING MATERIAL	ELIMINATION OF INFILTRATION/EXFILTRATION
NON STRUCTURAL RENOVATION	CHEMICAL GROUTING	Impregnation of the soil surrounding the pipe with a curable compound, thus effectively sealing the soil. Chemical grouting can be used to treat entire pipe runs or single identifiable points.	Depending on diameter	Up to 600	Principally sodium silicate	Up to 100%. Pipe hydraulics and structural integrity remain unchanged.
	POINTING	Repair of localised defects with mortar, usually using hand tools.	Practical	Man-entry sewers	Mortar	Up to 100% locally
STRUCTURAL RENOVATION	PIPE BURSTING (Hydraulic & Pneumatic)	Technique which uses radial forces to break out and enlarge the existing pipe and thereby permit a new pipe to be simultaneously installed.	70-110 typical	60-630. Upsize available up to 800.	PVC-U. PE and clayware	Almost 100% as existing laterals are disconnected and reconnected in open cut.
	LINING WITH CURED-IN-PLACE PIPES	Flexible tube externally coated with a polyurethane membrane and internally with resin, is inverted on site by air/water pressure. The tube turns inside out and travels down the pipe	Typically 100-400m with 1 – 1000m in some conditions	75-2500	Unsaturated polyester resin & sheet mould compound	Maximum 80% reduction as reconnection of laterals by robot breaches pipe integrity. If lining of laterals is carried out from the main pipe reduction can go up to 95%
	SLIP LINING	Insertion by pulling or pushing of a new pipe into the old. The remaining annular space may be filled with granular material.	Typically up to 400	63-2500	MDPE	Maximum 80% reduction as reconnection of laterals by robot breaches pipe integrity.
	TEMPORARY REDUCTION IN DIAMETER (Modified Slip Lining)	Insertion of plastic pipe in reduced cross section, into the existing main. The pipe is then reverted to its original diameter by water pressure and should fit neatly into the existing pipe.	Over 1000 in the right conditions	75 - 450	Standard polymer pipe	Maximum 80% reduction as reconnection of laterals by robot breaches pipe integrity.
	COLLAPSED/FOLDED SECTION (modified Slip Lining)	Insertion of plastic pipe in folded section, which when warmed on site by hot air or water will revert to its original circular form	Up to 500	100 – 1100	Standard polymer pipe	Maximum 80% reduction as reconnection of laterals by robot breaches pipe integrity.
	SPIRAL WINDING	PVC ribbed profiles with interlocking edges will, when wound together, form a tube. The tube can be wound directly into an existing pipe in need of repair.	Up to 120	150 – 900	Specially formulated PVC compound	Maximum 80% reduction as reconnection of laterals by robot breaches pipe integrity.
	MAN-ENTRY LINING WITH PIPE SEGMENTS	Installation of a lining consisting of one or two pieces. In the one-piece system lining begins from a position furthest from the access point. In the two-piece system the crown and the invert panels can be passed through the relined area. Annulus grouting is required.	Depending on safety and access requirements	Up to 3000	GRC, PRC, Ferro cement, GRP	Almost 100% as existing laterals can be connected to the new liner with a watertight joint.
	MAN-ENTRY LINING WITH IN-SITU COATING	Application of a coating by pumping behind shuttering or by hand spraying directly onto the sewer surface	Depending on safety and access requirements	Up to 3000	Gunite, Ferro cement, Concrete cementitious mortar	Control of infiltration is required whilst the lining is curing. After curing the laterals can be restored to ensure complete elimination of infiltration
LOCAL REPAIR	Repair of localised defects using a short length of pipe or resin injection	Typically 1 to 3	Generally in the range 100 to 600	Various. Epoxy resin with or without fibreglass/ polyester felt	Up to 100%	

Pipeline Renovation Techniques (Abstract from CIRLA Project Report for RP501)