Engineering

Technical Standard

TS 0136 – Pipework Access and Protection

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Government of South Australia

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Only the current revision of this Standard should be used which is available for download from the SA Water website.

Documents Superseded by this Standard

The following documents are superseded by TS 0136:

- TS 0142 Vehicular Crossovers for Above Ground Trunk Mains: the entire document
- TG 0120 Alterations to SA Water Infrastructure for Road Works undertaken by Commissioner of Highways: the entire document
- WSA 02—2014 -3.1 Gravity Sewerage Code of Australia Version 3.1: Table 5.4
- WSA 03—2011-3.1 Water Supply Code of Australia Version 3.1: Table 5.5
- SA Water Supplementary Documentation Pressure Sewerage Code - Part 1 (Design): Pt 1 – 3.12 – Obstructions and Clearances
- SA Water Supplementary Documentation Sewerage Code - Part 1 (Design): Pt 1 – 4.4 – Obstructions and Clearance
- SA Water Supplementary Documentation Water Supply Code - Part 1 – Design: Minimum clearance of Table 1 "Table 1 - Easement Widths and Clearances"
- Code of Practice "Services in Streets – A Code for the Placement of Infrastructure Services in New and Existing Streets" (1997).

Significant/Major Changes Incorporated in This Edition

This is the first revision of this Technical Standard and supersedes TS 0136 Version 1.0.

Amendments include:

- Title: Changed from "Third Party Works Near SA Water Pipework" to "Pipework Access and Protection", to better reflect the scope of this Standard.
- Section 2: Updated the scope to provide better clarity on the intent of the Standard.
- Section 5, Table 4 Notes:
    - Updated Note #8 by removing the requirement to support drainage conduits.
    - Deleted Note #19 and moved requirement to Section 12.5.
    - Minor updates to other notes.
- Section 9: Added new section "Pipes Crossing Roads, Railways and Waterways".
- Section 12:
    - Added Section 12.5.4 "Minimum Excavation Clearance from Thrust Blocks"
    - Updated Table 8: Safe Vibration Limits (PPV)
- Section 13: Added new section "Specialist Engineering Assessment".
- Minor updates throughout.

Document Controls

Revision History

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1.0	02/02/2022	Hany Habib	Final issue
2.0	20/03/2023	Hany Habib	Major update

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1 Introduction

SA Water is responsible for operation and maintenance of an extensive amount of engineering infrastructure such that it is safe and fit for purpose.

This standard has been developed to assist in the design, maintenance, construction, and management of this infrastructure.

1.1 Purpose

The purpose of this standard is to detail SA Water's minimum requirements to ensure that infrastructure covered by the scope of this standard are designed and constructed such that it is safe (to operate, maintain or work near) and achieves the required design life to serve SA Water's customers.

1.2 Glossary

The following glossary items are used in this document:

Term	Description
ABS	Acrylonitrile Butadiene Styrene Pipe
AC	Asbestos Cement Pipe
AS	Australian Standard
CAD	Computer Aided Design
CI	Cast Iron Pipe
CICL	Cast Iron Cement Lined
CICS	Cast Iron Insitu Cement Mortar Lined
DBYD	Dial Before You Dig
De	Diameter of the most extreme external surface of a pipe, interchangeable with OD – Outside Diameter of pipe
DICL	Ductile Iron Pipe Cement Lined
DN	Nominal Diameter
GRP	Glass Reinforced Polymer Pipe
MS	Mild Steel Pipe
MSCL	Mild Steel Pipe Cement Lined
PE	Polyethylene Pipe
PP	Polypropylene Pipe
PPV	Peak Particle Velocity
PVC-M	Modified Polyvinyl Chloride Pipe
PVC-O	Molecularly Oriented Polyvinyl Chloride Pipe
PVC-U	Unplasticised Polyvinyl Chloride Pipe
RCP	Reinforced Concrete Pipe
RRJ	Rubber Ring Joint
SA Water	South Australian Water Corporation
SCM	Sewer Construction Manual
SEA	Specialist Engineering Assessment
SRZ	Structural Root Zone

Term	Description
TG	SA Water Technical Guideline
TPZ	Tree Protection Zone
TS	SA Water Technical Standard
VC	Vitrified Clay Pipe
WSCM	Water Supply Construction Manual
WTP	Water Treatment Plant

1.3 References

1.3.1 Australian and International

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

Number	Title
AS 1711	Asbestos cement pressure pipes (Withdrawn but listed as a historical reference)
AS 1724	Cast grey iron pressure pipes and fittings with bolted gland joints (Withdrawn but listed as a historical reference)
AS 1741	Vitrified clay pipes and fittings with flexible joints – Sewer quality
AS/NZS 2566	Buried flexible pipelines (set)
AS/NZS 3500	Plumbing and drainage
AS/NZS 3725	Design for installation of buried concrete pipes
AS/NZS 4058	Precast concrete pipes (pressure and non-pressure)
AS 4970	Protection of trees on development sites
BS 5228-2:2009	Code of Practice for noise and vibration control on construction and open sites - Vibration
WSA 02-2014	Water Services Association of Australia, Gravity Sewerage Code of Australia
WSA 03-2011	Water Services Association of Australia, Water Supply Code of Australia
	Water Industry Act 2012
	Water Industry Regulations 2012

1.3.2 SA Water Documents

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

Number	Title
4005-30002	SA Water standard drawings WSCM: General information & preferences
4005-30004	SA Water standard drawings WSCM: Allocation of space for services
4005-30005	SA Water standard drawings WSCM: Main laying
4005-20003	SA Water standard drawings SCM: Excavation embedment and trenching
4005-20004	SA Water standard drawings SCM: Allocation of space for services
	Planting near sewers guideline
	SA Water - Selecting and planting trees to lower risk of blocking pipes
	Water Retail Code – Major Retailers, Schedule 1: Service Standards

1.4 Definitions

The following definitions are applicable to this document:

Term	Description
Accepted	Determined to be satisfactory by SA Water's Representative
Alignment	The line on which the pipes are laid
Constructor	The organisation responsible for constructing and installing infrastructure for SA Water whether it be a third party under contract to SA Water or an in-house entity.
Contract Documents	A set of documents supplied to Constructor as the basis for construction; these documents contain contract forms, contract conditions, specifications, drawings, addenda, and contract changes
Damage	Physical damage to and interference with SA Water assets. Damage includes coating or lining damage, dents, scratches, cracks, bending, displacement, perforation, ruptures, joint opening. Interference includes preventing or restricting access for operation and maintenance. Damage can also include potential impacts that SA Water assets can have on a 3rdThird Party works
Designer	The organisation responsible for designing infrastructure for SA Water whether it be a third party under contract to SA Water or a Constructor, or an in-house entity
Responsible Discipline Lead	The engineering discipline expert responsible for TS 0136 defined on page 3 (via SA Water's Representative)
Risk	The likelihood of work causing damage to SA Water assets, as well as SA Water assets causing damage to a 3rdThird Party work
SA Water's Assets	Includes any SA Water's water and wastewater assets, but in this standard, most commonly refers to water pipelines and sewer pipelines and their associated fittings and structures
SA Water's Representative	The SA Water representative with delegated authority under a Contract or engagement, including (as applicable): • Superintendent's Representative (e.g., AS 4300 & AS 2124 etc.) • SA Water Project Manager • SA Water nominated contact person
Services	Includes telecommunications cables, gas mains, power poles and cables, as well as water, wastewater and drainage assets owned by other organisations and/or SA Water

Term	Description
Sewerage Infrastructure	Sewerage Infrastructure refers to sewerage mains, customer connections, inspection points, maintenance shafts, pump stations and other associated infrastructure
'Shall' and 'Should'	In this Standard the word 'shall' indicates a requirement that is to be adopted to comply with the Standard. The word 'should' indicates practices which are advised or recommended
TDRF	Technical Dispensation Request Form. This form is part of SA Water's Technical Dispensation Request Procedure which details the process by which those required to comply, or ensure compliance, with SA Water's technical requirements may seek dispensation from those requirements.
Technical Standard (TS)	SA Water Technical Standard relevant to the works being undertaken
Terminology	• Where an obligation is given and it is not stated who is to undertake these obligations, they are to be undertaken by the Constructor. • Directions, instructions, and the like, whether or not they include the expression 'the Constructor shall' or equivalent, shall be directions to the Constructor, unless otherwise specifically stated. • Where a submission, request, proposal is required and it is not stated who the recipient should be, it is to be provided to SA Water's Representative for review. • Each word imparting the plural shall be construed as if the said word were preceded by the word "all". • Each word implying persons shall, where appropriate, also be construed as including corporations. • "Authorised", "approval", "approved", "selected", "directed" and similar words shall be construed as referring to the authorisation, approval, selection, or direction of SA Water's Representative in writing. • "Allow" shall mean that the cost of the item referred to is the responsibility of the Constructor. • "Provide" shall mean "supply and install". • "Submit" shall mean "submit to SA Water's Representative or his nominated delegate". • Submissions, requests, proposals are to be provided at least 7 working days prior to work commencing or material ordering (unless noted otherwise). • "Informative" shall mean "provided for information and guidance"
Third Party	The individual, group of people or organisation that is undertaking work near SA Water assets
Water Infrastructure	Water infrastructure refers to water mains, customer connections, water meters, pump stations, and other associated infrastructure
Works	The development of all types of buildings, structures, and other obstructions (including residential buildings, pools, sheds, carports, major developments, transport infrastructure, services, stockpiles, ground anchors, trees, equipment installed on SA Water assets), and any work that causes changes to the ground (including movement of heavy vehicles, blasting, pile driving, ground compaction, dewatering, earthworks, open and trenchless excavations)
Zone of Influence	The zone of influence is an area extending both transversely and longitudinally along a buried pipeline. It is the area in which loads from buildings or structures on the surface may potentially cause damage to the pipeline. Settlement or disturbance of the ground within this zone may also cause damage to buildings or structures on the surface above

2 Scope

This Standard is designed to provide unhindered safe access to existing SA Water pipework for unplanned maintenance works when new SA Water pipework and/or new third party works are proposed.

At the same time, it stipulates the requirements to maintain the structural integrity of existing SA Water pipework by mitigating potential damage resulting from the installation and/or operation of new infrastructures.

It sets out SA Water minimum requirements for water supply pipelines and wastewater pipelines, and for both flexible and rigid pipes.

This standard is not to be applied retrospectively to existing infrastructures already affecting SA Water pipework.

It covers the following Works:

- Linear Underground Services (Section 5)
- Structures with a Vertically Loaded Foundation (Section 6)
- Structures with a Laterally Loaded Foundation (Section 7)
- Transport Infrastructure Supporting SA Water Pipework (Section 8)
- Pipes Crossing Roads, Railways and Waterways (Section 9)
- Trees and Shrubs (Section 10)
- SA Water Maintenance works (Section 11)
- Ground Disturbing Construction Works (Section 12)
- Specialist Engineering Assessment (Section 13)

An overview of SA Water assets and the objectives of this standard are detailed in Section 3 and 4 respectively.

Section 14 of this Standard also specifies procedures to be followed when a Third Party plans to undertake works near SA Water pipework, including risk mitigation measures and the Obligations of Third Party Asset Owners.

2.1 Technical Dispensation

Departure from any requirement of this Technical Standard shall require the submission of Technical Dispensation Request Form (TDRF) for the review and approval (or otherwise) of SA Water Principal Engineer listed in Page 3, on a case-by-case basis.

The Designer shall not proceed to document/incorporate the non-conforming work before the Principal Engineer has approved the proposed action in writing via the Technical Dispensation Request Form (TDRF).

SA Water requires sufficient information to assess dispensation requests and their potential impact. The onus is therefore on the proponent to justify dispensation request submissions and provide suitable evidence to support them.

Design works that are carried out without being appropriately sanctioned by SA Water shall be liable to rejection by SA Water and retrospective rectification by the designer/constructor.

3 Overview of SA Water Assets

3.1 General

SA Water owns and operates an extensive network of water and wastewater assets throughout South Australia.

SA Water pipelines have different functions, criticalities, sizes, depths, and materials.

Many pipes operate at high pressures and flow rates, and some may contain hazardous gases.

This section is for information only and to be used as a guide and not intended to be used for design purposes.

3.1.1 Water Supply Pipelines

Water supply (including potable and recycled water) pipelines operate under pressure and are identified by blue (for potable water) and purple (for recycled water) coloured paint.

These pipelines include:

Major Pipeline

Major Pipelines are the six (6) major pipe facilities that transport bulk water from a source to a Water Treatment Plant (WTP) or over large distances across the state.

Trunk Main

Trunk Mains (excluding the 6 Major Pipelines) usually transport water from the water treatment plant to the reticulation network. These pipes range in size from 375 mm to 2100 mm in diameter.

Water Reticulation Networks and Customer Connections

Reticulation Mains transport water between the trunk mains and customer connections. These pipes range in diameter between 20 mm (property connections) to 63 mm and 375 mm in diameter.

3.1.2 Wastewater Pipelines

Wastewater pipelines may operate via gravity or under pressure and are identified by green coloured paint.

These pipelines include:

Trunk Sewers

A wastewater collection pipeline which is 450 mm or larger and flows by gravity.

Sewer Reticulation Networks and Customer Connections

A wastewater collection pipeline that services individual properties and flows by gravity and conveys the flow to trunk sewers. This typically includes pipelines that have a diameter of 100 mm (property connections) to less than 450 mm in diameter.

Sewer Pressure Main

A wastewater collection pipeline that operates under pressure. This includes sewer pumping mains and pipelines that operate under vacuum, as well as property connections as part of low-pressure sewer systems.

3.2 Type of SA Water Pipes

3.2.1 Flexible Pipes

Most of SA Water's buried pipes are classified as "flexible" in accordance with AS/NZS 2566 Buried Flexible Pipelines, as follows:

- Metallic pipes: Ductile Iron (DI), Mild Steel (MS) and Stainless-Steel pipes
- Thermoplastic pipes: ABS, PVC-U, PVC-M, PVC-O, PE, or PP
- Glass Reinforced Polymer (GRP) pipes.

Buried flexible pipelines rely primarily on the side support, offered by embedment materials together with native soils, to resist vertical loads (fill and traffic) without excessive deformation. The flexible pipe itself carries a very small portion of imposed loads with the rest of the load being transferred to the surrounding soil material.

3.2.2 Rigid Pipes

Some of SA Water's pipes are classified as "rigid" where the pipes are sufficiently strong (both within the pipe wall and joints) to withstand most anticipated live and dead loads. A pipe's ability to resist imposed loads is improved by "better" embedment conditions.

Rigid pipes may include:

- Reinforced Concrete (RC)
- Masonry and concrete oviform
- Cast Iron (CI)
- Asbestos Cement (AC)
- Vitrified Clay (VC)

3.3 Pipe Trench Width for Maintenance Works

During design of new pipework, dimension of pipe trench is specified to ensure the pipe is adequately protected and supported.

For maintenance works, trench width larger than the design trench width is required to allow for safe access during unplanned maintenance works, noting the need for welding, installing collars, Gibault, fittings and other type of repairs.

The pipe trench width for maintenance works on SA Water pipework is provided in Table 1 and Figure 1 below.

Table 1: Maintenance Trench Width for SA Water Pipework

Depth of Pipe Invert (m)	Pipe De (external diameter) (mm)	Maintenance Trench Width (mm)
All Depths	All diameters	1200 + De

Notes:

1) The width of the maintenance trench is the minimum width required to excavate the pipeline (using trench supports) to safely undertake emergency maintenance and repairs, which depends on the size of the pipeline.

2) For the same pipe diameter, the maintenance trench width is larger than the corresponding design trench width due to emergency nature and the need for larger space for safe access to undertake repair/maintenance works.

3) De is diameter of the most extreme external surface along the pipe barrel.

4) Near pipe fittings (e.g., valves), the trench width is locally widened and deepened to allow for fitting size and associated concrete thrust blocks. Similarly, local widenings are provided for access chambers, manholes/shafts, etc.

5) For pressurised pipes (such as water mains, recycled water mains and sewer pressure mains), the maximum trench depth is about 3.0 m.

6) For gravity sewers, trench depth can be as deep as 6 m.

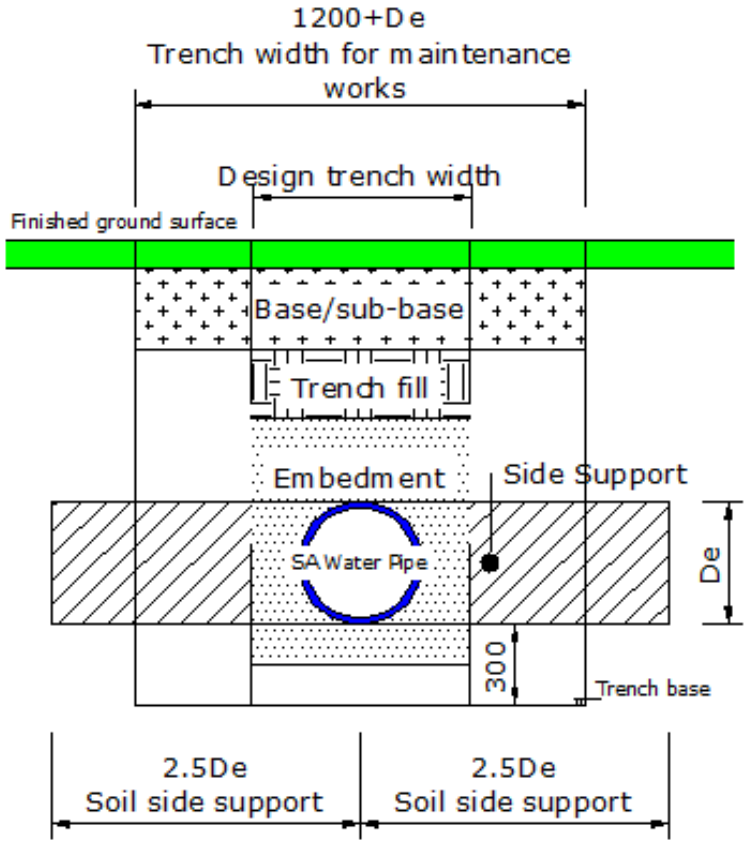

Figure 1: Maintenance Trench Width

3.4 SA Water Pipes in Easements

SA Water generally position pipework within roadways, however, there exist instances where SA Water is required to establish easements in which pipework is to be laid.

All such easements are vested in the name of the South Australian Water Corporation.

Other utilities and individuals are not permitted to share or co-locate within SA Water easements.

Typical SA Water easement widths for water mains and sewers are provided in SA Water's Supplementary Documentation to WSAA 02-2002 and WSAA 03-2011, and is shown in Table 2 and Table 3 respectively:

Table 2: Water Mains - Easement Width

Pipe DN	Easement Widths (mm)	Pipe Location within Easement
DN100 to DN 150	7 000	Usually, one Third of the easement width
DN200 to DN 375	10 000	
DN450 to DN 600	15 000	
DN750 to DN 1200	20 000	
≥ DN 1200	Requires SA Water Assessment	

Table 3: Sewer - Easement Width

Depth to Invert (m)	Pipe Size	Easement Width (m)	Pipe Location within Easement
≤ 1	DN150 & DN225	2.5	Central
	DN300	5.0	Central
1 to 3.3	DN150 & DN225	3.0	Central
	DN300	5.0	Central
> 3.3	DN150 & DN225	4.0	Central
	DN300	5.0	Central

Slightly larger easements are constructed where sewer easements are approved by SA Water to be shared with stormwater pipelines. Reference shall be made to SA Water Supplementary Documentation Sewerage Code - Part 1 (Design).

For additional notes refer to WSCM 4005-30002-01 and SCM 4005-20002-03.

3.5 Pipeline Condition

SA Water pipelines vary in condition. The rate of deterioration and remaining useful life can vary due to several factors, including, but not limited to, construction methodology, pipe material, soil movement, soil corrosivity, internal and external coatings, water quality parameters, internal operating pressures and external dynamic and static loadings.

While age can contribute to these deterioration rates it is not a primary factor in assessing pipes condition.

3.6 Pipeline Fittings and Structures

There are many different fittings and structures associated with SA Water pipelines. These fittings and structures are essential for pipeline operation and delivery of services to the community.

Common fittings and structures include:

- Thrust and anchor blocks.
- Cathodic protection test points, wiring, anode, and control equipment
- Flushing, injection, and sampling points
- Maintenance structures (such as access chambers, manholes, maintenance shafts)
- Valves and chambers
- Water hydrants, scour and air release points.
- Service connection pipework (water and wastewater)
- Flow measurement devices (such as water meters).

Some of these fittings can be identified by indicators on the surface, such as covers and lids, while other fittings will be below ground and will not be visible. Buried fittings may be located at different depths than the pipeline or may be offset from the pipeline, and therefore do not always accurately indicate the pipeline location.

3.7 Elevated Water Tanks

Elevated water tanks are sometimes affected by Third Party works as they are commonly used for mounting telecommunications equipment to avoid building other structures.

3.8 Other Assets

Other assets include pumping stations, emergency storage facilities, reservoirs, and treatment plants. These assets are usually in dedicated reserves or landholdings; however, this is not always the case.

3.9 SA Water Infrastructure – Potential Hazards

Potential hazards associated with SA Water assets include, but are not limited to:

- Large forces associated with the release of water or wastewater under high pressure.
- Rapid release of large volumes of water leading to injuries, drowning or traffic hazards.
- Biohazards associated with wastewater contact.
- Exposure to asbestos (asbestos cement pipe and asbestos in some pipe wrapping)
- Exposure to toxic gases in the wastewater system
- Exposure to hazardous wastes discharged by various industries into the wastewater system.
- Ignition of combustible gases in the wastewater system
- Fall hazards associated with accessing access chambers or high structures.
- Electric shock hazards arising from electrical infrastructure in the vicinity of pipelines, electrical faults, or lightning.
- Secondary hazards arising from damage or disruption to other structures or services due to damaged pipelines.

Occasionally SA Water assets also fail for reasons that are unrelated to new works (such as from corrosion or mechanical failures) which can also have hazardous impacts.

4 Objectives of this Standard

The main objectives of this standard concerning new works near SA Water pipework can be summarised as follows:

4.1.1 Maintain the Structural Integrity of SA Water Pipework

SA Water's pipes are in different stages of deterioration and in some cases of unknown condition. Therefore, clearances and requirements are specified to maintain the structural integrity, load carrying capacity and continuous operation of SA Water pipework including associated infrastructure.

This includes:

- Maintaining the integrity of the embedment materials and the surrounding soil, as depicted in Figure 1 above.
- Eliminating the imposition of any additional loads on SA Water pipework during the construction and operation of new infrastructures
- Not undermining SA Water pipework or its infrastructure (valves, thrust blocks, etc.) during the construction and operation of new infrastructures
- Eliminating soil differential settlement by ensuring the stresses induced by new infrastructures are imposed outside the trench footprint.
- Employing a construction methodology which eliminates any damages to SA Water pipework.

4.1.2 Maintain Unhindered Access to SA Water Assets for Unplanned Emergency Maintenance Works

Levels of service to customers are mandated by Legislation, Standards and Australian Codes of Practice. In addition, minimising service interruptions, due to bursts and leaks, is ranked as one of the highest customer focus areas.

Consequently, SA Water has developed 'Levels of Service', encompassing its commitments to the South Australian Community to provide high quality and reliable water and wastewater services.

As SA Water's Level of Service is measured by frequency of disruption, response times and restoration times (including operational maintenance works), unhindered access to SA Water assets, for unplanned emergency maintenance works, is essential.

Having a new infrastructure that requires enabling works, such as stabilisation, isolation, temporary removal of parts and/or a time-consuming process to design, approve and construct will greatly hinder SA Water's ability to access its pipework, at short notice, to maintain, repair and deliver on its commitments to the South Australian community.

The intention of this Standard is to eliminate these situations as far as reasonably practicable.

4.2 New Infrastructure Effects on Existing SA Water Pipework

New infrastructure can be classified as follows:

- Linear underground services such as water and sewers, gas mains, telecommunication conduits and cables, electricity conduits, stormwater and similar drainage conduits, etc.
- Vertical loaded foundations such as residential, industrial, institutional, bridge abutments and similar structural footings
- Laterally loaded foundations such as retaining walls, masts and light poles, gantry signs, traffic lights, etc.
- Transport structures such as road and railway bridges, tunnels, and culverts where SA Water pipework are supported/suspended
- Roads, railways, and waterways
- Trees and shrubs
- Ground disturbing construction works.

Generally, linear assets and vertically loaded foundations will not adversely affect SA Water pipework and will achieve the above objectives provided they adhere to the minimum clearance specified herein and employ a construction methodology that maintains the structural integrity of SA Water pipework and its surrounding soil.

Laterally loaded foundations require special consideration to eliminate its adverse effect on SA Water pipework and achieve the above objectives.

Special requirements for safe access and design consideration are stipulated for transport structures supporting SA Water assets as well as for pipe crossing roads, railways and waterways.

As trees and shrubs have root systems which are often uncontrolled, special consideration must also be given to minimise their adverse impacts on SA Water pipework.

Special requirements for clearance and protecting SA Water assets against ground disturbing works (such as earthworks, heavy vehicle traffic, dewatering, vibrations, excavations, and road development) are also stipulated.

Special requirements including SA Water threshold assessment criteria to facilitate preparation of a Specialist Engineering Assessment is also provided.

5 Linear Underground Services

5.1 Definition

Linear Underground Services

Include water and sewer pipelines, gas mains, telecommunication conduits and cables, electricity conduits, stormwater, and similar drainage conduits, etc. They are generally laid in trenches by open excavation or trenchless technology and run either parallel to SA Water pipework or crossing it.

Minimum Services Clearance

The minimum horizontal clearance for linear underground services is defined as the clear horizontal distance between the edge of SA Water pipe and the nearest edge of the trench wall of a linear service.

The minimum vertical clearance for linear underground services is defined as the clear vertical distance between the edge of SA Water pipe and the nearest conduit edge of a linear service.

Refer Figure 2.

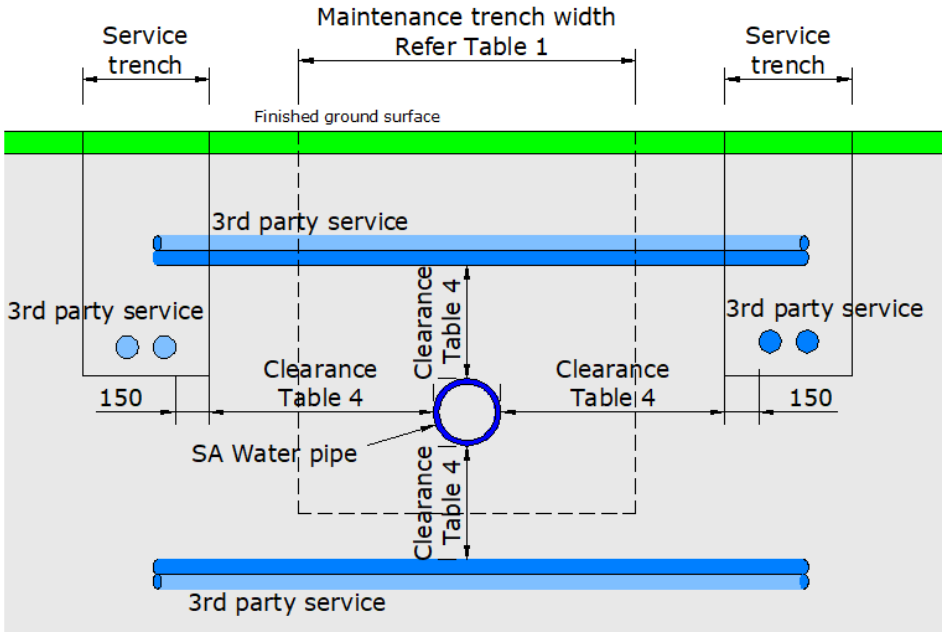

Figure 2: Minimum Service Clearances

5.2 SA Water Requirements

A minimum service clearance is required to protect SA Water pipe and its soil supporting zone from ground disturbance resulting from the construction, operation, and future maintenance works of new linear services.

Linear underground services shall comply with minimum service clearance listed in Table 4.

Unless specified otherwise, clearances shown are for the proposed/existing linear services in relation to SA Water pipework whether water or wastewater.

Table 4: Minimum Clearances between SA Water Pipework & Other Services

Proposed/Existing Service[1,20, 21]	Minimum Horizontal[2,4] Clearance from Edge of SA Water Pipework to Trench Wall of Services (mm)	Minimum Vertical[3,4] Clearance from Edge of SA Water Pipework to Edge of Services (mm)
Water Mains[5]	600[6]	150 (DN[7]≤ 300) 300 (DN[7]> 300)
Telecommunication Conduits and Cables [10,11]		
Stormwater Drains[8]		
Distribution Gas Pipes[9 to 13]		300
Transmission Gas Pipes[10 to 13]		500
Electricity Conduits and Cables [11 to 13]	1000	300
Sewers (Gravity, Pressure and Vacuum)[14,15]	1000/600[16]	500/750[16]
SAPN ≤ 33kV Conduits[13,17 to 19]	1150	600
SAPN 66kV Conduits[13,17 to 19]	1500	1000
Outside Gas Bottle Hazard Zones[22] (Exchange/Insitu Fill)	1500/3500	-

Notes:

1) Services shall cross SA Water mains at 90 degrees where possible but not less than 45 degrees.
2) The horizontal clearance is also applicable to pipework-related infrastructures (valves, concrete thrust blocks, chambers, manholes as listed in Section 0) and measured from their edges.
3) The vertical clearance is also applicable to doglegs within SA Water pipework or other services. For additional information, refer SA Water Standard Drawing Series 4005-30005.
4) If SA Water pipework is concrete encased, minimum clearances shall be measured from the outside of the encasement.
5) Clearances shown are for water mains in relation to water mains.
6) An absolute minimum horizontal service clearance equal to the maintenance trench width of Table 1 has been adopted. Additional 150 mm shall be included for the embedment materials of the Third-Party trench.
7) The Nominal Diameter (DN) applies to either SA Water pipe or the proposed/existing service.
8) Drainage conduits shall cross beneath water mains and over sewer mains, where possible. Sewers crossing under brick barrel drains or unlined open drains, or channels shall be sleeved or concrete encased. Where no alternative exists but for water mains to cross under drainage conduits, water main shall be made with restrained joints (e.g., welded) for water quality purposes.
9) Gas meters also considered as distribution gas pipes.
10) Where welding is to be undertaken on pipework, there is a risk of possible explosion if gas mains are nearby. Clearance may be modified with respect to safe welding practices.
11) Electrical, gas and telecommunication services installed near SA Water assets may present a risk to SA Water's maintenance personnel; these services are to be clearly marked and where required provided with suitable protection.
12) Electrical, gas and telecommunications utilities are not permitted to share or co-locate within SA Water easements to facilitate their respective services.
13) For safer access to SA Water pipework, SAPN conduits and gas pipes shall be installed under SA Water mains, where possible.
14) Clearances shown are for sewer mains in relation to water mains. For two sewer mains, the horizontal and vertical clearances shall be 600 mm and 300 mm respectively.

15) Sewer mains shall cross beneath water mains. Where no alternative exists, the sewer main shall be sleeved extending a minimum of 3 m either side of the water main with the sewer located centrally within the sleeve. Alternatively, joint-free water main shall be installed extending a minimum of 3 m either side of the sewer main.

16) For sewer at a minimum vertical clearance of 500 mm, the minimum horizontal clearance shall be 1000mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.

17) Clearances for SA Power Network (SAPN) 33kV and 66kV conduits are based on Figure 1 and 2 of NICC 404: Working in the Vicinity of SA Power Networks Infrastructure.

18) The objective of the clearances related to SAPN conduits above is to locate the SA Water maintenance trench footprint in Restricted Zone 2 for the < 33kV underground network and Restricted Zone 3 for the 66kV underground network, where mechanical digging is permitted. Zones 2 and 3 are defined in Figure 1 and 2 of NICC 404.

19) High voltage power lines in the vicinity of metallic pipelines must be assessed for AC interference hazards.

20) No encroachment is allowed into SA Water easements.

21) Reference shall be made to Section 14 for procedure, risk mitigation and obligations of Third-Party asset owners.

22) Horizontal exclusion zone from ground level measured from centre of cylinder.

5.3 Third Party-Specified Service Clearance

Where a Third-Party assets owner has its own set of service clearance requirements, the larger of the SA Water requirements and the Third-Party requirements shall be used.

6 Vertically Loaded Footings

6.1 Definition

Vertically Loaded Footings

Vertically loaded footings apply to structures where loadings are transferred to the supporting founding soil by vertical bearing. It includes, but not limited to:

- Single storey and multi-storey permanent structures
- Bridge abutments/piers
- Underground permanent structures
- Light weight structures
- Walls and fences

Pipe Trench Zone of Influence

The zone of influence is an area extending both transversely and longitudinally along a buried pipeline.

It is the area in which loads from buildings or structures on the surface may potentially cause damage to the pipeline.

Settlement or disturbance of the ground within this zone may also cause damage to buildings or structures on the surface above.

Figure 3 shows the extent of zone of influence for a typical pipe trench of a 3.0 m maximum depth.

Figure 4 shows the extent of zone of influence for a typical pipe trench of 3.0 to 6.0 m maximum depth. Note for deep sewers, a truncated zone of influence has been adopted to reflect the minimum impact of surface loadings on such deep pipes.

Table 5 shows typical gradient of zone of influence as extracted from AS 3500.2.

6.2 Building Exclusion Zone

The building exclusion zone applies to the area directly above, below, and adjacent to a buried pipeline.

The depth of the building exclusion zone is taken from ground level to 300 mm below the pipeline invert level.

The width of the building exclusion zone is the minimum width required to excavate the pipeline (using trench supports) to safely undertake emergency maintenance and repairs (i.e., equal to the maintenance trench width).

The width of the building exclusion zone shall be 1200+De in millimetres.

Building is not permitted within this zone (refer Section 11.2 for overhead services).

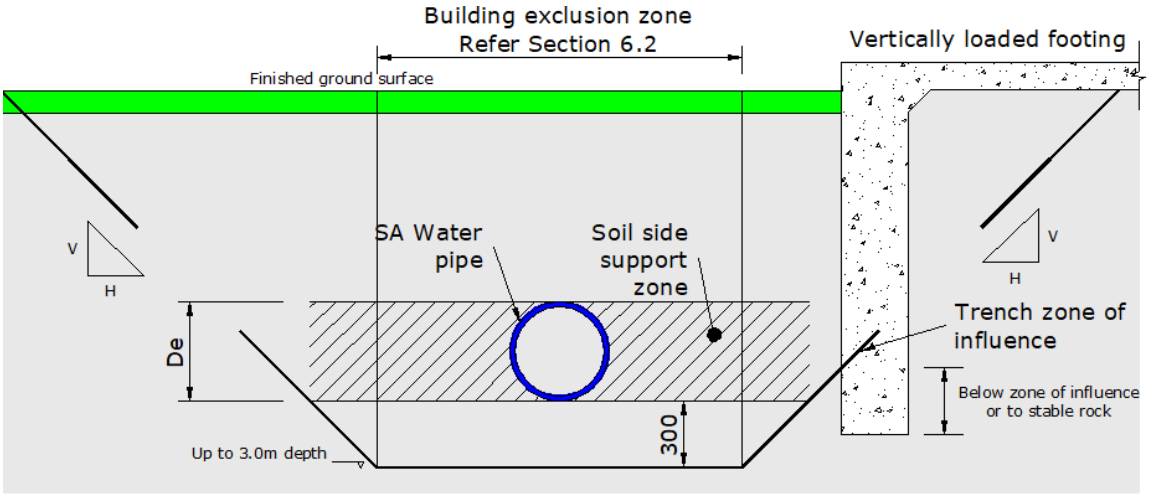

Figure 3: Zone of Influence for Trenches up to 3.0 m Deep

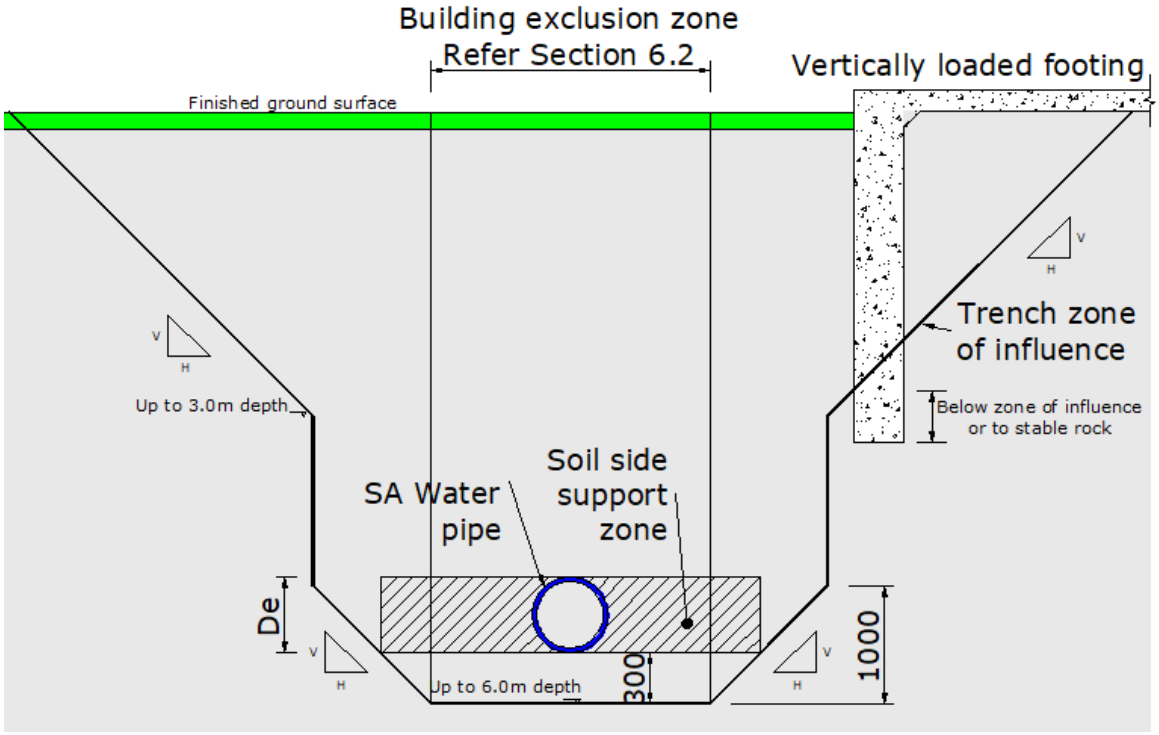

Figure 4: Zone of Influence for 3.0 to 6.0 m Deep Trenches

Table 5: Gradient of Zone of Influence for Pipe Trench, from AS 3500.2

Soil Type	Slope V:H	
	Compacted Fill	Undisturbed Ground
Stable Rock	2:3	8:1
Sand	1:2	1:2
Silt	1:4	1:4
Firm Clay	1:2	1:1
Soft Clay	Not suitable	2:3
Soft Soils	Not suitable	Not suitable

Factors which determine the zone of influence are:

- The building exclusion zone; refer to Section 6.2 for details.
- The nature of ground; the boundary of the zone of influence is determined by the angle of repose of the surrounding ground. The angle of repose is the steepest angle at which loose ground material is stable.
- The depth of SA Water pipework.

6.3 SA Water Requirements

SA Water requirements are listed below for various structures.

6.3.1 Single Storey and Multi-Storey Permanent Structures

Single storey and multi-storey permanent structures may include, but are not limited to:

- Habitable, commercial, and industrial buildings
- Carports and garages attached to main buildings
- Above ground industrial tanks
- Fixed plant (permanent machinery and equipment)
- Fixed above ground pools.

Permanent structures shall comply with the following SA Water requirements (refer Section 6.2, Figure 3 and Figure 4):

1) The structure shall be self-supporting within the trench zone of influence; this is commonly achieved using foundation supports, such as piles, which extend to a depth below the zone of influence or to stable rock.

2) The structure shall be outside the building exclusion zone; If all other options have been exhausted SA Water may allow the use of tunnels to protect against additional loading from single storey and multi-storey structures inside the building exclusion zone and provide safe access. However, this option is only permitted as a last resort.

6.3.2 Underground Permanent Structures

Underground permanent structures may include, but are not limited to:

- Bridge abutments/piers
- Below ground swimming pools and spas
- Below ground tanks
- Basements.

Underground permanent structures shall comply with the following SA Water requirements:

1) The structure shall be self-supporting within the trench zone of influence; this is commonly achieved using foundation supports such as piles which extend to a depth below the zone of influence or to stable rock.
2) The structure shall be outside the building exclusion zone.
3) Allowance shall be made for excavation of SA Water assets for maintenance and repair without undermining the integrity of the adjacent below ground structure.
4) Some pools are designed to be supported by the surrounding soil when they are full. Where continued use of a pool is important, such as for public swimming pools and hotel developments, the asset owner should consider designing the pool to allow adjacent SA Water assets to be excavated without needing to empty the pool. Refer Figure 5.

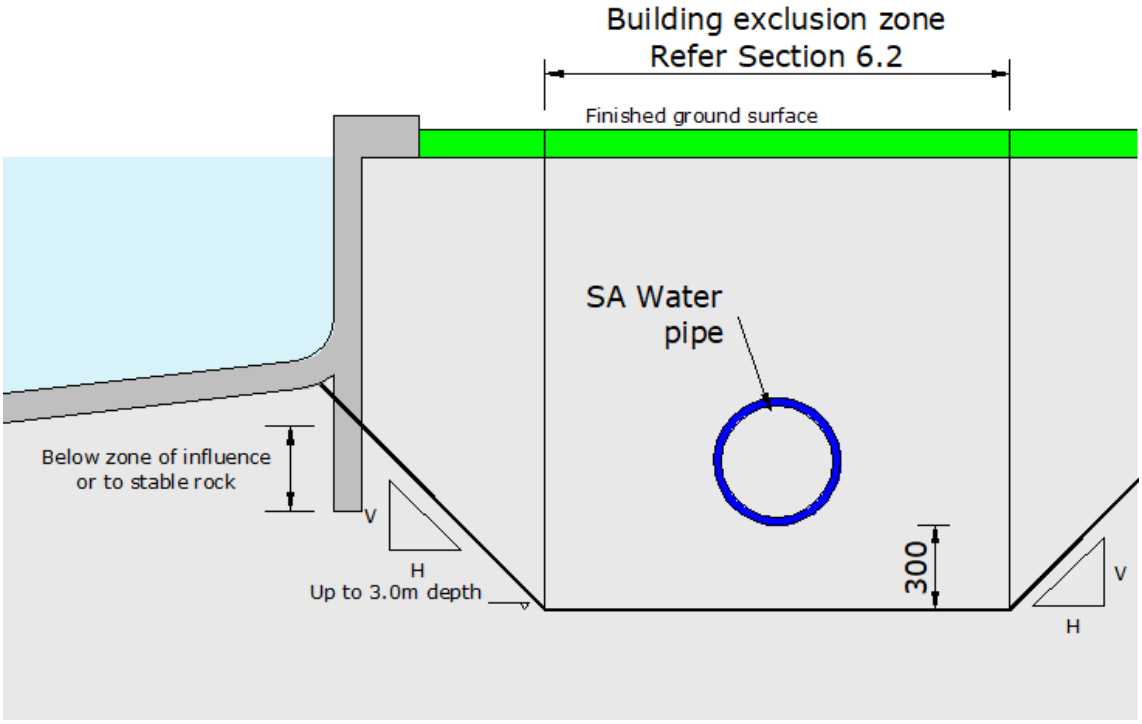

Figure 5: Underground Permanent Structures

6.3.3 Light Weight Structures

Light weight structures are structures that are detached from main buildings and can be readily dismantled and removed at any time.

They may include, but are not limited to:

- Colourbond sheds
- Framed patios and carports
- Decking
- Above ground demountable pools, spas, and tanks.

Light weight structures shall comply with the following SA Water requirements (refer Figure 6):

1) Light weight structures shall be easily demountable.
2) **Pressurised Pipelines:** lightweight structures shall not be placed within the zone of influence of SA Water's pressurised pipeline trenches.
3) **Gravity Sewers:** lightweight structures can be placed over sewers provided:
   a) They can be dismantled and removed, when requested by SA Water
   b) Vertical clearance between the top of pipe and footing is at least 750 mm
   c) Horizontal clearance between the pipe wall and footing is at least 1000 mm

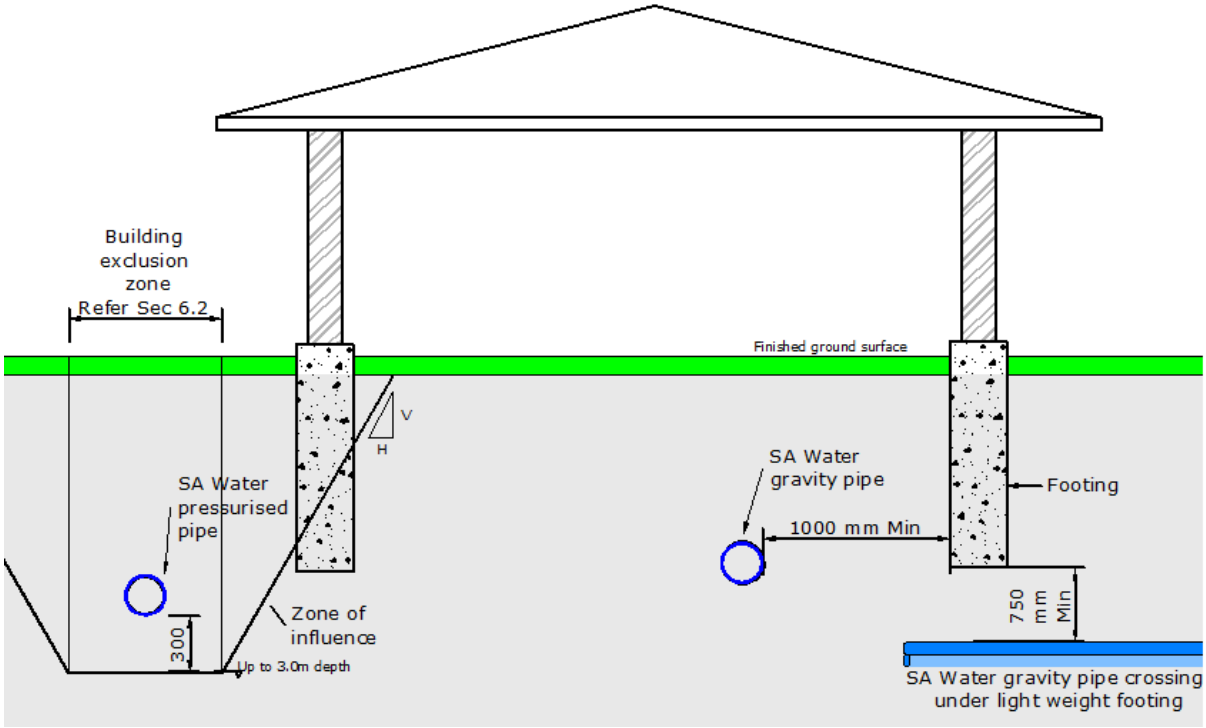

Figure 6: Light Weight Structures

6.3.4 Light Weight Walls and Fences

Light weight walls and fences that can be readily dismantled and removed at any time, usually include, but not limited to:

- Timber, metal, or concrete fibre fences no greater than 1.8 m high
- Mass walls made from brick, stone or concrete no greater than 1.8 m high
- Noise attenuation walls no greater than 1.8 m high
- Retaining walls, no greater than 1.2 m high

Light weight walls and fences shall comply with the following SA Water requirements (refer Figure 7):

1) Walls and fences parallel to SA Water pipes shall not be placed within the building exclusion zone and should avoid being placed in the trench zone of influence where possible.
2) Walls and fences crossing SA Water pipes shall:
   a) Cross at a 90 degrees angle to the pipe where possible but not less than 45 degrees
   b) Maintain a vertical clearance between the top of pipe and any footing of at least 750 mm.
3) Walls and fences shall not be built directly over maintenance structure covers, valve pit covers nor covers associated with all other pipe fittings.

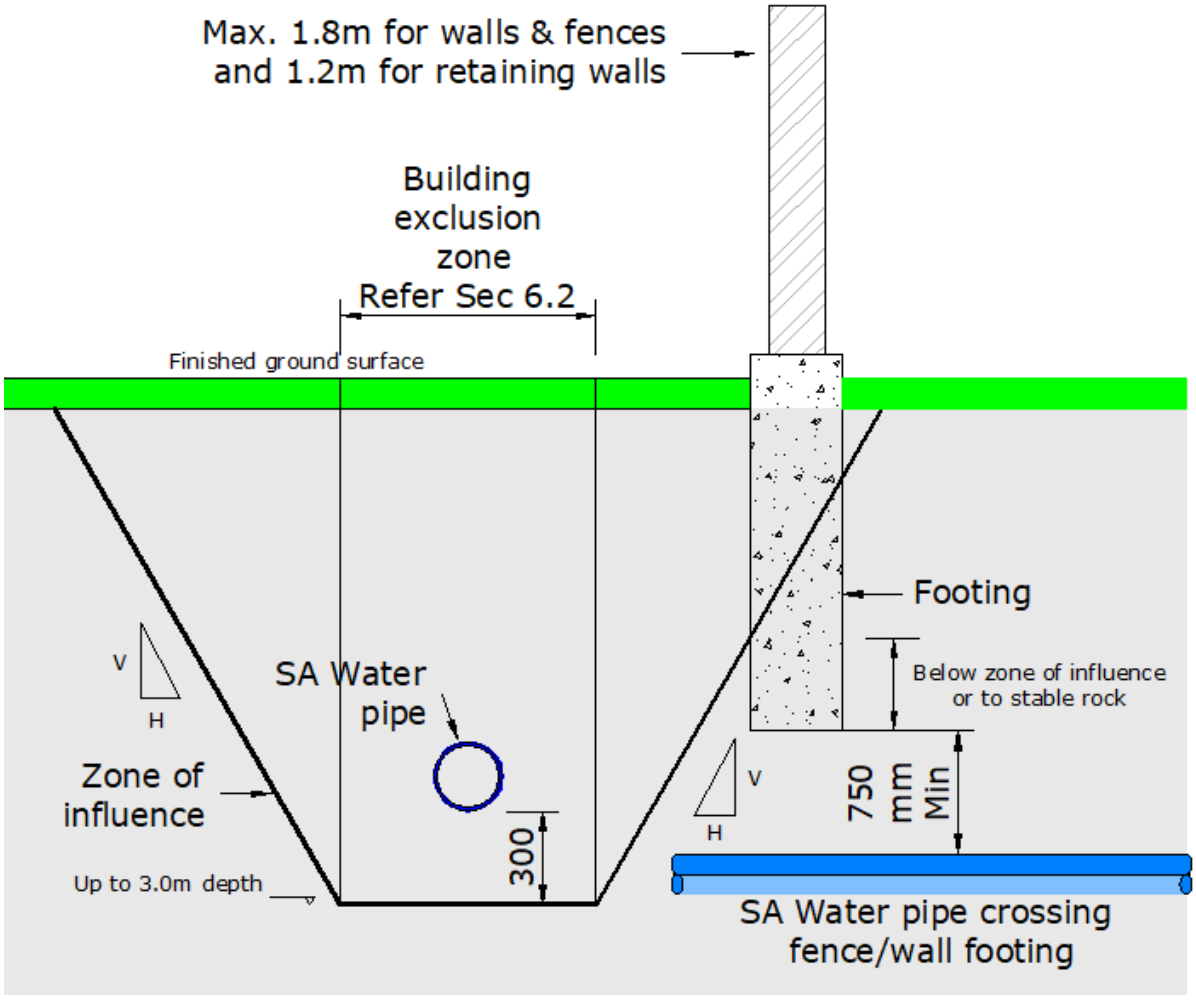

Figure 7: Light Weight Walls and Fences

7 Laterally Loaded Footings

Laterally loaded footings usually resist lateral loads such as wind, earthquake, earth and liquid pressures and impacts. They predominately rely on the surrounding soil to support applied loads and may take the form of single or group of piles, continuous sheet piling and cofferdams, secant piled walls, etc.

Laterally loaded footings apply to structures including, but not limited to:

- Retaining walls
- Masts and light poles
- Gantry signs
- Electrical towers/Stobie poles
- Traffic barriers

7.1 SA Water Requirements

The issues with laterally loaded footings can be summarised as follows:

- Laterally loaded footings exert lateral soil pressure which may exceed the load carrying capacity of SA Water's pipework and consequently compromise the structural integrity. Refer to the objective in Section 4.1.1 "Maintain the Structural Integrity of SA Water Pipework".
- As the laterally loaded footings rely on the surrounding soil, excavation of SA Water assets for maintenance and repair may undermine the integrity of the adjacent footing and will require planned work to stabilise the footing before accessing the pipe. Refer to the objective in Section 4.1.2 "Maintain Unhindered Access to SA Water Assets for Unplanned Emergency Maintenance Works".

The asset owner of a laterally loaded footing shall comply with the following requirements:

1) Laterally loaded footings shall not be placed within the building exclusion zone (refer Section 6.2 for extent).
2) Footings shall extend to a depth below the zone of influence or to stable rock.
3) Engage qualified geotechnical and structural engineers to determine the separation distance between the laterally loaded footing and SA Water maintenance trench width as in Table 1, in order to (refer Figure 8):
    - Minimise the effect of the footing-induced soil pressure on SA Water pipe to keep it within the pipe load carrying capacity taking into consideration pipe condition
    - Allow unhindered access to SA Water pipes for unplanned emergency maintenance works without the need for time consuming process to design, approve and construct footing stabilisation works.

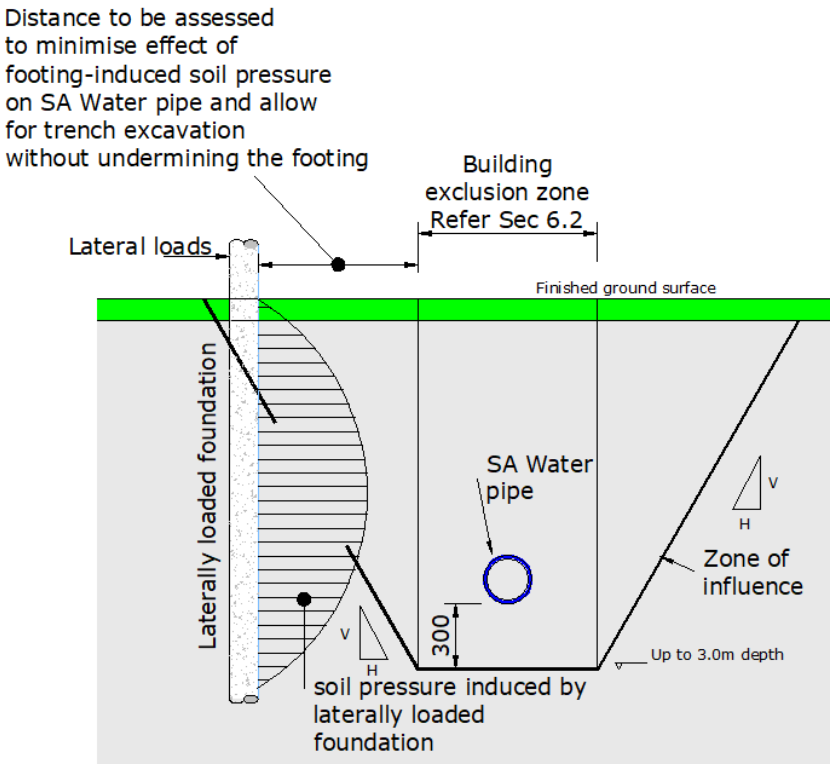

Figure 8: Laterally Loaded Footing

8 Transport Infrastructure Supporting SA Water Pipework

Transport structures include, but not limited to:

- Road bridges
- Pedestrian bridges
- Railway bridges
- Underpass and tunnels
- Culverts

SA Water pipework are sometimes supported on such structures.

8.1 SA Water Requirements

Where SA Water pipework is to be supported on a transport structure, the following shall be considered in the design:

1) Initiate early consultation with SA Water regarding the development of key transport infrastructure. This allows the design and safety issues to be identified and incorporated at an early stage, reducing the need for ongoing iterations, costs, and delays to the project.
2) The design of the transport infrastructure shall:
    a) Ensure adequate access to SA Water assets for future maintenance, repairs, or replacements without presenting a risk to the transport infrastructure or SA Water assets.
    b) Reduce the risk of SA Water assets being impacted by the Transport Authority's work, for example protecting assets from vibrations generated by heavy vehicles
    c) Minimise the impacts and consequences of assets bursts or failure on the Transport Authority's infrastructure
    d) Have enough redundancy in the pipe supporting system.
    e) Consider thermal and hydrostatic thrust forces induced by the pipe when transferred to the transport structure.
    f) Consider access for machinery during repair work and/or replacement.
    g) Consider electrical current interference hazards on SA Water pipework
    h) Provide adequate clearance to other services as stipulated Section 5.
3) SA Water pipework shall be:
    a) Readily and safely accessible for maintenance at short notice
    b) Located to minimize disruption to traffic and road/bridge closure, in case of maintenance works
    c) Where possible, not connected to the outside of the bridge where unplanned maintenance works is not feasible.
    d) Provided minimum clearance from other services in accordance with Section 5.2
    e) Where required, designed to resist relevant loads imposed by the transport infrastructure.
    f) Sleeved through bridge abutments and approach slabs to facilitate future replacement.

9 Pipes Crossing Roads, Railways and Waterways

Pipelines design and construction often requires crossing of roads, railways and creeks.

Minimal impact on the operation and maintenance of pipelines and infrastructures, traffic, etc. shall be considered in the design. This includes choosing the most appropriate pipe alignment and construction methodology.

Relevant Australian standards, WSA, standards by SA Water, DIT, Councils, ARTC and other service authorities shall be considered in the design.

9.1 Road Crossing

There are various techniques for laying pipes across roads.

The most common crossing techniques are trenching and boring.

If trenching is impractical due to safety reasons, vehicular traffic, excessive excavation, underground services and other obstructions, boring shall be used.

9.1.1 Trenching

- Prior approval from relevant authorities shall be obtained for any pipeline to be installed transversely across a road.
- Where trenching is to traverse a road, the trench shall be excavated approximately perpendicular to the road (90 degrees) to minimise restoration impact (generally pavement) and ensuring the minimum clearances between the main and other services are achieved as per Section 5. Roads and pavements shall be reinstated according to relevant authority requirements.
- The pavement shall be saw cut or cold planed prior to excavation. Any additional breakage of the existing pavement edge shall be cut out square to the edge of the excavation prior to reinstatement.
- The excavation shall be of sufficient width to allow for safe and practical working, including proper laying of pipework, shoring, dewatering systems and for the compaction of backfill.
- The depth of the trench shall be sufficient to achieve the minimum cover given in Table 6 and Table 7.
- Reference shall be made to DIT Specification RD-EW-C2 Trench Excavation and Backfill.

9.1.2 Boring

- Design shall develop a technical specification for Boring construction.
- Boring can be by either HDD or pipe jacking. It shall not disturb or damage any underground service, pavement, or other structure in any way.
- Boring under roads shall comply with DIT Specification RD-EW-C3-Boring and WSCM.
- Water and sewer mains installed under road pavement and shoulders by under-road boring shall have a minimum cover of 1.5 m below the surface.
- All water mains installed by boring shall be sleeved.
- The design and construction **must take construction tolerances into consideration** including vertical and horizontal alignment and exit point.
- Entry/exit pits shall be decommissioned by removing all construction equipment and filling the pits to finished surface level with SA-C sand compacted to 95% MMDD.

9.2 Railway Crossing

9.2.1 Boring under Railway Tracks

- Design shall develop a technical specification for Boring construction.
- Boring shall be used for installation of pipework under railway tracks in accordance with ARTC requirements, DIT Specification RD-EW-C3-Boring and AS 4799.
- Water and sewer mains installed under railway tracks by under- track boring shall have a minimum cover of 2.0 m from the top of the existing rail. Elsewhere, the minimum cover shall be as listed in Table 6 and Table 7.
- All water mains under railways shall be sleeved.
- Crossings shall be made as close as practicable perpendicular to the railway.
- The design and construction **must take construction tolerances into consideration** including vertical and horizontal alignment and exit point.

9.3 Creek Crossing

9.3.1 Preferred Option – Above Ground Crossing

- The water main shall span the creek above ground with an appropriate support system (piers, trestle bridges, etc.).
- Crossings shall be near perpendicular to the creeks or drainage reserves where practicable.
- The design shall address all anticipated loadings, including forces from water flow to AS 5100.2 that will impact on the main and support structure.
- Crossing shall minimise interference with the natural channel form and capacity.
- The pipe support structure shall be founded a minimum of 1.0 m below creek bed with additional erosion measures.
- Provide permanent safe access to pipework that complies with AS 1657 for operation and maintenance. Alternatively, the proposed support structure may include measures for installation of temporary planks and scaffolds for safe access.

9.3.2 Boring

- Design shall develop a technical specification for Boring construction.
- Pressure pipes installed under creek bed shall have a minimum cover of 2.0 m below the surface.
- All water mains installed by boring shall be sleeved.
- The design and construction shall take construction tolerances into consideration including vertical and horizontal alignment and exit point.
- Entry/exit pits shall be reinstated by removing all construction equipment and filling the pits to finished surface level with SA-C sand compacted to 95% MMDD.

10 Trees and Shrubs

10.1 General

Trees and shrubs rely on their roots to find moisture and nutrients and SA Water assets are an attractive moisture source. Tree roots can penetrate assets through joints, damaged sections of pipes or maintenance structures, causing blockages and subsequent overflows.

Trees can also cause damage through expansion of roots, transferring loads into the zone of influence and placing pressure on the pipe. This movement often occurs as roots grow (such as after rain events) or during tree maintenance activities.

The risk of damage depends on the type and size of tree, and the type of asset affected. Some assets are more susceptible to damage by trees than others (e.g., AC, RC and VC pipes).

Some tree species have large and extensive root systems which are more likely to cause damage to underground services than others. Some tree species, while appearing small, may have highly invasive root systems that regularly seek out water from underground services more so than others.

Section 13 of the Water Industry Regulation details the requirements for protection of water and wastewater assets during tree planting:

1) For the purpose of protecting sewerage infrastructure:
    a) trees and shrubs (except those listed in Schedule 2 and Schedule 3) must not be planted on public land without the written approval of any water industry entity that owns or operates sewerage infrastructure that may be affected by the planting; and
    b) the trees and shrubs listed in Schedule 2 must not be planted on a road closer than 2 metres to any sewerage infrastructure; and
    c) the trees and shrubs listed in Schedule 3 must not be planted on a road closer than 3.5 metres to any sewerage infrastructure;
2) For the purpose of protecting water infrastructure: trees and shrubs must not be planted on a road closer than 1 metre to any water infrastructure without the written approval of the water industry entity that owns or operates the infrastructure.

To assist planting the right tree in the right place, SA Water has developed a Tree Planting Guide. This provides a list of the tree species approved for planting in the Water Industry Act Regulations, as well as tools to assist tree planting planning protect pipes during tree planting.

10.2 SA Water Requirements

Regarding the interface between trees and SA Water assets, two aspects are considered:

- The potential damage to SA Water assets from tree root intrusion and lateral pressure on the pipe
- The potential damage to tree roots when excavating for maintenance purposes, considering the safety of SA Water personnel, the protection of the pipe and the health of the tree.

Therefore, when planting trees, Section 13 of the Water Industry Regulation, as described above in Section 10.1, details the requirements for protection of water and wastewater assets. Ensure to consider the tree at mature size when considering the lateral clearances specified in Section 10.1.

In cases where the clearance is satified, however there exist significant roots in the maintenance trench width, SA Water will safely manage any excavation where tree roots are required to be excavated for maintenance purposes, considering the safety of SA Water personnel, the protection of the pipe and the health of the tree.

10.2.1 Construction Requirements

During construction of tree pits, adjacent pressurised mains (including water mains and pressurised sewer mains) may become unstable if unsupported, leading to a pipe break. Therefore, to manage this risk during construction:

- Final clearance (i.e., the clearance at the completion of works), and the clearance maintained during the works, should be kept at a minimum of 600 mm.
- For clearance maintained during works, care must be taken to ensure SA Water pipe trench is always supported.

10.2.2 Preventive Measures

To support tree planting initiatives, where there is an inability to ensure that these clearances can be achieved, preventive measures, such as root protection barriers or tree pit liners, may be considered on a case-by-case basis. These are to be assessed and approved by SA Water prior to installation to ensure the protection of underground assets. For more information, refer to the Tree Planting Guide or contact SA Water Alterations, as per Section 14.

For assistance in locating the proximity of proposed tree planting to SA Water network of water and sewerage mains use the online map, Healthy Pipes in conjunction with Dial Before You Dig (noting it provides indicative locations only).

10.2.3 Tree and Shrub Removal

SA Water reserves the right to remove a tree or shrub (even if preventive measures are installed) if SA Water has reason to believe it is causing damage to any infrastructure.

If SA Water or its Constructors require to undertake maintenance works on SA Water assets, SA Water reserves the right to remove a tree if required, once all reasonable and practical alternatives have been considered to avoid root impacts (such as Hydro Vac).

This is to be as per Sections 14 and 15 of the Water Industry Act Regulations.

11 SA Water Maintenance Structures

To safely access SA Water assets to undertake maintenance and repair works, the following clearance shall be provided:

11.1 Maintenance Structures

To allow safe and adequate access to SA Water maintenance structures such as manholes, maintenance shafts, inspection openings and below ground valve chambers, all infrastructure shall satisfy the following minimum clearance around maintenance structures (refer Figure 9):

- An unconfined access way of at least 1.0 m wide shall be always maintained around the edge of maintenance structures.
- A headroom (clearance between finished ground level and the underside of an overhanging structure, such as a roof, of at least 2.4 m shall be always maintained.

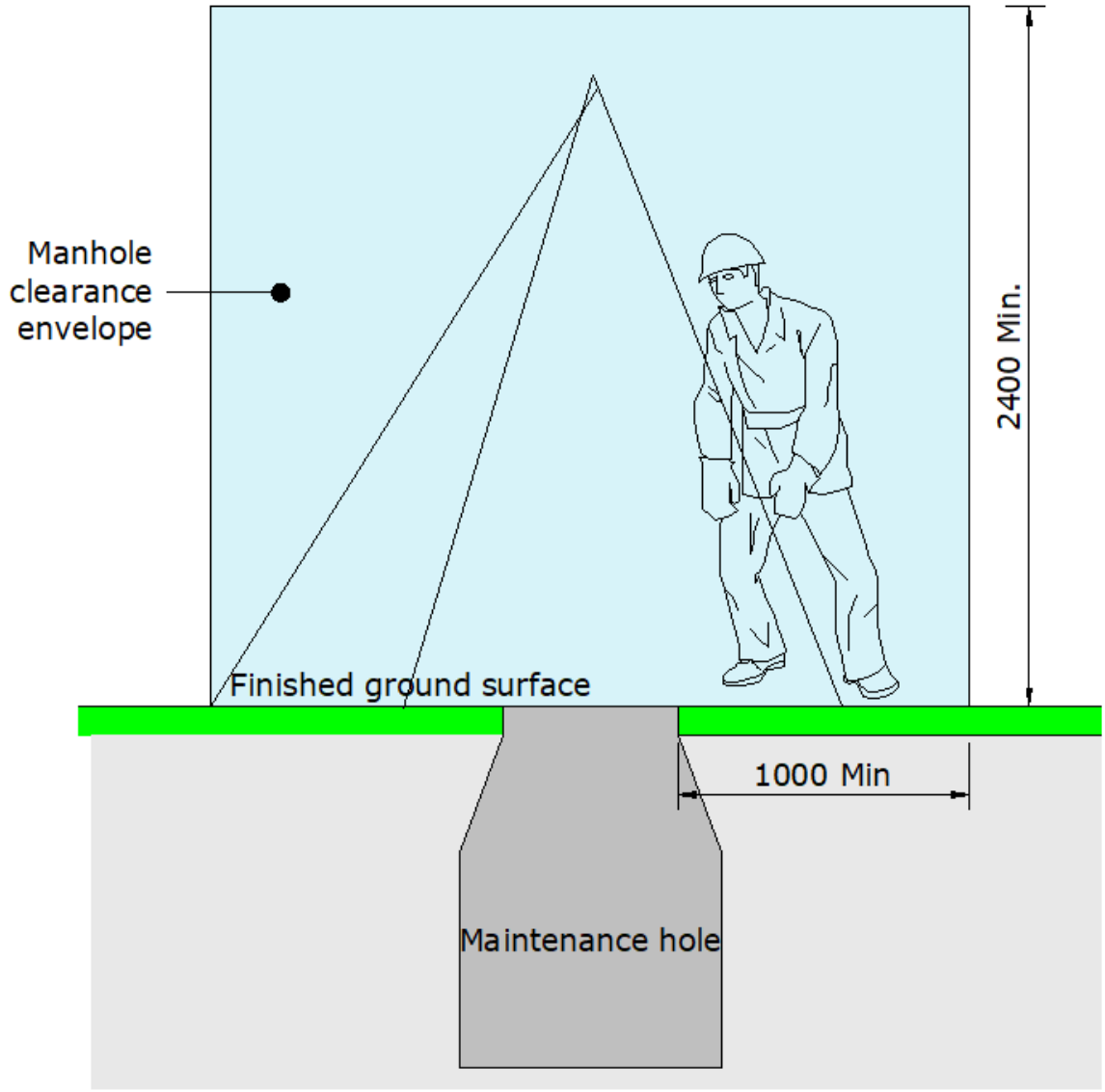

Figure 9: Clearance Around Maintenance Structures

11.2 Overhead Services

Where overhead services are planned near SA Water assets, the following requirements shall be adhered to:

- A headroom (distance between ground level and overhead lines) shall be as per SA Power Networks standard to enable safe access for lifting equipment. Clearance distances are measured from the point of maximum swing or sag of the powerlines.
- Poles and other structures associated with overhead services that are under heavy loading and/or cannot be readily removed must be self-supporting within the zone of influence – this can be achieved using foundation supports such as piles which extend to a depth below the zone of influence or to stable rock (refer to Section 6 and 7 above).
- Poles and other structures associated with overhead services are not to be placed inside the building exclusion zone (refer Section 6.2).
- High voltage power lines in the vicinity of metallic pipelines must be assessed for AC interference hazards.
- Reference shall be made to relevant Industry regulations and guidelines (Electricity (General) Regulations 2012, WH&S Act and Regulations 2012, Electricity (Principles of Vegetation Clearance) Regulations 2010, and SafeWork SA Codes of Practice).

12 Ground Disturbing Construction Works

The following stipulates SA Water requirements for construction activity works with the potential to disturb the ground and adversely affect SA Water pipework.

12.1 Earthworks

12.1.1 General

The soil cover (depth from ground level to top of pipe) over buried assets provides support and protection from excessive loads and damage.

Earthworks and alteration of surface levels, including removal or placement of soil, concrete, bitumen, and paving, may expose assets to excessive loading.

Reduced cover in ground conditions where the water table is higher than the asset also has the potential to cause flotation. Flotation occurs where there is not enough cover over the pipe to balance the upward force created by the water table.

12.1.2 SA Water Requirements

1) **Minimum Cover Requirements**: In general, SA Water's minimum cover requirements must be achieved at all times. Table 6 and Table 7 below provides a guide to the minimum cover requirements for water and sewer respectively for different types of assets depending on their location. Refer to SA Water Standard Drawings (in particular WSCM Drawing Set 4005-30002 and SCM Drawing Set 4005-20003) for full details of SA Water's cover requirements.
2) **Asset Location:** the location of the asset determines the type of loading that the asset will be exposed to. This is normally categorised by two main conditions: trafficable and non-trafficable.
3) **Box Out Depths:** cover can be reduced temporarily to 300mm for boxing out purposes in road reserves, car parks and other trafficable areas. The 300mm specified is the absolute minimum to maintain and protect the overlay embedment material above the pipe.
4) **Reinstatement of Pipe Trenches:** for trench reinstalment reference shall be made to SA Water Standard Drawings (WSCM Drawing Set 4005-30003 and SCM Set 4005-20003).
5) **Compaction over SA Water Pipework:**
    - Heavy vibrating/non-vibrating compaction equipment shall not be used until the minimum fill cover is 750mm.
    - For fill cover less than 750 mm, only hand compaction equipment shall be used.
6) **Maximum Cover Requirements:**
    - Pressurised reticulation pipelines (<= DN 375) generally shall not be buried deeper than 1.2 m. Pipelines may need to be raised where maximum cover cannot be achieved.
    - Pressurised pipelines larger than DN 375 should be kept close to the minimum cover where possible for access purposes.
7) **Potholing:** the depth of cover above an asset must be confirmed with potholing – while assets are installed to meet minimum cover requirements to protect them from damage, the cover may have altered since the time of installation due to excavation activities, erosion, or ground subsidence. Reference shall be made to Section 14.3.2 below.
8) Please note, any sewer break in the vicinity of a drinking water main is a Department for Health and Wellbeing's reportable incident and must be reported.
9) For additional information refer to 4005-30002-01.

For non-compliance with the above cover requirements, SA Water requires an engineering assessment demonstrating that there will be no excessive loadings on SA Water assets. The assessment should take into consideration the condition of SA Water assets based on an asset condition assessment undertaken by the Party undertaking the works.

Table 6: Minimum and Maximum Pipe Cover for Water Mains

Pipe DN	Pipe Cover	
	Minimum (mm)	Maximum (mm)
63 – 200	750	1200
250	800	1200
300	875	1200
375	950	1200
>375	950	NA

Table 7: Minimum and Maximum Pipe Cover for Sewer Mains

Surface Use	Pipe Cover	
	Minimum (mm)	Maximum (mm)
Trafficable Areas (DIT Roads)	1000	NA
Trafficable Areas (Other Roads)	800	
Non-Trafficable Areas	750	

12.2 Heavy Vehicles

12.2.1 General

Heavy vehicles, such as construction equipment or other heavy transport, crossing buried assets can cause damage due to heavy loads and vibration. Even relatively light loads can crack assets if the asset is brittle with shallow cover. RC, AC, VC and CI pipelines are particularly susceptible to damage from the movement of heavy vehicles.

12.2.2 SA Water Requirements

- The depth of cover above an asset must be confirmed with potholing (refer Section 14.3.2) – while assets are generally installed to meet minimum cover requirements to protect them from damage, there are occasions of shallow covers and/or the cover may have altered since the time of installation due to excavation activities, erosion, or ground subsidence.
- Subject to having minimum cover for trafficable conditions (refer Table 6 and Table 7 for water and sewer respectively), vehicles that are legally permitted on public roads are generally allowed.
- For heavy construction plant or vehicles that exceed maximum legal load limits (such as piling rigs, cranes, and rollers), an engineering assessment demonstrating that there will be no excessive loadings or vibrations on SA Water assets shall be provided. The assessment should take into consideration the condition of SA Water assets based on an asset condition assessment undertaken by the Third Party undertaking the works.
- The use of temporary protective measures such as increased ground cover above the asset or steel road plates may be permitted where no other viable options are available.

- Installation of temporary road plate is meant to distribute a truck wheel loads over larger footprint of SA Water pipe and as a result reduce the imposed traffic load on the pipe. The ability of a road plate to effectively distribute the load is dependent on its stiffness (thickness and width) with consideration of plate length to span over the pipe. Design calculations and details are required prior to installation of road plates.
- Additional requirements apply if the surface loading is to permanently change from non-trafficable to trafficable conditions. Refer to Section 12.6 for more information on road development requirements.

12.3 Dewatering

12.3.1 General

Dewatering (the removal of ground water from a construction site) has the potential to cause ground subsidence which may affect the stability of buried assets.

12.3.2 SA Water Requirements

A Dewatering Management Plan that addresses the risks to SA Water assets shall be provided for SA Water's consideration. The Plan shall include, but is not limited to:

- Purpose of dewatering (an explanation of why dewatering is necessary)
- Dewatering technique (such as wellpoint, deep well, or open hole)
- Anticipated dewatering flow rate and total dewatering duration.
- Measures and techniques to manage geotechnical stability issues.
- Contingency plans in case of any emergency.

12.4 Vibrations

12.4.1 General

Excessive vibrations can cause direct damage to SA Water assets, such as damage to pipe joints or cracking of brittle pipes (AC, RC, VC and CI), or can cause soil subsidence resulting in the collapse of the assets.

Common types of work that generate excessive vibrations include:

- Vibratory ground compaction
- Movement of heavy vehicles
- Blasting
- Demolition works
- Pile driving
- Tunnel boring machines

The risk of vibration near the asset will vary depending on several factors including the size of vibrations, asset condition, ground conditions, and distance from the source of vibration.

12.4.2 SA Water Requirements

1) Low vibration work methods shall be used, where possible.
2) Heavy and Mechanical Vibration Equipment is not to be used within 750 mm of the top of the pipe, as per WSCM and SCM Section 3.
3) Vibration is to be controlled at the source – consider substituting equipment that creates large amounts of vibrations for equipment that generates lesser vibrations, including:
   a) **Vibratory Ground Compaction Equipment**
      i) Refer Section 12.1.2
      ii) The use of light rollers, plate compactors and tampers over the use of heavy vibratory rollers is preferred.
      iii) The use of static compaction equipment over vibratory compaction equipment
      iv) Working in shallower layers.
   b) **Piling**
      i) The use of bored piles over the use of driven piles.
   c) **Blasting**
      i) Blasting near SA Water assets is to be avoided whenever possible; non-explosive methods or rock breaking is preferred
      ii) Where explosive methods cannot be avoided, a Blast Plan shall be provided that includes an engineering assessment of the impact of the blast on nearby assets and proposed risk mitigation actions.
4) During significant vibratory works, SA Water may require the Third Party to:
   a) Perform an asset condition assessment to confirm the condition of SA Water's asset prior to works commencing
   b) Undertake prior testing of vibrations to establish safe limits for the specific conditions of the work
   c) Undertake continuous monitoring of vibrations and asset condition using a calibrated device during the work and provide a record of continuous monitoring results to SA Water
   d) Adhere to safe vibrations limits (peak particle velocities (PPV)) which SA Water may specify for a particular asset – in general, the maximum vibrations at the asset shall not exceed the limits provided in Table 8: Safe Vibration Limits (PPV) below.

Table 8: Safe Vibration Limits (PPV)

Vibration Type	Safe PPV Limit for Rigid Pipelines (AC, RC, VC, CI)	Safe PPV Limit for Flexible Pipelines	Safe PPV Limit for Masonry/Mass Concrete Oviforms
Continuous vibration	5 mm/s maximum	10 mm/s maximum	2 mm/s maximum
Intermittent or transient	10 mm/s maximum	20 mm/s maximum	

Note: Refer to British Standard 5228-2:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 2 Vibration.

12.5 Excavations

12.5.1 General

An excavation is any operation in which earth, rock or other material in the ground is moved, removed, or otherwise displaced using tools, machinery, or explosives. Excavations can be open or trenchless.

Excavations of all types can cause damage from excavation equipment directly impacting SA Water assets or may affect the stability of SA Water assets by undermining the assets' embedment (bedding, side support and overlay) material.

The risk of damage increases with more extensive excavations and larger machinery, or for excavations near brittle pipe materials (AC, VC, RC, and CI), which can be more easily damaged.

AC, RC, and VC pipelines are assembled from short pipe lengths. Any differential soil movement can damage these joints causing a leak or burst.

12.5.2 SA Water Requirements for Open Excavation

Open excavation work generally refers to work involving the removal of soil or rock from a site to form an open face, hole or cavity using tools, machinery, or explosives.

1) Any deep excavation (i.e., deeper than the asset or 1500mm, whichever is lesser) where its zone of influence passes under the asset, is required to have a ground support system, such as shoring, in use. Consideration shall also be given to having the asset temporarily taken offline during the works to prevent any possible inundation.
    a) When shoring is installed, it is a requirement to ensure that no ground movement/subsidence occurs on removal particularly in proximity of AC, RC & VC mains.
2) If the main is to be taken offline the following applies:
    a) **Pressure Pipe**
        i) The main is to be depressurised during the duration of the works, by isolation or by temporarily cutting and capping the main on either side of the excavation, in an area outside of the zone of influence of the excavation.
        ii) Depending on the specific location, a temporary bypass main and temporary services may be required.
    b) **Gravity Pipe**
        i) An approved plug is to be installed upstream of the excavation in an area outside of the zone of influence of the excavation.
        ii) Depending on the specific location, tankering or a temporary bypass main and temporary services, or may be required.
3) Buried assets must not be exposed; at least 300 mm embedment overlay cover is to be maintained at all times including during road box-out.
        i) Establishment of actual cover is to be carried out prior to the works commencing via potholing, preferably by vacuum excavation techniques (refer Section 14.3.2).
4) Thrust blocks restrain thrust forces in pressurised pipelines and are commonly found at pipeline fittings and changes in pipeline size and direction. Thrust blocks and the ground supporting them shall never be disturbed as this could cause sudden failure of the asset. Minimum clearances for thrust blocks are outlined in Section 0.
5) Excavation of acid sulphate soils can cause damage to assets through corrosion, in particular steel pipelines. SA Water may require an Acid Sulphate Soils Management Plan to address the risks and management controls for SA Water assets.

6) Details of proposed work methods (including excavation equipment) and details of any assets near which the works will be undertaken including duration of time, shall be provided.

7) Backfilling and reinstatement: SA Water pipelines are installed in compacted bedding, selected fill and support material which is part of the pipeline design. Backfill reinstatement shall be undertaken in conjunction with relevant SA Water Standards.

8) SA Water reserve the right to inspect the works by an SA Water representative before backfilling takes place and may require compaction test results.

9) For additional notes refer to SA Water's standard drawings (WSCM and SCM)

12.5.3 SA Water Requirements for Trenchless Excavations

While trenchless excavations cause minimal disturbance to soil and surface infrastructure compared to open excavations, they pose a great risk to underground services.

Care should be taken when using trenchless methods to avoid colliding with SA Water assets.

1) Details of proposed work methods shall be provided, including:
   a) The type of trenchless installation equipment
   b) Bore diameter
   c) Ground conditions
   d) The accuracy and reliability of the technique or equipment being used
   e) Proposed drill site and drill path
   f) Details of the affected assets (including clearance between drill path and asset)
   g) Technical specification

2) Potholing shall be used to positively locate all underground assets to ensure adequate clearances are maintained between assets (refer Section 5 for Service Clearances). Potholing at each asset crossing and at regular spacing along parallel assets is recommended. All buried assets that cross or are parallel within 1 m of the drill path should be exposed. Reference shall be made to Section 14.3.2

3) Where trenchless excavations cross pipelines, the launch pit (rather than the receive pit), should be located nearest to the most significant pipeline if possible.

4) The depth of the installed utility must be proven at all pipeline crossing points.

5) Continuously monitor the path and depth of the drill head, including during back reaming, where the path of the drill head may deviate from the original path. Potholes are to be kept open to monitor the progress of the drill head near assets and to ensure clearance distances are maintained.

6) An asset condition assessment may need to be undertaken upon completion of the work.

7) Reference shall be made to Section 9 above.

8) For additional notes refer to SA Water's standard drawings (WSCM).

9) Pipe bursting of AC pipe conduits near SA Water infrastructure is not permitted, in accordance with the AC code of practice.

12.5.4 Minimum Excavation Clearance from Thrust Blocks

Pressured pipes with unrestrained joints are held together by thrust blocks. The thrust blocks resist transverse thrust forces at bends and tees, and longitudinal forces at closed valves. The thrust forces are transmitted from the thrust blocks to the soil behind.

When excavating in the vicinity of a thrust block with the pipe pressurised, a minimum clearance from the back of thrust blocks shall be provided as shown in Figure 10.

For the depth of the thrust block, reference shall be made to the As-constructed drawings and/or the WSCM. In this case, potholing is not recommended as it may compromise the integrity of the thrust block.

If excavation closer than Figure 10 clearance distance is unavoidable, depressurising the pipe is needed during the duration of the excavation works. Backfilling shall be engineered fill to a compaction standard equivalent to or exceeding the native soil. Alternatively, CLSM materials shall be used for backfilling.

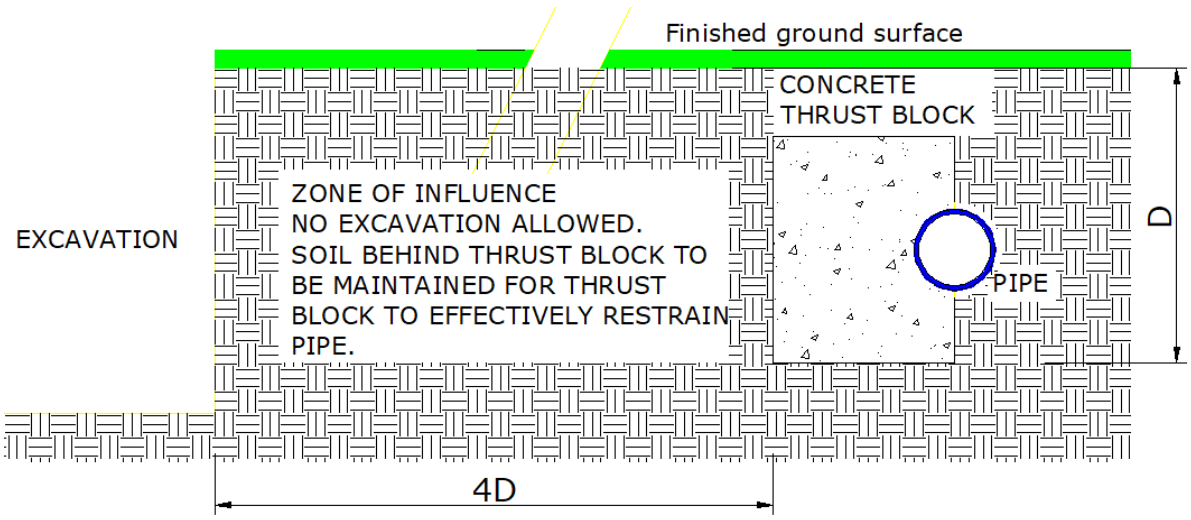

Figure 10: Excavation Clearance from Thrust Blocks

12.6 Road Development

12.6.1 General

Road development includes any proposed creation or alteration of public and private roads including change surface use from non-trafficable to trafficable.

12.6.2 SA Water Requirements

1) The location of SA Water pipelines shall be in accordance with relevant SA Water Standards. Road crossings must achieve the minimum ground cover requirements for trafficable conditions (refer Table 6 and Table 7). Levels achieved during boxing out operations are to conform to minimum cover requirements (refer Table 6 and Table 7).
2) Depending on the criticality of the SA Water asset and classification of the road, SA Water may require new pipelines to be installed using trenchless technology and be placed in sleeves (refer Section 9.1).
3) Prior to the development of roads, pipe joints for existing steel pipelines may need additional protection (e.g., welding of additional collar plates).

4) For new road proposed to be constructed parallel to SA Water's above-ground pipeline, the following requirements shall be adhered to:

    a) Undertake road safety assessment as part of the road design and in accordance with Austroads – Guide to Road Safety taking into consideration the need to protect SA Water pipeline from collision with errant vehicles.

    b) Install road safety barrier to protect SA Water pipe which also provide protection/hazard minimisation to vehicles and its occupants. The concept of Clear Zone (providing adequate width measured from the edge of the lane line to allow errant vehicles to recover back to the road) is no longer supported as it does not eliminate the hazard. Therefore, a safety barrier is required.

    c) Provide a minimum of 1.5 m clear distance between the edge of proposed drainage swale and the nearest edge of existing pipe or concrete chair.

5) Refence shall be made to Section 12.1 to 12.5.

13 Specialist Engineering Assessment

SA Water pipelines are usually designed for traffic and fill loads to ensure long-term supply of services.

However, these pipes may be subjected to additional stresses and strains due to loads or actions (e.g., piling, tunnelling, ground movements, etc.) from nearby construction works. Such activities may result in adverse effects such as physical damage to and subsequent failure of the infrastructures, resulting in compromised levels of service to customers, flooding, damage to property, compromised safety of operation and maintenance staff and third parties and even fatalities.

In general, the proposed construction works shall not:

- Interfere with the delivery of services to SA Water customers both during and after the completion of work.
- Reduce the whole life value of SA Water infrastructures i.e. It will not suffer damage, loss of capacity, or be otherwise downgraded.
- Inhibit or otherwise prevent maintenance and repair to SA Water infrastructures.

Therefore, where instructed by SA Water, the Proponent for proposed construction works must undertake a Specialist Engineering Assessment (SEA) to demonstrate there will be no adverse impact or nominate protection measures to prevent any adverse impact to SA Water assets.

13.1 Works that may Adversely Affect SA Water Pipelines

Works that can adversely affect SA Water infrastructures and result in damage include but not limited to:

- Piling: driven or displacement piles (hammer, sheet) and bored or replacement piles
- Loading: cranes, piling rigs, self-propelled modular transporters (SPMT), abnormal loads
- Tunnelling, excavations, and dewatering
- New buildings, structures, or fixtures
- Placement of fill material or construction materials stockpiles
- Ground improvement works such as compaction, dynamic compaction, impact rolling, grouting, jet grouting and soil nailing
- Vibration associated with construction activities, including rock excavation,
- Construction activities in soft or compressible soils prone to significant settlement and/or instability such as landslide risk.

13.2 SA Water Threshold Assessment Criteria

Table 9 lists the Threshold Assessment Criteria to facilitate preparation of the SEA to demonstrate that the risks to SA Water infrastructures are acceptable.

They are to be used as a guide only and represent levels of change in strain and joint rotation below which the risk of significant damage may be considered low. They are not safe or allowable values.

SA Water does not guarantee that even lower values will not result in damage.

It is the Proponent and their consultant's responsibility to select appropriate assessment criteria for the specific site.

Values lower than those detailed in Table 9 are likely to be acceptable. Higher values would require justification that the risk of damage remains low.

If alternative criteria values are considered to be appropriate by Designers, it is suggested that SA Water be consulted as early as possible in the assessment process.

The Proponent must note they are accountable for rectification of damage to SA Water infrastructures, including any consequential damage.

Table 9: SA Water Threshold Assessment Criteria

Pipe Material	Joint Type	Maximum Increase in Joint Pull Out (mm)	Maximum Increase in Joint Rotation (degrees)	Maximum Increase in pipe strain – tensile (micro-strain)	Maximum Increase in pipe strain – compressive (micro-strain)
Cast Iron – unlined (CI)	Lead Joints (no-yarn)	5	0.1	80	350
Cast Iron Cement Lined (CICL)	Lead Joints (no-yarn)	5	0.1	80	350
Cast Iron Insitu Cement Mortar Lining (CICS)	Lead Joints (no-yarn)	5	0.1	80	350
Cast Iron Cement Lined (CICL)	Rubber Ring Joint (RRJ)	10	0.3	80	350
Reinforced Concrete Pipes (RCP)	Lead Joints (no-yarn)	5	0.1	20	100
Reinforced Concrete Pipes (RCP)	RRJ	5	0.1	20	100
Concrete Oviform	unknown	N/A	N/A	0.3 MPa equivalent stress limit	1.5 MPa equivalent stress limit
Masonry Oviform	unknown	N/A	N/A	0.0 MPa equivalent stress limit	1.0 MPa equivalent stress limit
Vitrified Clay (VC)	RRJ	5	0.1	20	150
Ductile Iron Cement Lined (DICL)	RRJ	10	0.3	200	200
Ductile Iron Cement Lined (DICL)	Tyton-Lok	N/A	0.3	200	200
Mild Steel Cement Lined (MSCL)	RRJ	10	0.3	150	150
Mild Steel Cement Lined (CICL)	Welded	N/A	N/A	150	150
Polyethylene (PE)	Fusion Bonded/Welded	N/A	N/A	2500	2500
Asbestos Cement (AC)	RRJ	10	0.3	20	100
Polyvinyl chloride (PVC)	RRJ	10	0.3	500	500

Notes:

1) The criteria in apply to longitudinal impacts on SA Water pipelines due to ground movements caused by construction works, where there are no transverse impacts (e.g., cross-sectional distortion). In the event when there is a transverse impact, the combination effects need to be fully analysed and assessed.
2) For the vibration limits, reference shall be made to Section 12.4.

13.3 Specialist Engineering Assessment (SEA)

Where required, the Specialist Engineering Assessment shall include, but not limited to:

1) Desktop studies and inspections to gather background information regarding:
    - SA Water infrastructures that may be impacted
    - Geotechnical condition
    - Condition assessment of the affected infrastructures
    - Operation and maintenance considerations
2) Geotechnical investigations
3) Geotechnical and Structural Engineering assessment to model, predict and understand impacts to SA Water infrastructures.
4) Risk Assessment to identify and analyse potential issues that may adversely affect SA Water assets, taking into consideration the severity of the risk, control measures and effectiveness of those measures.
5) Design details of protective measures to be implemented, if any, to protect SA Water infrastructures.
6) Instrumentation and Monitoring Plans to validate outcomes of the engineering assessment and confirm impacts are within predicted limits.
7) Work Method Statement (WMS) describing construction activities to ensure impacts are within predicted limits.
8) Contingency Plans describing the activities required in the event of an incident to ensure continuity of supply of services to customers.
9) Submission of a Specialist Engineering Assessment Report for SA Water review and comment.

13.3.1 Conditions When A SEA may be Required

SA Water may require a project-specific SEA when any of the following assets is within the proposed construction works zone of influence:

- Reticulation pipes of size less than or equal to DN375
- Pipes, conduits, and associated structures with greater than DN375 (non-reticulation assets).
- High-risk assets (pipework associated with treatment plants, pumping stations, dams/reservoirs must be considered high risk)
- Critical assets as nominated by SA Water

13.4 Modelling Considerations

The analysis shall consider the following:

13.4.1 Asset Loading/Unloading

The analysis shall consider the existing stress conditions, associated with the existing loads, around SA Water infrastructure.

The original construction methodology adopted shall be reproduced to depict a realistic representation of the stress field.

Loads and load combinations shall be in accordance with relevant Australian standards.

The assets may experience higher loading intensity during construction than in the serviceability state, hence construction load and construction sequence shall be considered.

The analysis shall be performed for the least favourable load case.

13.4.2 Dimensions of SA Water Infrastructures

Dimensions of the infrastructure shall be extracted from As-Constructed drawings, if available, or from pre-condition assessment reports.

In the absence of reliable data, a sensitivity analysis shall be performed or shall be determined by inspection.

13.4.3 Material Properties

Contemporary design acceptance criteria for new structures may not be applicable in structural integrity assessment of many old SA Water infrastructure. Therefore, the limitations in the application of contemporary standards and codes to existing structures shall be recognised.

The material parameter selection shall consider the deterioration of the structures and the causes of deterioration shall be understood. Effects on rate of deterioration due to proposed works shall be estimated in the SEA. Conservative assumptions shall be made for the structural properties or further investigations carried out to determine material parameters.

13.4.4 Sensitivity Analysis

There is inherent uncertainty associated with analytic assumptions and methodology.

Uncertainty includes but are not limited to variability in geotechnical and structure material properties, existing loads acting on the asset, present condition of the asset, groundwater conditions. Therefore, sensitivity analysis is an integral part of the Engineering Assessment to evaluate the potential variations in the risk profile.

Ground conditions, material properties and groundwater could vary from the estimated values used for analysis. Therefore, a sensitivity analysis shall be conducted on the geotechnical and structural parameters assumed for the analysis.

The proposed works could trigger changes in groundwater conditions. The ground water level variability and settlement impacts on the asset shall be considered. Where relevant, a sensitivity analysis on groundwater conditions shall be conducted to address uncertainty.

13.4.5 Settlement Analysis

Reference shall be made to Table 9 above.

14 Procedure, Risk Mitigation and Obligations of Third Party Asset Owners

When a Third Party is considering working near SA Water assets, the following methodology shall be adhered to:

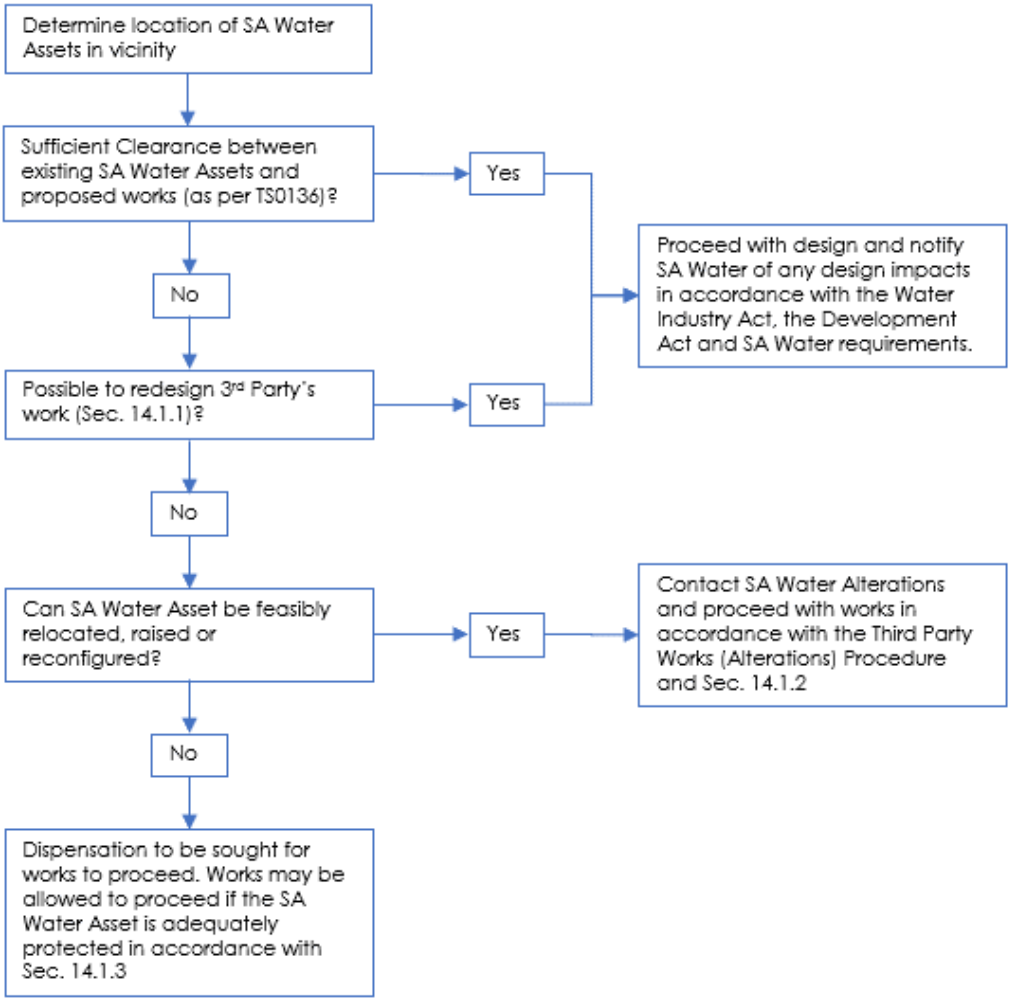

Figure 11: Procedure when Working Near SA Water Assets

Where potential damage may occur, options per Section 12.1 shall be considered to reduce the risk of damage (provided in order of preference):

14.1 Options to Reduce Risks

14.1.1 First Preference - Redesign the Third Party's Work

In all instances, the preferred option is for the Third Party asset owner to redesign the proposed work to comply with the requirements of this Standard.

14.1.2 Second Preference - Relocate SA Water's Asset

Where it is not technically feasible to comply with the requirements of this Standard, SA Water assets may be able to be relocated, raised, or reconfigured. Where this option is feasible, the Third Party shall contact SA Water Alterations via sawateralterations@sawater.com.au. SA Water Alterations will coordinate the required works and subsequent funding in accordance with the Third Party Works (Alterations) Procedure.

SA Water requirements for relocation works are as follows:

1) Notify SA Water within 30 days of discovering the non-compliance issue.

2) The Third Party is to supply the following documentation to SA Water:

   a) Contact name (including organisation, phone number and email)

   b) Scope of works including clear identification of each clash with SA Water infrastructure and alterations required (e.g., levels of top and underside of stormwater pipe etc)

   c) Drawings should be submitted as a DWG file, where possible. Please bind CAD/DWG files to enable full view and functionality.

   d) Proposed delivery dates for works (earliest possible notification)

3) Design and delivery of the proposed relocations of water reticulation. sewer reticulation and all other assets shall be undertaken by SA Water design, in accordance with the Third Party Works (Alterations) Procedure, unless otherwise agreed with the Third Party. In this instance:

   a) Proposed relocations of water reticulation and sewer reticulation assets shall be designed by a design engineer who is a suitably qualified practicing professional engineer with appropriate engineering experience and is fully familiar with SA Water current Design Standards.

   b) For all other assets, relocation designs shall be completed by one of the design engineers from SA Water's prequalified engineering consultants list.

4) All proposed relocations shall be in accordance with current editions of applicable SA Water and Australian Standards.

5) The Third Party shall be responsible for the full costs associated with asset relocation that is necessary to offset the effects of the proposed Third Party work, unless cost sharing applies under Section 52 of the Water Industry Act, which specifies 50-50 cost sharing arrangements for works in roads, depending on the remaining life of the asset. This includes the cost of any necessary isolations, connections, design, and inspections that may need to be performed by SA Water personnel.

6) Asset relocations will normally be like-for-like replacements (material, size, and pressure rating) except for AC, CI, RC, and VC pipelines which should be replaced with an approved pipe material, as per SA Water's Design Standards, of equal internal diameter.

7) SA Water will assess proposed relocations with consideration to future demand requirements in which case a request may be made to increase pipeline size or strength. SA Water will bear the cost of replacements above and beyond like-for-like replacements required to meet future demands.

14.1.3 Third Preference - Protect SA Water's Asset

In cases where minimum clearance cannot possibly be achieved, either through modification of the proposed design or through SA Water Alterations, then dispensation shall be sought by the Third Party via the TDRF. In these instances, SA Water may allow the proposed work to proceed if SA Water assets will be adequately protected.

SA Water will only consider this option when the Third Party:

1) Demonstrates that redesigning the work and relocating SA Water assets are not feasible options.
2) Demonstrate that they will employ a safe system of work regarding any hazards associated with working on or near SA Water assets.
3) Adhere to SA Water technical direction for protecting SA Water assets.
4) Where necessary, employ methods that protect SA Water assets and their work from potential damage, including.
    a) **Temporary Protection:** This type of protection is typically used for temporary works that will only remain in position for a short time, and can include:
        i) Safe work methods such as supporting an excavation with shoring to prevent loss of ground support around an asset.
        ii) Selecting alternative construction equipment such as using ground compaction equipment that generates smaller vibrations.
        iii) Increase ground cover above the asset or steel road plates.
            - Installation of temporary road plate is meant to distribute a truck wheel loads over larger footprint of SA Water pipe and as a result reduce the imposed traffic load on the pipe.
            - The ability of a road plate to effectively distribute the load is dependent on its stiffness (thickness and width) with consideration of plate length to span over the pipe.
            - Design calculations and details are required prior to installation of road plates.
        iv) Installation of temporary bridges to span over SA Water assets.
    b) **Permanent Protection:** This type of protection is typically used for permanent works that will remain in position for a long time (e.g., buildings and structures). Permanent protection shall consider the following requirements:
        i. Spans over the pipe taken into consideration width of trench for maintenance purpose (Table 1).
        ii. Is designed and constructed in small segments with lifting lugs to allow future removal for maintenance purposes (weight of segment to be confirmed with local operation dependant on available lifting equipment).
5) Proposed protection work for water reticulation and sewer reticulation assets shall be designed by a design engineer who is a suitably qualified practicing professional engineer with appropriate engineering experience and is fully familiar with SA Water current Design Standards.
6) For all other assets, protection work shall be designed and completed by one of the design engineers from SA Water's prequalified engineering consultants list.
7) All permanent protection works shall be designed with a 100-year design life and shall be in accordance with current editions of applicable SA Water and Australian Standards.
8) Drawings for all protection works are to be certified by the design engineer and submitted to SA Water for approval. It is the designer's responsibility to ensure that the selected protection method is suitable for the application, including confirming that the ground conditions are acceptable for the final design.

SA Water will not be responsible for any costs associated with protection works that is necessary to offset the effects of the proposed Third Party work.

14.2 Obligations of Third Party Asset Owners

The Third Party asset owner shall plan, design, and employ a construction methodology that maintains the structural integrity of SA Water pipework.

This may include:

1) Work Planning and Designing, including but not limited to:
   a) Submitting a Dial Before You Dig (DBYD) enquiry to determine the approximate location of SA Water assets.
   b) Performing a site inspection to identify any surface indicators of underground assets
   c) Surveying the SA Water pipework route including potholing
   d) Collecting relevant data of SA Water assets including function, age, material, condition, cover depth, etc.
   e) Superimposing and consolidating the relevant information into the Third Party asset design model
2) Risk Assessment and Options, including but not limited to:
   a) Conducting a damage risk assessment to determine whether the proposed work presents a risk of damage to SA Water assets
   b) Consideration of what options are available to reduce risks to allow work to be carried out safely
3) Develop a safe solution and design that complies with the requirement of this Standard including undertaken a Safety in Design process in accordance with SA Water TS 101 or a Third Party equivalent standard.
4) Seek SA Water approval as per Section 14.1.3.
5) Develop a Work Method Statement to not adversely affect or damage SA Water pipework; including but not limited to:
   a) Providing continuous trench support, such as shoring
   b) Not loading SA Water pipework with heavy machinery during construction
   c) Using trenchless technology
   d) Contingency planning to manage potential damage to SA Water pipework
   e) Liaising and working closely with SA Water Operation staff
6) Delivery of the proposed works, including but not limited to:
   a) Conducting a site meeting with one of SA Water's representatives at project start-up and before project close out
   b) Allowance for work that needs to be performed by SA Water such as asset inspections, isolations, and connections (note that costs may be incurred). The associated costs will be provided to the third party once the application has been submitted.
   c) Incident notifications
7) Close out, including but not limited to:
   a) Final walkover
   b) Commissioning test, if applicable
   c) Providing SA Water with all documents required for final acceptance including as-constructed drawings.

14.3 How to Locate SA Water Assets

14.3.1 Dial Before You Dig

Before any works are undertaken, a Dial Before You Dig (DBYD) enquiry shall be submitted to determine the approximate location of SA Water assets. DBYD enables plans to be requested from multiple asset owners who have assets in the work area.

The plans are intended to identify what assets are near the proposed works so it can be determined what steps need to be taken to reduce the risk of potential damage. The plans should never be relied on as the sole means of locating assets. Actual asset details and locations should be accurately confirmed using potholing.

The annotations on the DBYD plans will help to identify asset type, size, and material.

The following information should also be considered when plans are being reviewed:

- Individual sewer and water services to properties are not usually shown on the plans however their existence should be assumed. Some properties such as hospitals may have more than one sewer or water service to the property.
- Only SA Water owned assets are shown on the plans. There may be other water or wastewater services not shown on the plans.

Disclaimer

Any plans or other information provided by SA Water must be used as a guide only. Plans (including the location of pipes and other assets) are approximate only and it is the third party's responsibility to locate the exact location of SA Water assets before commencing work.

SA Water does not warrant or make any representation as to the accuracy, completeness, reliability, currency, quality, or fitness for purpose of any plans or other information (including, but not limited to, the accuracy of the scale of, or the location of, anything shown on any plan or diagram).

14.3.2 Potholing

The location, depth, and direction of all assets near the proposed works must be confirmed using potholing.

Potholing is the technique of locating buried assets by carefully hand digging trial holes or using other non-destructive techniques such as vacuum excavation, air excavation or water excavation.

The use of mechanical excavation equipment to pothole is not allowed.

SA Water's requirements for potholing include:

1) Potholing must be undertaken with reference to DBYD plans and other information provided by SA Water
2) Potholing is to be carried out prior to drilling or excavating to establish the exact location of SA Water underground assets
3) Where the installation of a service, whether by open excavation or trenchless methods, crosses a pipeline, each crossing point must be potholed
4) For excavations or drillings parallel to a pipeline, potholing shall be required at the beginning and end and at a longitudinal spacing determined by risk assessment including proximity to SA Water pipework. the size of the work area, density of assets in the work area, and the risk of potential damage associated with the work
5) As an alternative to risk assessment, the following longitudinal spacing may be adopted:

a) For excavations or drillings parallel to a pipeline within 1.0 m, potholing should be required at the beginning and end and every 20 m along the route

b) For excavations or drillings parallel to a pipeline greater than 1.0 m, potholing should be required at the beginning and end and every 60 m along the route

6) For trenchless excavations, the pothole must extend deep enough to visually see the pipeline to ensure no damage during Third party trenchless works. Minimum clearances must be observed

7) Potholes must be backfilled once the work has been completed – clean bedding material should be used for the first 300 mm above the exposed asset.

8) For excavations parallel to a pipeline or drilling, the location of all potholed assets is to be surveyed by a qualified surveyor:

a) Survey levels are to be to the Australian Height Datum (AHD)

9) Any surface indicators should also be surveyed (see Section 14.3.4)

a) This survey requirement does not apply for works crossing SA Water pipeline

14.3.3 Electronic Detection

- Electronic detection technology may be used in combination with potholing to positively verify assets.
- Metallic and reinforced concrete assets which contain steel, may be detected with electronic detection technology, however non-metallic assets cannot be detected by this method.
- Pipe material may also change over distance, sometimes changing from metallic to non-metallic material and back again.

A physical inspection of the site where the works are proposed will allow the working environment to be assess and any surface indicators of underground assets identified.

14.3.4 Surface Indicators

There are several surface indicators which may point to the location of buried SA Water assets, including:

- Cathodic protection test points
- Electrical equipment such as cabinets
- Access covers to sewer and drain maintenance structures
- Valve covers
- Water hydrants
- Sampling points
- Inspection covers
- Customer meters
- Signs, markers, and tags.

While these surface indicators may be indicative, they are not to be relied on, as covers may not be directly above assets.