

# Master Specification

## Part PR-LS-C9

### Irrigation

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**Government of South Australia**  
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## PR-LS-C9 Irrigation

### 1 General

- a) This Master Specification Part specifies the requirements for the design, supply and installation of irrigation systems, including:
- i) the documentation requirements, as set out in section 2;
  - ii) the water supply requirements, as set out in section 3;
  - iii) the salvaged materials requirements, as set out in section 4;
  - iv) the requirements for setting out and checking of work, as set out in section 5;
  - v) the backflow prevention requirements, as set out in section 6;
  - vi) the trenching and boring requirements, as set out in section 7;
  - vii) the requirements for laying and jointing of pipes, as set out in section 8;
  - viii) the pipes and fittings requirements, as set out in section 9;
  - ix) the joints and jointing materials requirements, as set out in section 10;
  - x) the valve requirements, as set out in section 11;
  - xi) the valve box requirements, as set out in section 12;
  - xii) the filter requirements, as set out in section 13;
  - xiii) the sprinkler requirements, as set out in section 14;
  - xiv) the drip irrigation system requirements, as set out in section 15;
  - xv) the thrust block requirements, as set out in section 16;
  - xvi) the electrical requirements, as set out in section 17;
  - xvii) the control system requirements, as set out in section 18;
  - xviii) the As-Built Records requirements, as set out in section 19;
  - xix) the manuals and documentation requirements, as set out in section 20;
  - xx) the inspection and testing requirements, as set out in section 21;
  - xxi) the maintenance (Defects Liability Period) requirements, as set out in section 22; and
  - xxii) the Hold Point requirements, as set out in section 23.
- b) Unless specified otherwise in the Design Documentation, the Contractor is responsible for:
- i) completion of the final irrigation system Design Drawings;
  - ii) connection to water supply points;
  - iii) supply and installation of all components of the irrigation system;
  - iv) programming, flushing, commissioning and testing of the irrigation system; and
  - v) ensuring that the irrigation system is fully functioning.
- c) The design, supply and installation of irrigation systems must comply with the Reference Documents, including:
- i) in relation to water supply:
    - A. AS 1628 Water supply - Metallic gate, globe and non-return valves;

- B. AS/NZS 3500.1 Plumbing and drainage, Part 1: Water services; and
- C. Guidelines for Non-Drinking Water in South Australia Part 1 - Infrastructure, and Part 2 - On-site plumbing;
- ii) in relation to joints and jointing materials:
  - A. AS 1646 Elastomeric seals for waterworks purposes;
  - B. AS 2129 Flanges for pipes, valves and fittings;
  - C. AS 3688 Water supply and gas systems — Metallic fittings and end connectors; and
  - D. AS/NZS 3879 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings;
- iii) in relation to thrust blocks:
  - A. AS/NZS 2566.2 Buried flexible pipelines, Part 2: Installation;
- iv) in relation to pipes:
  - A. AS/NZS 1477 PVC pipes and fittings for pressure applications;
  - B. AS/NZS 2032 Installation of PVC pipe systems;
  - C. AS/NZS 2033 Installation of polyethylene pipe systems;
  - D. AS 2698.2 Plastics pipes and fittings for irrigation and rural applications, Part 2: Polyethylene rural pipe;
  - E. AS/NZS 4129 Fittings for polyethylene (PE) pipes for pressure applications;
  - F. AS/NZS 4130 Polyethylene (PE) pipes for pressure applications; and
  - G. AS 4809 Copper pipe and fittings - Installation and commissioning; and
- v) in relation to electrical:
  - A. AS/NZS 3000 Electrical installations; and
  - B. SAPN Service & Installation Rules Manual No. 32 (available from: <https://www.sapowernetworks.com.au/industry/service-installation-rules/>).
- d) For the purposes of this Master Specification Part, the definitions included in Table PF-LS-C9 1-1 will apply and will take precedence over PC-IN2 “Glossary of Terms” to the extent of any inconsistency.

**Table PF-LS-C9 1-1 Defined terms**

Term	Definition
Lateral	Means intermittently pressurised pipework with outlets attached, downstream from control valves
Mainline	Pipes that are constantly pressurised that feed water to control valves
Station	Output terminal of the automatic controller, valve or valve group
Submain	Manifold of controlled pressure to feed laterals

## 2 Documentation

### 2.1 Design Documentation

- a) In addition to the requirements of PC-EDM1 “Design Management”, the Design Documentation must include in relation to irrigation system design:

- i) detailed Design Drawings showing the location and size of all controllers, pipes, filters, and valves; and
  - ii) a specification.
- b) The Design Drawings and specification required by section 2.1a) must be submitted:
- i) in accordance with PC-EDM1 “Design Management”; or
  - ii) where PC-EDM1 “Design Management” does not form part of the Contract Documents, submitted to the Principal which will constitute a **Hold Point**. The supply and installation of the irrigation system must not commence until this Hold Point has been released.

## 2.2 Construction Documentation

In addition to the requirements of PC-CN3 “Construction Management”, the Construction Documentation must include:

- a) details of SA Water’s backflow prevention requirements and evidence of SA Water’s approval, in accordance with section 6b);
- b) a copy of licences to install backflow prevention devices, in accordance with section 6d);
- c) all necessary permits and approvals from SA Water, including special permission to install back flow devices below ground as required, in accordance with section 6e); and
- d) details of all areas containing rock material and the proposed removal methodology for the extraction of rock material, in accordance with section 7.2.

## 2.3 Quality Management Records

In addition to the requirements of PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable), the Quality Management Records must include:

- a) construction verification ensuring that the irrigation system has been constructed in accordance with the Design Drawings and specification in section 2.1a);
- b) a certificate of installation compliance upon completion of the installation of the backflow prevention device, in accordance with section 6f);
- c) test certificates for gate valves and swing check valves, in accordance with section 11.4b);
- d) certification of electrical compliance, in accordance with section 17.1d); and
- e) provision of manuals and documentation, in accordance with section 20a).

## 2.4 As-Built Records

As-Built Records must be submitted in accordance with section 19.

# 3 Water supply

- a) The location of the water service take off points must be in accordance with the Design Documentation.
- b) The number of water connection points (water meters per asset owner) must be minimised.
- c) The Contractor must organise SA Water service connections at the locations agreed with the Principal. The asset owner (either the Department or relevant municipal council) must also be engaged if required.
- d) All irrigation componentry must be new.
- e) If non-potable water is used, the Contractor must install visual identification systems in accordance with SA Water requirements, including:

- i) lilac coloured pipe or lilac coloured striping;
- ii) lilac coloured sprinkler covers, valve covers and valve boxes; and
- iii) adequate signage indicating the use of non-potable water in accordance with the Guidelines for Non-Drinking Water in South Australia Part 1 - Infrastructure, and Part 2 - On-site plumbing.

## 4 Salvaged materials

- a) Any existing irrigation components that are not required for the new irrigation system must either be:
  - i) decommissioned, removed from Site and disposed of so that they do not present a safety hazard to others; or
  - ii) exhumed, cleaned, and returned to the relevant municipal council if required.
- b) Any excavations required must be reinstated to finished grade as specified in the Design Documentation.

## 5 Setting out and checking of work

### 5.1 Setting out pipe

- a) For contract forms where the design has been provided by the Principal, if the Contractor becomes aware of any discrepancy or ambiguity in or between the Design Documentation, specification and actual conditions on the Site, they must notify the Principal as soon as practicable and before commencing work on the affected part of the Works.
- b) The Contractor must clearly identify the location of mainline pipe runs using paint or pegs. The Contractor must give 24 hours' notice to the Principal to inspect the marking out of the mainline pipe run locations, which will constitute a **Hold Point**. The Contractor must not commence trenching until this Hold Point has been released.
- c) The Contractor must clearly identify the location of lateral pipe runs using paint or pegs. The Contractor must give 24 hours' notice to the Principal to inspect the marking out of the lateral pipe run locations, which will constitute a **Hold Point**. The Contractor must not commence trenching until this Hold Point has been released.
- d) The Contractor must clearly identify the location of control valves using paint or pegs. The Contractor must give 24 hours' notice to the Principal to inspect the marking out of the control valve locations, which will constitute a **Hold Point**. The Contractor must not commence trenching until this Hold Point has been released.
- e) The Hold Points in sections 5.1b), 5.1c) and 5.1d) can be combined into one inspection if the set-outs are ready at the same time.
- f) The Contractor must set out the pipework to enable the sprinkler and drip tube to be installed in locations in accordance with the Design Documentation and ensure uniform coverage. Any variations in the set out of the pipework to avoid obstacles must be approved by the Principal, which will constitute a **Hold Point**. The Contractor must not commence trenching until this Hold Point has been released.

### 5.2 Connections to existing mainlines

The Contractor must make all necessary provision for exclusion of water from the pipes while a connection to existing mainlines is being made.

## 6 Backflow prevention

In relation to the installation of backflow prevention, the Contractor must:

- a) install approved backflow prevention devices to all water supply points in accordance with:
  - i) AS/NZS 3500.1 Plumbing and drainage, Part 1: Water services; and
  - ii) SA Water requirements;
- b) provide the details of SA Water's requirements and evidence of SA Water's approval to the Principal as part of the Construction Documentation;
- c) ensure that the backflow prevention devices are installed by a person licenced to install and test backflow devices;
- d) provide a copy of the licences required by section 6c) to the Principal as part of the Construction Documentation;
- e) obtain all necessary permits and approvals from SA Water, including special permission to install back flow devices below ground as required, and provide this information to the Principal as part of the Construction Documentation;
- f) supply the Principal with a certificate of installation compliance upon completion of the installation of the backflow prevention device as part of the Quality Management Records;
- g) at each meter site, install:
  - i) a double check backflow prevention device approved by SA Water, 300 mm above the ground level adjacent to the water meter;
  - ii) double test cocks for maintenance and testing, and SA Water approved isolation valves either side of the meter;
  - iii) a bronze Y strainer approved by SA Water immediately upstream of the backflow device; and
  - iv) screwed bronze barrel union or flanges (in accordance with AS 3688 Water supply and gas systems — Metallic fittings and end connectors) on the inlet and outlet side of the check valve;
- h) use copper with copper fittings for all above ground pipework with male and female threads made of dezincification resistance brass;
- i) install the base of the valve assembly on a minimum of 75 mm class N20 concrete with a conduit in the concrete to allow for the installation of the pipework;
- j) wrap the section of copper pipe installed in the conduit with Denso Tape or equivalent;
- k) install the backflow prevention device in a hot dip galvanised vandal proof cage that is removable (in accordance with the requirements in Appendix 5: Backflow prevention assembly - above ground), unless specified otherwise in the Design Documentation;
- l) install the backflow prevention device in accordance with the requirements of Appendix 4: Backflow prevention assembly - below ground, and Appendix 5: Backflow prevention assembly - above ground;
- m) install the following items in hard drawn copper:
  - i) connection of the potable water meter to the backflow device;
  - ii) all pipework from the potable water meter to the inlet-isolation valve; and
  - iii) the pipe from the isolation valve on the discharge side of the check valve to the irrigation main pipe; and
- n) ensure all copper pipework complies with AS 4809 Copper pipe and fittings - Installation and commissioning.



## 7 Trenching and boring

### 7.1 General

- a) Trenches for irrigation purposes outside of sealed roads must be constructed in accordance with Appendix 1: Trench details.
- b) Pipes for irrigation purposes under sealed roads must be placed in conduits installed by boring in accordance with RD-EW-C3 “Boring”.
- c) Where the Design Documentation requires the trenching of a sealed road, it must be constructed in accordance with RD-EW-C2 “Trench Excavation and Backfill”.
- d) The conduits required by section 7.1b) must:
  - i) consist of minimum of class 12 pressure pipe;
  - ii) be installed at the specified depth required for the pipe so that no deviation in pipe level occurs; and
  - iii) be 50 mm wider in diameter than the socket end of the pipe or connection to be covered by the conduit, or a minimum size of 50 mm in diameter.
- e) Where pavers are present in driveways and footpaths, the Contractor must minimise the number of pavers removed.
- f) Where trenches are shared with other cables, conduit, pipes, or detection tape:
  - i) the Contractor must ensure proper placement according to the Master Specification and Design Documentation; and
  - ii) if 2 pipes are installed in the one trench, they must be placed apart at least by the greater of 50 mm and the diameter of the smallest pipe.
- g) If trenching is proposed within the Tree Protection Zone (TPZ), an arborist must be engaged prior to trenching to advise on the most suitable alignment or pipe installation method to prevent damage to the tree. The Contractor must give 24 hours’ notice to the Principal to undertake a joint site inspection by the Principal and the arborist prior to providing the advice, which will constitute a **Hold Point**. The Contractor must not commence any trenching within TPZ until this Hold Point has been released.
- h) Pipes under sealed roadways must have a minimum depth of cover as specified in Table PR-LS-C9 9-1, subject to section 7.1j).
- i) In locations not under sealed roadways, all mainline and lateral trenches must have a minimum depth of cover as specified in Table PR-LS-C9 9-1, subject to section 7.1j).
- j) The depth of cover specified in section 7.1h) and 7.1i) can be aligned to other Utility Services if agreed with the relevant Utility Services Authority.
- k) Where the minimum cover specified in sections 7.1h) and 7.1i) cannot be achieved (e.g. to avoid other Utility Services), the Contractor must notify the Principal.
- l) When placing pipes in hot conditions, the Contractor must take precautions to ensure that the pipes will not become excessively stressed by subsequent contraction of the pipe at lower temperatures.
- m) The Contractor must install the mainline and give 24 hours’ notice to the Principal to inspect the installation of the mainline, which will constitute a **Hold Point**. The Contractor must not commence backfill of the mainline until this Hold Point has been released.

### 7.2 Rock

The Contractor must include the following as part of the Construction Documentation:

- a) details of all areas identified as containing rock material that cannot be removed by manual tools or a standard backhoe with appropriate attachments; and
- b) if applicable, the proposed removal methodology for extraction of the rock material identified in section 7.2a).

### 7.3 Alignment of trenches

- a) Trenches must be aligned with surface visible items such as kerbs, plantings, sprinklers, and valve locations.
- b) The Contractor must peg all mainline and lateral pipes and use string lines where instructed in the Design Documentation for straight line trenching. The trench must not vary by more than one trench width from the string line.
- c) When there is a need to divert around obstacles:
  - i) the trench must be offset parallel to the first trench and 45° angles must be used to join the pipes;
  - ii) deflecting the pipe is permitted when the radius is not less than the recommended 130 times the nominal pipe diameter or within the manufacturer's joint deflection tolerances; and
  - iii) abrupt changes in horizontal alignment must be made only where specified bends are provided.

### 7.4 Directional boring beneath buildings, gardens and other places

- a) The Contractor must directional bore under existing paths, roads, buildings, trees, lawn, garden plots or similar in accordance with the Design Documentation.
- b) Where trees are designated to be preserved during the directional boring in accordance with the arborist's advice in section 7.1g):
  - i) the preserved trees must be protected at all times;
  - ii) pipelines adjacent to or under the preserved trees must be laid without interference to the limbs and roots; and
  - iii) the Contractor must hand excavate past or directional bore under the preserved trees and tree roots.

### 7.5 Excavated material

- a) Material excavated from the trench must be deposited in such a manner as to not obstruct any drain, roadway, footpath, right of way or building access and must not be deposited against the wall of any building or fence, or areas to be landscaped or have been landscaped.
- b) Any topsoil excavated from the trench must be kept separate from other material to allow for respreading at the completion of the trench, unless:
  - i) the trench is to be landscaped, in which case the material from the trench must not be used as backfill, and soil in accordance with PR-LS-C7 "Topsoil and Earthworks" must be used; or
  - ii) the material excavated from the trench is contaminated, in which case it must be disposed of off-site in accordance with environmental requirements.
- c) The Contractor must remove surplus excavated materials from the Site as soon as practicable.
- d) Any rock excavated from the trench must not be used for backfill and removed from Site by the Contractor.

## 7.6 Reinstatement of paved areas

- a) Subject to section 7.6b), where the Contractor has installed irrigation in paved areas including roads, footpaths, driveways, and carparks, the Contractor must:
  - i) reinstate the pavement to the same condition that existed prior to the excavation of the trench; and
  - ii) not reinstate the area with pavement of a lesser standard and thickness than the existing pavement.
- b) If a trench crosses a road maintained by the Commissioner of Highways, the Contractor must reinstate the pavement in accordance with RD-PV-C6 "Reinstatement of Existing Pavements".

## 7.7 Reinstatement of unpaved areas

Where the Contractor has installed irrigation in unpaved areas, the Contractor must:

- a) replace any topsoil that was present, level off the surface, and remove stones, debris, and other undesirable materials;
- b) top up and re-compact any trench which subsides during the Defects Liability Period; and
- c) provide final surface treatments as set out in the Design Documentation.

# 8 Laying and jointing of pipes

## 8.1 General

- a) Pipes must be laid complete with all valves and fittings in accordance with the Design Documentation.
- b) No pipes or wiring must be laid beneath a concrete, paved, or bituminous driveway, footpath, or roadway unless contained within a conduit.
- c) No joins in either wiring or pipes must occur within, or within 500 mm of, the conduit section.

## 8.2 Witness marks

Where the use of witness marks is recommended by pipe manufacturers, they must be marked on the pipe spigot and must remain visible after making the joint.

## 8.3 Making joints and tolerances

- a) Pipes must be laid by inserting spigots into sockets.
- b) Only manual jointing is permitted and excavation plant must not be used to push pipes into sockets.
- c) Tolerances and deflections must not exceed those defined by the pipe manufacturers.
- d) uPVC and poly pipe must be cut square with a fine tooth saw or tube cutter, and burrs must be removed prior to making joints.

## 8.4 Prevent dirt from entering pipes

- a) Pipes and fittings must be free from dirt or foreign matter before being laid.
- b) All pipe ends must be sealed at all times until the completion of the relevant works.

## 8.5 Flushing

- a) All pipes must be flushed at the maximum velocity possible given the available valving, pump, or mains pressure.

- b) The pipes must be flushed repeatedly using start-up surges to move debris downstream.
- c) The flushing in accordance with section 8.5a) and 8.5b) must occur immediately at final installation and prior to operation of the irrigation system. The Contractor must give 24 hours' notice to the Principal to attend the mainline and lateral flushing, which will constitute a **Hold Point**.

## 9 Pipes and fittings

### 9.1 uPVC pipes and fittings

- a) All uPVC pipes and fittings must:
  - i) conform to AS/NZS 1477 PVC pipes and fittings for pressure applications; and
  - ii) be installed according to AS/NZS 2032 Installation of PVC pipe systems.
- b) Solvent weld joints must be made using cement to AS/NZS 3879 Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings.
- c) All uPVC pipes must be class 12 minimum.
- d) uPVC pipes less than 80 mm nominal diameter must use solvent welded joints.
- e) All pipes of 80 mm or greater must use rubber ring joints.
- f) All fittings must be uPVC to class 18 and solvent weld jointed.
- g) When non-potable water is being utilised, all uPVC pipes must be lilac coloured and all mainline and lateral trenches must have lilac marker detection tape installed 250 mm below surface level. Mainline detection tape must have stainless steel wire.
- h) Suitable fittings must be used to prevent kinking in uPVC pipes.

### 9.2 High density polyethylene pipes and fittings

- a) All polyethylene pipes must:
  - i) be minimum PE100;
  - ii) be PN12.5 for mainline pipe;
  - iii) be PN10 for lateral pipe; and
  - iv) use compression type joints in accordance with manufacturer's specifications.
- b) Polyethylene fittings above 63 mm diameter must be electrofusion.
- c) When non-potable water is being utilised, all pipes must be lilac coloured, and all mainline and lateral trenches must have lilac marker detection tape installed 250 mm below surface level. Mainline detection tape must have stainless steel wire.
- d) All high-density fittings must conform to AS/NZS 4129 Fittings for polyethylene (PE) pipes for pressure applications.

### 9.3 Depth of cover to top of pipes

The depth of cover to the top of pipes must comply with Table PR-LS-C9 9-1.

**Table PR-LS-C9 9-1 Cover to pipes**

Location of pipe or pipe type	Minimum cover
Under a sealed road	1.0 m
Mainline pipework	450 mm
Lateral pipework	350 mm
Low density polyethylene drip tube	Laid on the surface and covered with mulch to a depth in accordance with PR-LS-C2 "Planting"

## 9.4 Copper fittings

Connections to copper pipework must be made by copper weld on fittings or optional compression fittings.

## 10 Joints and jointing materials

Joints and jointing materials must be in accordance with Table PR-LS-C9 10-1.

**Table PR-LS-C9 10-1 Joints and jointing materials**

Pipe material	Pipe size	Joint type	Jointing method	Standard
uPVC	All pipes	Spigot and socket	Solvent material	AS/NZS 2033 Installation of polyethylene pipe systems
uPVC	All pipes	Rubber ring	Mechanical	AS 1646 Elastomeric seals for waterworks purposes
Polyethylene	All pipes	Screwed fittings	Mechanical (PTFE tape)	AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
Polyethylene	All pipes	Titan fittings	Mechanical	AS/NZS 4129 Fittings for polyethylene (PE) pipes for pressure applications
Polyethylene	All pipes	Stainless steel cobra clamps	Mechanical	AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
High density polyethylene	All pipes	Spigot and socket	Electrofusion	AS/NZS 4129 Fittings for polyethylene (PE) pipes for pressure applications

## 11 Valves

### 11.1 General

- a) All valves and their installation must comply with the relevant Reference Documents and SA Water requirements for their intended use.
- b) No valve must be used to terminate pipework.
- c) A minimum length of 2.0 m must be left between a valve and the end of a line. The end of the pipe must be capped and anchored.
- d) No valve must be installed at the same depth as the pipework.
- e) All valves must be installed close to the surface to allow for easy access and aid maintenance.
- f) The number of the valve shown on the irrigation Design Documentation must be identified on the outside of the valve box on a 200 mm x 100 mm aluminium plate or similar approved.

### 11.2 Pressure reducing valves

- a) At each connection to the mains water supply, a pressure reducing valve must be used.

- b) The pressure reducing valve required by section 11.2a) must be of a type that will adjust to the flow requirements within a set limit and maintain a fixed pressure. Friction losses within the pipework must be allowed for.

### 11.3 Isolation valves

Isolation valves must be:

- a) the same nominal size as the supply pipe;
- b) bronze with screwed connections in accordance with AS 1628 Water supply - Metallic gate, globe and non-return valves; and
- c) installed in accordance with Appendix 6: Isolation valve - installation detail.

### 11.4 Gate valves and swing check valves

- a) Gate valves and swing check valves must be:
  - i) the same size as the pipes in which they are incorporated; and
  - ii) tested in accordance with section 11.4b).
- b) The body of each gate valve and swing check valve must be factory tested under a test pressure equal to 2,000 kPa. Copies of test certificates must be provided to the Principal prior to valve installation as part of the Quality Management Records.
- c) Gate valves and swing check valves must be constructed from bronze, cast iron or stainless steel with flanges or screwed connections. If specified in the Design Documentation, an approved spring-loaded check valve (non-return valve) must be installed.

### 11.5 Solenoid valves

- a) Solenoid valves must be:
  - i) installed in accordance with Appendix 2: Solenoid valve 50 mm - typical installation detail and Appendix 3: Solenoid valve 25 mm - typical installation detail; and
  - ii) serviceable without removing the valve body from the pipeline.
- b) When non-potable water is being utilised, the solenoid valve must have a lilac flow control handle in accordance with SA Water requirements.

## 12 Valve boxes

- a) All valves must be installed in valve boxes of suitable size to allow easy access for maintenance.
- b) The valve boxes required by section 12a) must:
  - i) be constructed from green high-density polypropylene, unless non-potable water is utilised, in which case a lilac coloured valve box lid must used;
  - ii) be lockable and rectangular;
  - iii) have a lid secured down with a stainless steel anti-theft threaded bolt;
  - iv) set flush with the final grade;
  - v) have metal detection tape attached underneath the lids;
  - vi) allow ready access to the hand wheels or control levers; and
  - vii) be capable of withstanding being run over by motor vehicles of 3 t gross weight.

- c) All valve boxes, excluding concrete boxes, must be mounted on a concrete paving slab or bricks. Bricks must be used to adjust the height of the valve boxes and backfilled with washed quarry sand or 10 mm gravel aggregate to prevent contact with the pipe.
- d) No part of the valve box must rest on any pipe or fittings.
- e) Bricks and valve boxes must be constructed so that the soil level inside the valve box remains lower than the bottom of the valve.
- f) Isolation valve boxes must allow ready access to the hand wheels or control levers.
- g) Surrounding soil must be prevented from entering the valve box.
- h) Valve box size and installation must enable proper function of valves and permit ongoing maintenance of all internal components including filters, valves and solenoids.

## 13 Filters

The filter must be installed in a separate valve box and must have a 120 mesh screen.

## 14 Sprinklers

### 14.1 Type and size

- a) Sprinklers must be of the type and size specified in the Design Documentation.
- b) Pop-up sprinklers must be:
  - i) installed to finished grade;
  - ii) perpendicular to the surface; and
  - iii) installed in accordance with Appendix 7: Pop up sprinkler - typical installation detail.
- c) Part circle sprinklers must be adjustable.
- d) Where a part circle sprinkler is positioned adjacent to a hard edge (concrete path, paving, etc.), the body of the sprinkler must be no more than 50 mm from the hard edge.
- e) All sprinklers must stainless steel.
- f) Sprinkler heads must be set on compacted soil to the height of the finished design level and be reset to that height as required by the Contractor for the duration of the Defects Liability Period.
- g) The thread size of the riser must be the same as the inlet thread size of the sprinkler.
- h) Sprinklers must be installed on polyethylene 300 mm articulated risers using 3 threaded elbows.
- i) The Contractor must install and adjust correct arc to each sprinkler to match site conditions.

### 14.2 Connection

- a) All sprinklers must be installed to manufacturer's instructions.
- b) The Contractor must mark out the position of each sprinkler before installation.
- c) Sprinklers must be installed within 100 mm of the location set out in the Design Documentation.
- d) The Contractor must give 24 hours' notice for the Principal to inspect the marking out of the sprinkler positions, which will constitute a **Hold Point**. Installation of sprinklers must not commence until this Hold Point has been released.

## 15 Drip irrigation system

### 15.1 General

- a) Each dripline must be flushed to remove dirt immediately at final installation prior to the operation of the irrigation system.
- b) Pressure reduction valves must be adjusted so that the pressure is within the range of 80 to 120 kPa.
- c) All drip tube must lie on the finished ground surface.
- d) Flushing and commissioning may be carried out in sections of the drip irrigation system.
- e) At the end of a section of drippers there must be a flushing valve the same size as the pipe.
- f) If using an isolation valve, a short length of hose must be attached to allow water to be directed on to the garden area during flushing.
- g) The downstream end of the dripline must be fitted with an end stop.
- h) The Contractor must give 24 hours' notice for a joint inspection by the Principal and the Contractor of the layout of drip tube and visual checks for leaks, which will constitute a **Hold Point**. The Contractor must not cover any part of the drip system until this Hold Point has been released.

### 15.2 Drip irrigation fittings

- a) All drip tube must be held in place with Asta stakes or equivalent at a minimum of 3 m intervals. If alternatives to Asta stakes are proposed, the Contractor must provide details of the proposed alternatives to the Principal in accordance with PC-CN3 "Construction Management" for approval by the Principal.
- b) All poly fittings must be Antelco SB (single barbed) or equivalent.
- c) All clamps must be NORMACLAMP® COBRA clamps or equivalent.

### 15.3 Drip irrigation for landscape garden beds

Drip irrigation for landscape garden beds must be in accordance with the Design Documentation.

### 15.4 Drip irrigation for trees

Drip irrigation for trees must be run on a separate station from drip irrigation for landscape beds.

## 16 Thrust blocks

- a) Anchor and thrust blocks must be provided at all changes in direction, where branches occur at blank ends and generally wherever an out of balance force is generated by the pressure and velocity of water in the main run pipe.
- b) The anchor and thrust blocks required by section 16a) must be in accordance with:
  - i) Appendix 9: Thrust blocks; and
  - ii) AS/NZS 2566.2 Buried flexible pipelines, Part 2: Installation.
- c) The allowable bearing pressure for the design of the thrust blocks must be in accordance with manufacturer's specifications.
- d) Concrete thrust blocks must have:
  - i) a minimum volume of 0.025 m<sup>3</sup>;
  - ii) a polyethylene film 0.2 mm thick placed between the pipe and the concrete;



- iii) concrete that does not encase more than half the diameter of the pipe; and
- iv) concrete that has been cured for a minimum of 48 hours prior to testing.

## 17 Electrical

### 17.1 General

The Contractor must:

- a) install all low voltage electrical wiring in accordance with:
  - i) AS/NZS 3000 Wiring Rules; and
  - ii) SAPN Service & Installation Rules Manual No. 32;
- b) ensure all new low voltage electrical wiring is installed by an electrician who is licenced in South Australia for such work;
- c) arrange all required SAPN connections and applications for supply for each service point; and
- d) provide a certificate of compliance to the Principal as part of the Quality Management Records.

### 17.2 Earthing and lightning protection

- a) Where earths are required by the Design Documentation or manufacturer's recommendations:
  - i) copper earthing rods must be installed so that resistance is less than  $8 \Omega$  to ground; and
  - ii) if the manufacturer of the irrigation controller has lightning protection equipment as an optional extra, the Contractor must supply and install all lightning protection equipment recommended by the manufacturer to achieve stable and reliable operation.
- b) Where earth stakes are required, they must be:
  - i) installed in compliance with AS/NZS 3000 Wiring Rules;
  - ii) present at the end of each decoder cable run, at each controller location and at no greater than 300 m intervals along the cable run; and
  - iii) installed at the nearest valve box location to the required interval.

### 17.3 Solenoid valve wiring

Low voltage wiring must comply with the following: all joints must be made with 3M Direct Bury Splice DBR/Y-6 connectors or equivalent. If alternate connectors are proposed, the Contractor must provide details of the proposed alternatives in accordance with PC-CN3 "Construction Management" for approval by the Principal;

- a) a minimum of one metre slack of wire neatly coiled must be provided at each solenoid valve to facilitate the removal of the coil when maintenance work is carried out;
- b) a single station must be installed at each solenoid valve;
- c) where possible, cable runs must be continuous between the controller and its destination;
- d) cable joints can be made in 150 mm isolation valve boxes, provided they are accurately marked on the As-Built Records;
- e) all cable must be polyethylene insulated and multi-stranded;
- f) common wires must be coloured black and minimum 2.5 mm<sup>2</sup>;
- g) active cables must be minimum 1.5 mm<sup>2</sup> with colour coding which does not change between the controller and the solenoid valve;

- h) expansion loops must be provided at intersections, bends and pipe crossovers;
- i) each controller must have its own cable and not be interconnected to another controller;
- j) underground wiring must be installed in electrical uPVC conduit;
- k) above ground wiring must be installed in a galvanized steel conduit;
- l) if conduits are laid in the same trench as water pipes they must be separated by a distance of 50 mm plus half the water pipe diameter; and
- m) solenoid valve wiring must be installed in accordance with Appendix 8: Irrigation control wiring - solenoid valve connection detail.

## 18 Control system

### 18.1 General

- a) The location of the irrigation controller must be confirmed on-site between the Contractor and the Principal, which will constitute a **Hold Point**. The installation of the irrigation controller on-site must not commence until this Hold Point has been released.
- b) The irrigation controller and necessary switch gear must be housed in an approved cabinet as described in accordance with Appendix 10: Irrigation control enclosure.
- c) The irrigation control enclosure must:
  - i) have vandal proof staple and hasps mounted at the top and bottom corners of the door;
  - ii) have a 3-point locking system with central handle and a mounting frame;
  - iii) have a door with rubber seals and a stainless steel wire door stop; and
  - iv) be coloured Woodland Grey.
- d) Electrical control cables must be copper (PVC insulated) and of sufficient size to allow long term operation of the control valves.
- e) The Contractor must make the electrical connection to the irrigation controller and install the specified number of general power outlets within the control cabinet.
- f) The Contractor must install decoder wiring from the valves to the irrigation controller. All control cable above ground to the irrigation controller must be installed within a conduit to AS/NZS 3000 Wiring Rules.
- g) Unless specified otherwise, the Contractor must program the irrigation controller.
- h) The Contractor must install an irrigation controller of solid state design with sufficient stations and run times to adequately provide for the Design Documentation.
- i) The irrigation controller must be fitted with a lithium or 9-volt battery to ensure that programming is not lost due to power failures.

### 18.2 ACC decoder system

- a) If specified in the Design Documentation, a decoder controller and all necessary components must be installed by the Contractor to the manufacturer's recommendations.
- b) The Contractor must ensure that each site has access to Global System for Mobile Communications (GSM) and the necessary components, including GSM sim cards to enable the Principal's operation of the irrigation system.

## 19 As-Built Records

- a) Within 2 weeks of completing the installation of the irrigation system, the Contractor must provide the Principal with a set of As-Built Records submitted in accordance with PC-CN2 "Asset Handover", accurately indicating all irrigation infrastructure design and installed.
- b) Without limiting the requirements of PC-CN2 "Asset Handover", the As-Built Records must:
  - i) be obtained using total station or GPS (to +/-50 cm accuracy) survey;
  - ii) be professionally labelled; and
  - iii) include all variations from the original Design Documentation.
- c) As-Built Records must be provided in AutoCAD format.

## 20 Manuals and documentation

- a) For the whole irrigation system and all its individual components, the Contractor must provide the Principal with the items listed in Table PR-LS-C9 20-1 as part of the O&M Manual, Quality Management Records or As-Built Records (as applicable).
- b) The Contractor must ensure that the Training Manual includes irrigation controller programming instructions and other necessary day-to-day operations. The Contractor must provide training pursuant to PC-CN2 "Asset Handover" on how to program the irrigation controller and other necessary day-to-day operations.

**Table PR-LS-C9 20-1 Manuals and documentation**

Item	Number of copies
Operating and maintenance instructions (including all set-points of all adjustable equipment) and schedules	3 copies, with one copy placed in a suitable holder in the control cubicle
Electrical wiring diagrams	3 copies, with one copy placed in a suitable holder in the control cubicle
Each guarantee	One copy in plastic sleeves within a folder
Test records	One copy in plastic sleeves within a folder

## 21 Inspection and testing

### 21.1 General

- a) The Contractor must undertake all testing necessary to verify that the irrigation system will perform to the intended level of service specified in the Design Documentation.
- b) Following completion of the installation of the irrigation system, the Contractor must:
  - i) complete several automatic cycles of the irrigation system without fault;
  - ii) test all components of the irrigation system to ensure proper function;
  - iii) pressure test the mainline and drip system in accordance with section 21.2; and
  - iv) check that the irrigation system complies with the requirements of this Master Specification Part, including the specification submitted in accordance with section 2.1a).

### 21.2 Mainline pressure test

- a) The Contractor must give 24 hours' notice to the Principal to attend a mainline pressure test. Provision of the successful mainline pressure test in the presence of the Principal will

constitute a **Hold Point**. Installation of the irrigation system beyond the solenoid valve must not proceed until this Hold Point has been released.

- b) The mainlined pressure test required by section 21.2a):
  - i) is deemed to be successful if, after applying a pressure of 1,000 kPa to all mainline pipework, the pressure has not dropped over 15 minutes;
  - ii) must not be performed earlier than 48 hours after pouring thrust blocks; and
  - iii) may be undertaken for separate sections of pipework.

### 21.3 Final inspection

- a) Following completion of the testing in accordance with sections 21.1b) and 21.2, the Contractor must provide at least 24 hours' notice to the Principal that the system is ready for the final inspection, which will be undertaken jointly by the Principal and the Contractor and will constitute a **Hold Point**. The installation of the irrigation system will not be considered complete until this Hold Point has been released.
- b) The final inspection undertaken jointly by the Principal and the Contractor must include:
  - i) checks for compliance with the requirements of this Master Specification Part, including the specification submitted in accordance with section 2.1a);
  - ii) pop-up height and alignment;
  - iii) trench compaction;
  - iv) drip tube row spacing;
  - v) check of correct operation of each irrigation station; and
  - vi) confirmation that each Third Party asset owner has an irrigation system as required by their respective Third Party Agreement.

## 22 Maintenance (Defects Liability Period)

- a) All work required during the Defects Liability Period including obtaining clearances and repair of damage to property must be carried out by the Contractor before final certification. The Defects Liability Period will be extended accordingly as set out in the Contract Documents.
- b) For the duration of the Landscape Maintenance Period, the Contractor must attend to all emergency calls within 24 hours.
- c) If during the Landscape Maintenance Period the Contractor does not attend to the emergency within 24 hours, the Principal reserves the right to engage others to rectify the problem and recover costs from the Contractor.
- d) In the event of any Defect rectification work not being carried out within 2 days (or shorter time if conditions are created that are hazardous and pose a safety risk to the community) of the need arising, the Principal may have the same work carried out by others and the cost will be deducted from any moneys due to the Contractor.

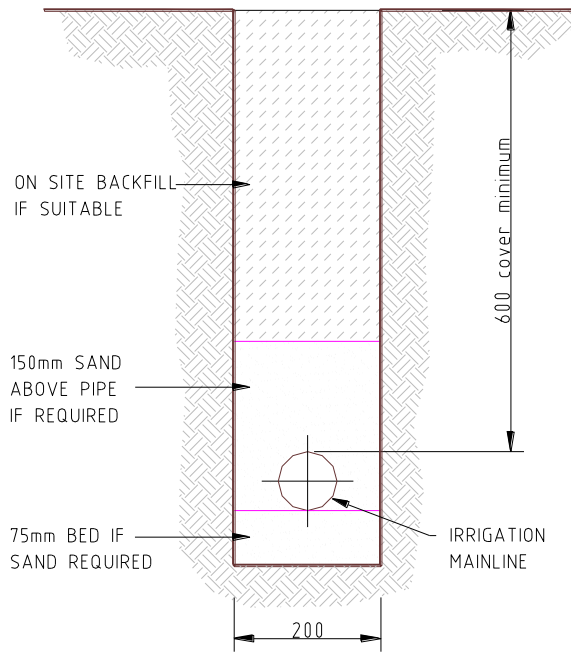
## 23 Hold Points

Table PR-LS-C9 23-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

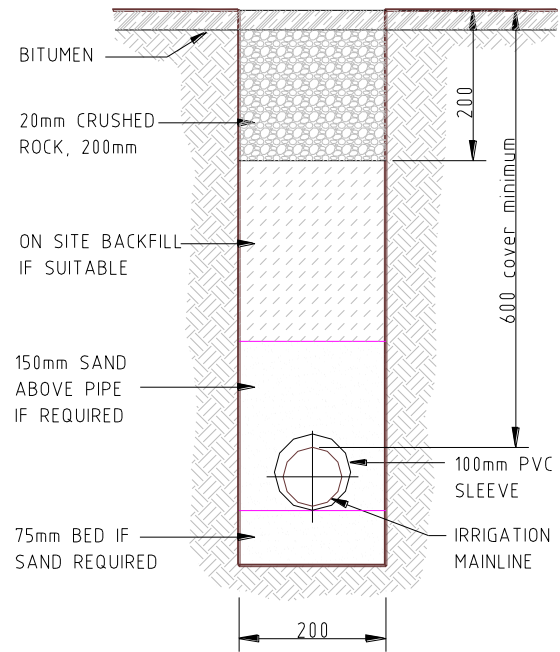
**Table PR-LS-C9 23-1 Hold Points**

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
2.1b)ii)	Submission of Design Drawings and specification	Documentation	10 Business Days review
5.1b)	Inspection of marking out of mainline pipe run locations	Construction quality	24 hours notification
5.1c)	Inspection of marking out of lateral pipe run locations	Construction quality	24 hours notification
5.1d)	Inspection of marking out of control valve locations	Construction quality	24 hours notification
5.1f)	Approval of variations to the set out of pipework to avoid obstacles	Documentation	3 Business Days review
7.1g)	Inspection prior to trenching in a TPZ	Construction quality	24 hours notification
7.1m)	Inspection of mainline installation prior to backfill	Construction quality	24 hours notification
8.5c)	Mainline and lateral flushing	Construction quality	24 hours notification
14.2d)	Inspection of marking out of sprinkler positions	Construction quality	24 hours notification
15.1h)	Inspection of layout of drip tube and visual checks for leaks	Construction quality	24 hours notification
18.1a)	Confirm location of controller on-site	Construction quality	3 days notification
21.2a)	Mainline pressure test	Construction quality	24 hours notification
21.3a)	Final inspection of the irrigation system	Construction quality	3 days notification

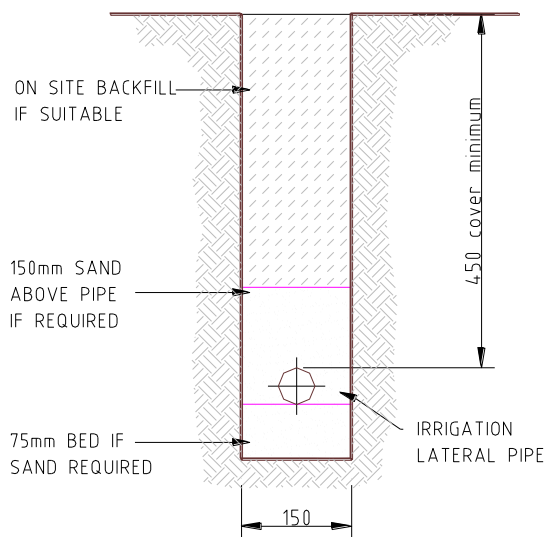
### 24 Appendix 1: Trench details



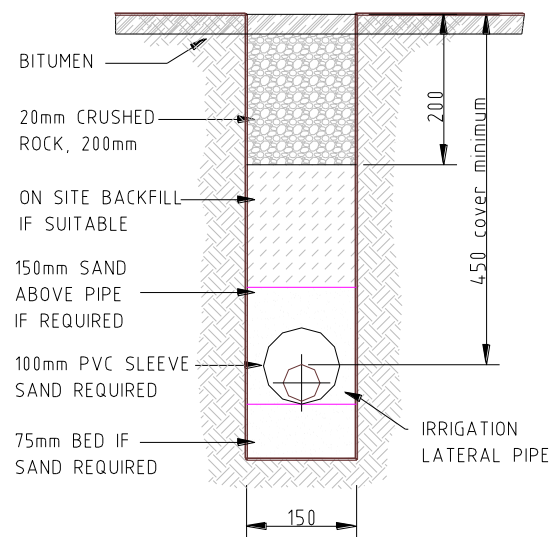
TYPICAL MAINLINE TRENCH DETAIL  
NOT TO SCALE



TYPICAL MAINLINE TRENCH DETAIL  
UNDER SEALED SURFACES  
NOT TO SCALE

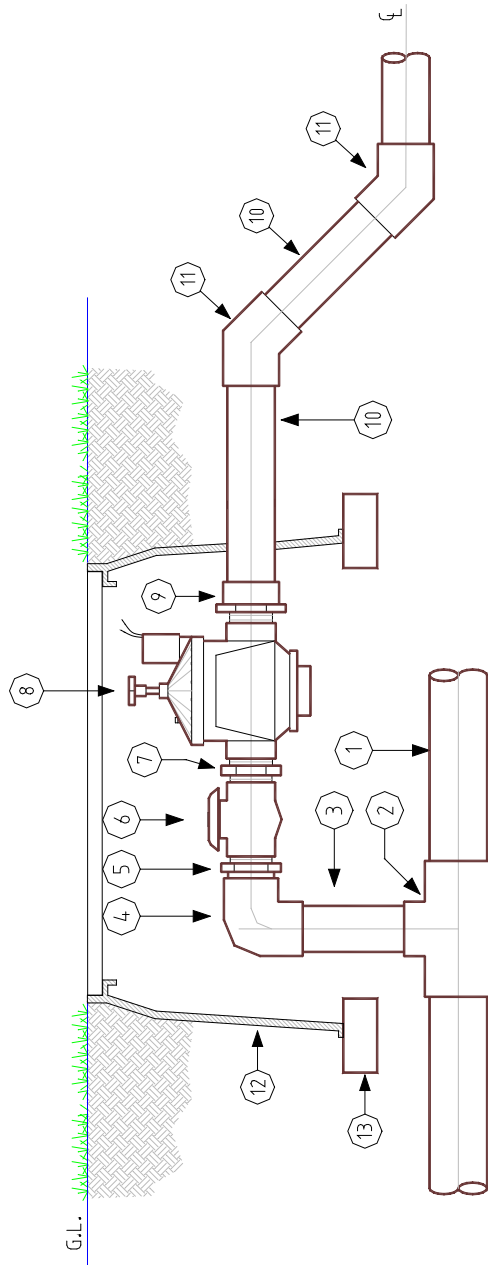


TYPICAL LATERAL TRENCH DETAIL  
NOT TO SCALE



TYPICAL LATERAL TRENCH DETAIL  
UNDER SEALED SURFACES  
NOT TO SCALE

## 25 Appendix 2: Solenoid valve 50 mm - typical installation detail

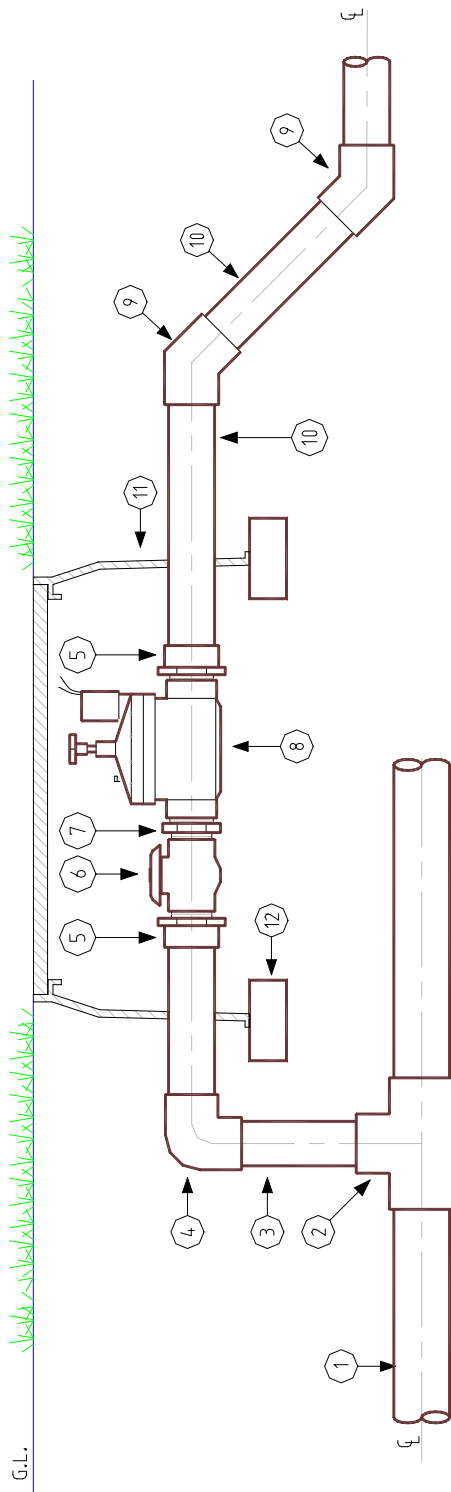


1. 80mm CLASS 12 uPVC MAINLINE
2. 80x50mm CAT.19 TEE
3. 50mm CLASS 12 PVC RISER
4. 50mm CAT.13 90° ELBOW
5. 50mm CAT.2 VALVE ADAPTOR
6. 50mm BALL VALVE
7. 50mm NIPPLE

8. 50mm SOLENOID VALVE
9. 50mm CAT.17 VALVE SOCKET
10. 50mm CLASS 9 PVC PIPE
11. 50mm CAT.10, 45° ELBOW
12. VALVE BOX
13. BRICK SUPPORT FOR VALVE BOX

SOLENOID VALVE  
TYPICAL INSTALLATION DETAIL NOT TO SCALE

## 26 Appendix 3: Solenoid valve 25 mm - typical installation detail



- 1. PVC IRRIGATION MAINLINE
- 2. TEE/ TAPPING SADDLE
- 3. 25mm PVC RISER
- 4. 25mm CAT.13 90° ELBOW
- 5. 25mm CAT.17 SOCKET
- 6. 25mm BALL VALVE

- 7. 25mm NIPPLE
- 8. 25mm SOLENOID VALVE
- 9. 25mm CAT.10, 45° ELBOW
- 10. 25mm PVC PIPE
- 11. VALVE BOX
- 12. BRICK SUPPORT FOR VALVE BOXES

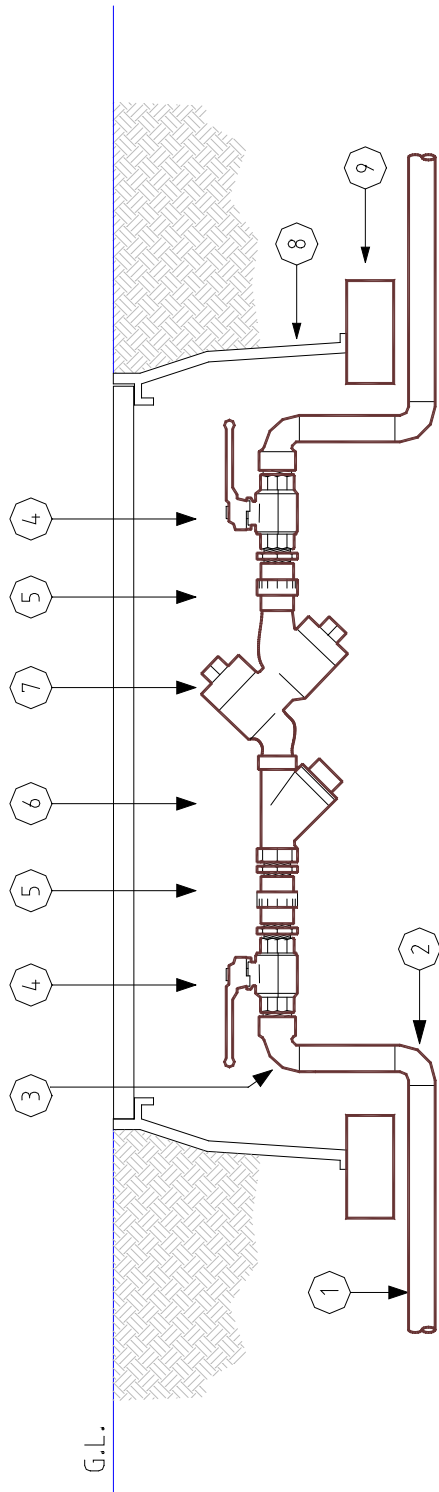
SOLENOID VALVE

TYPICAL INSTALLATION DETAIL

NOT TO SCALE



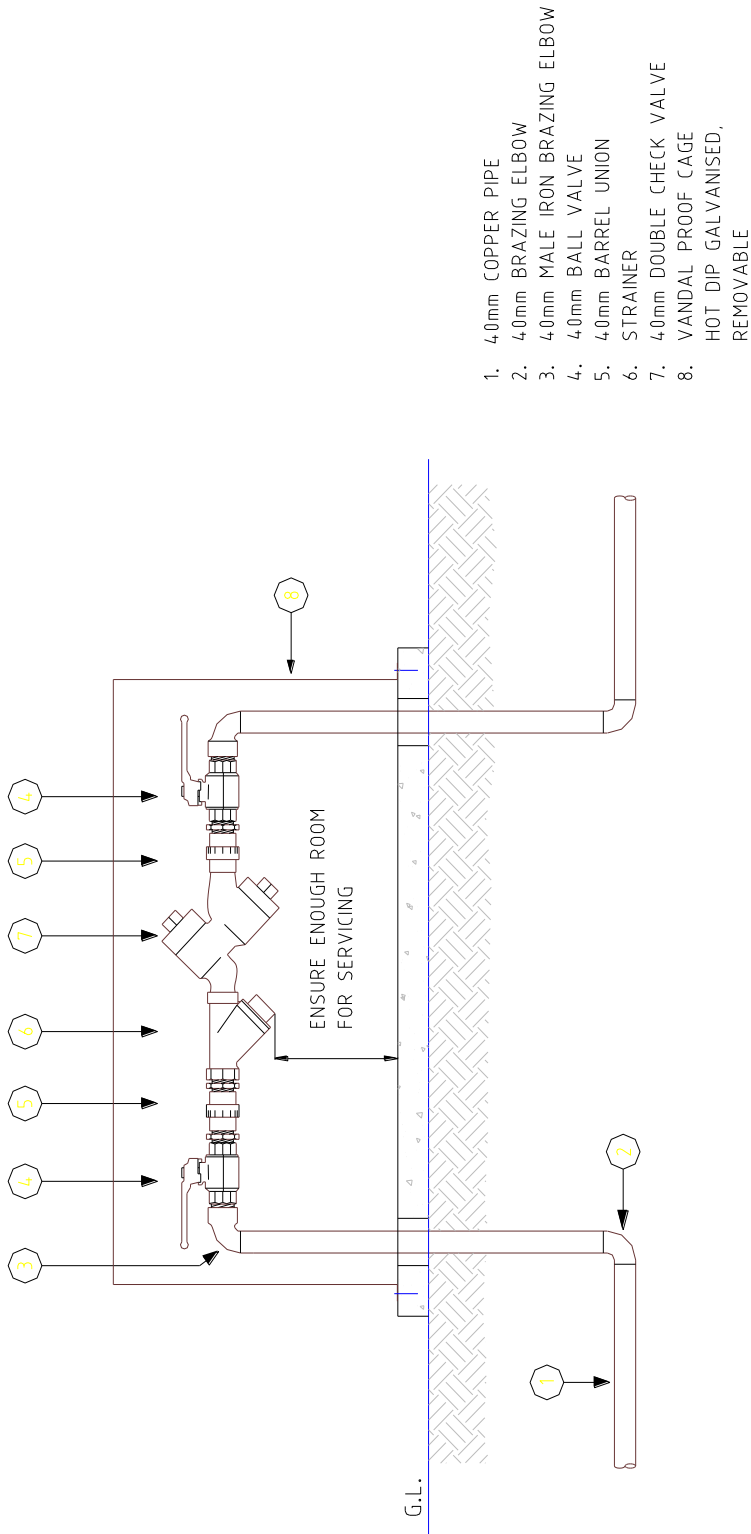
## 27 Appendix 4: Backflow prevention assembly - below ground



- |                                  |                                |
|----------------------------------|--------------------------------|
| 1. 4.0mm COPPER PIPE             | 6. STRAINER                    |
| 2. 4.0mm BRAZING ELBOW           | 7. 4.0mm FEBCO 805Y OR SIMILAR |
| 3. 4.0mm MALE IRON BRAZING ELBOW | DOUBLE CHECK VALVE             |
| 4. 4.0mm BALL VALVE              | 8. VALVE BOX                   |
| 5. 4.0mm BARREL UNION            | 9. BRICK SUPPORT               |

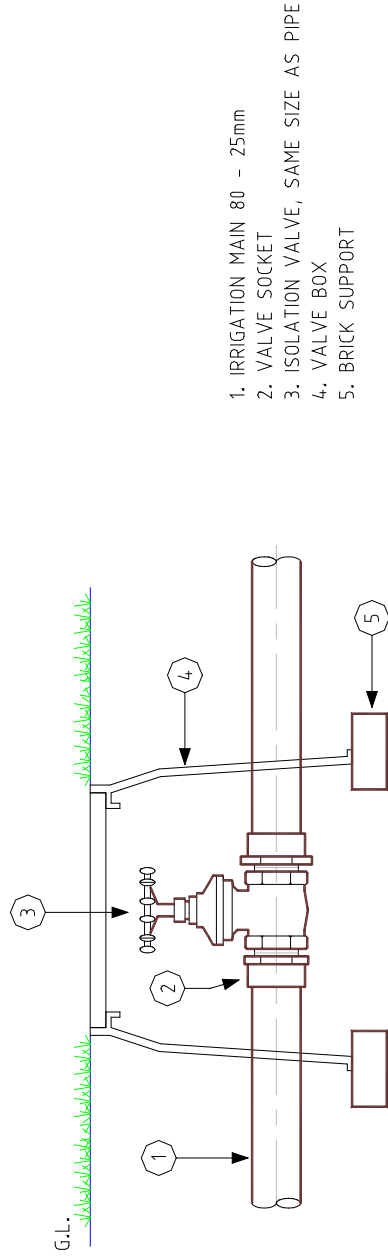
BACKFLOW PREVENTION ASSEMBLY  
 INSTALLATION DETAIL NOT TO SCALE

## 28 Appendix 5: Backflow prevention assembly - above ground



BACKFLOW PREVENTION ASSEMBLY  
INSTALLATION DETAIL NOT TO SCALE

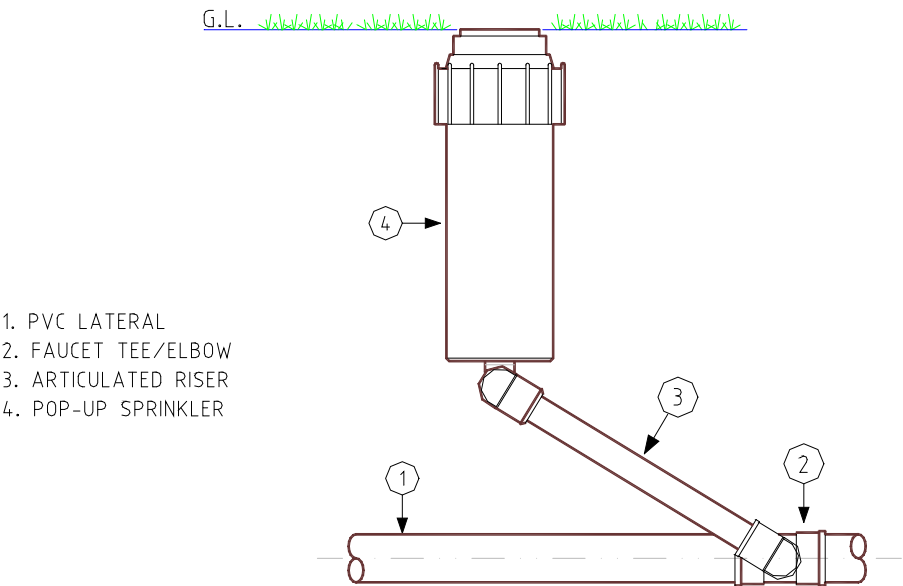
## 29 Appendix 6: Isolation valve - installation detail



NOT TO SCALE

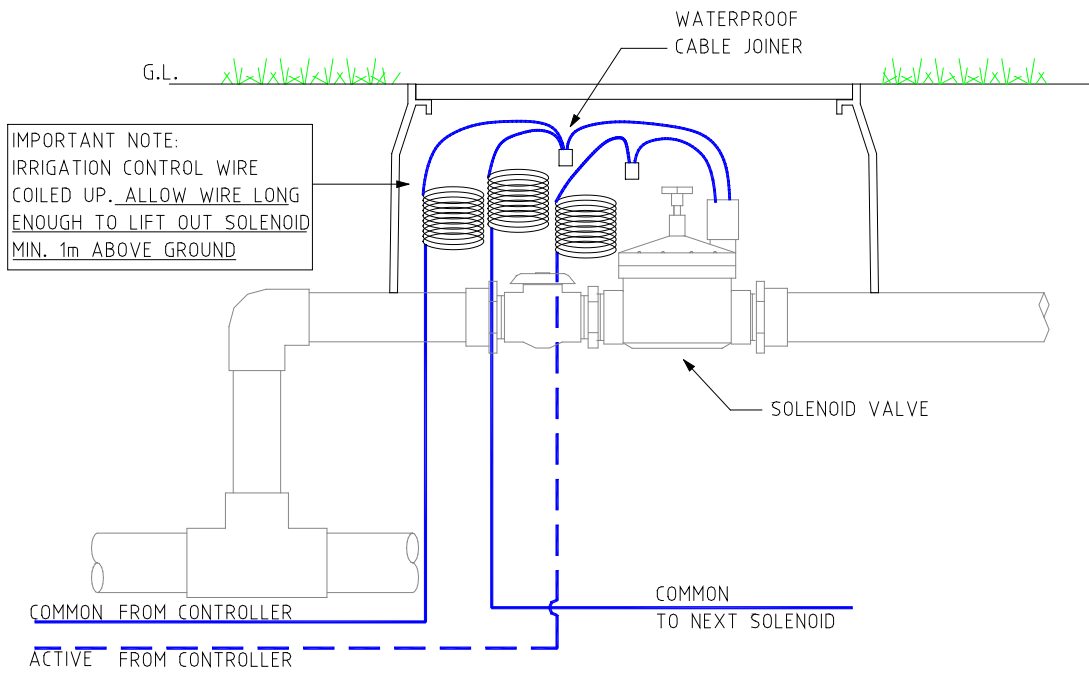
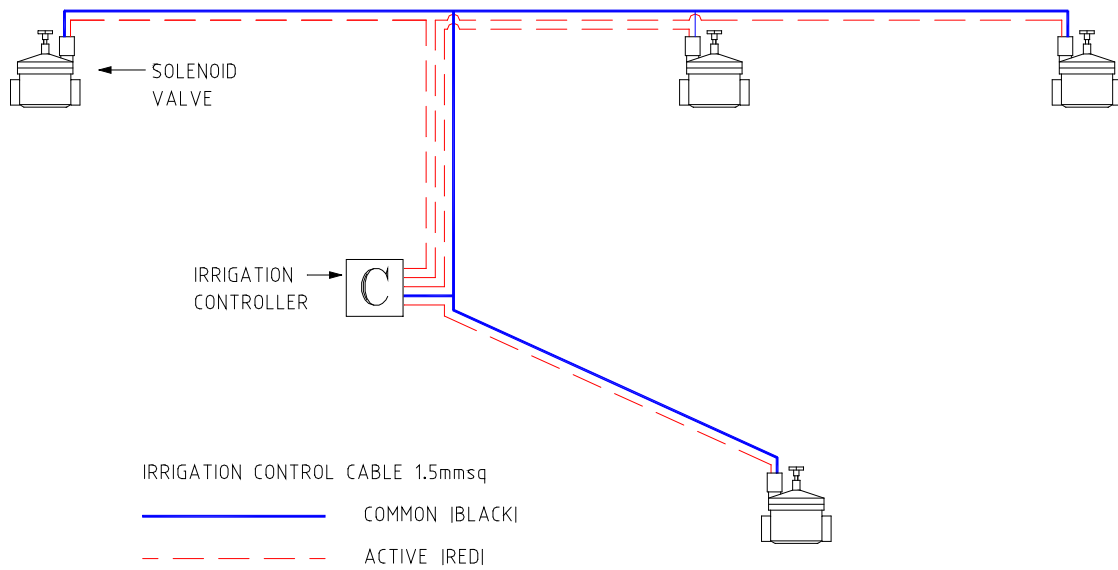
ISOLATION VALVE INSTALLATION DETAIL

### 30 Appendix 7: Pop up sprinkler - typical installation detail



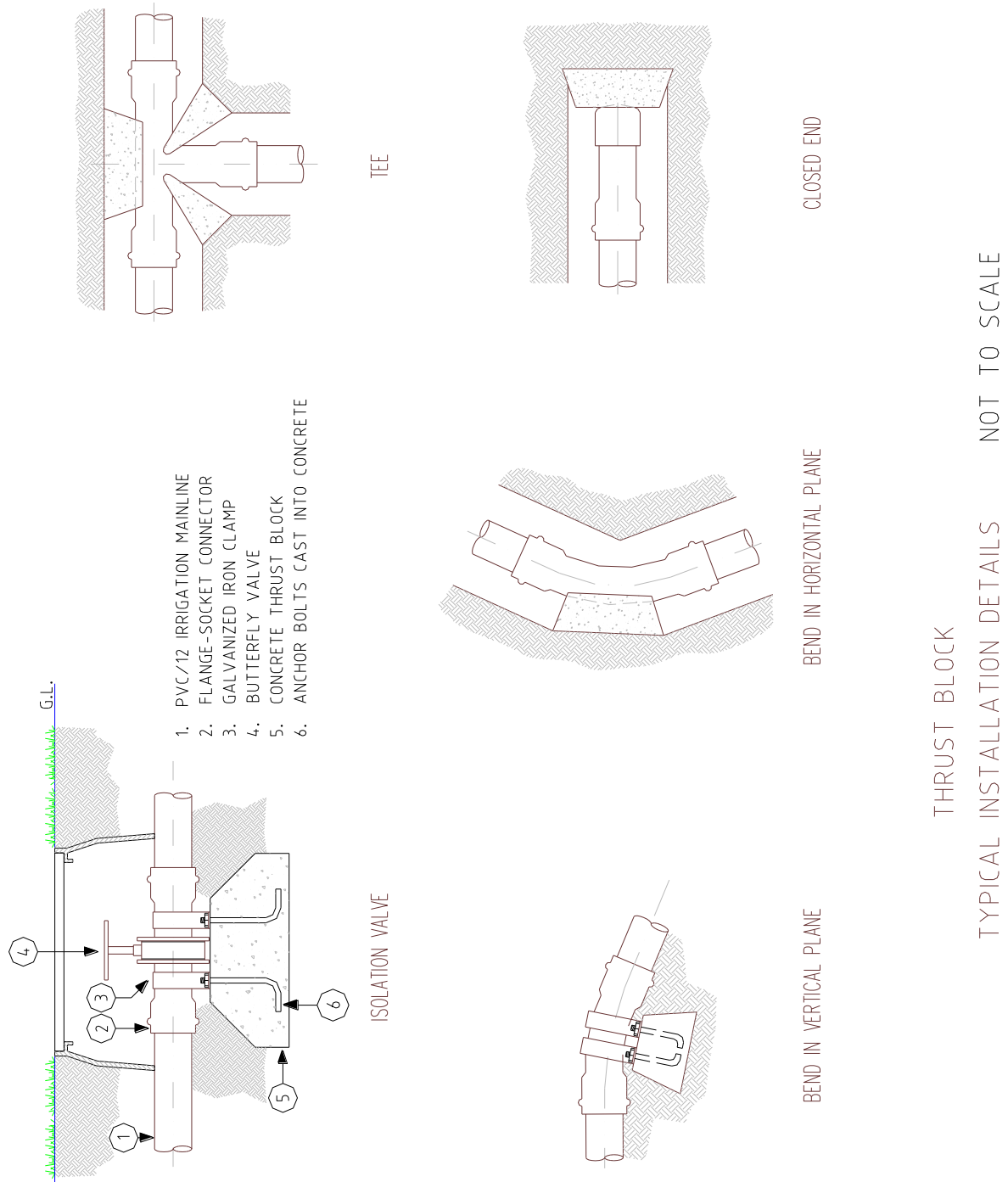
POP-UP SPRINKLER  
TYPICAL INSTALLATION DETAIL NOT TO SCALE

### 31 Appendix 8: Irrigation control wiring - solenoid valve connection detail



SOLENOID VALVE CONNECTION DETAIL NOT TO SCALE

### 32 Appendix 9: Thrust blocks



### 33 Appendix 10: Irrigation control enclosure

