

Technical guidelines

Sydney  
**WATER**

# Building over and adjacent to pipe assets



August 2021



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# How to use these technical guidelines

## Building over and adjacent

Section 1 explains what is covered by these guidelines, what are building over and adjacent (BOA) works, and details important terms used in the document.

## Protecting pipe assets

Section 2 explains the notion of free and full access, and describes temporary and permanent works usually used to protect pipe assets. It also provides general guidance on protecting our pipe assets from construction plant loadings.

## BOA diagrams

Section 3 contains diagrams illustrating common situations where works are built over and adjacent to our pipe assets. If your proposed works fit the depicted situation, the outlined technical requirements will apply. More than one diagram may apply to your case. If your works do not fall under any of the situations, you'll require a Specialist Engineering Assessment. Consult Sydney Water early and work with us to avoid damaging our assets.

## Acceptance

This document does not tell you how to obtain acceptance from Sydney Water for your proposed works. Our *Land development guide* and *Asset adjustment and protection manual* will guide you through the procedure. You can find these documents on our website.

# 1 Building over and adjacent

## 1.1 Overview

When you build over, adjacent, close to or under Sydney Water pipe assets, your work must not:

- obstruct full and free access to our assets
- cause physical damage to our assets
- weaken our assets leading to future damage
- increase the likelihood of a hazardous situation (for example, induced voltages onto our pipelines).

More information can be found in our Policy - *Building over or adjacent to Sydney Water assets*.

The following guidelines in this document outline the requirements that apply in common building work. You may use these guidelines to understand whether your proposed building work is likely to cause adverse impacts. If you don't understand some of the complex technical issues, seek appropriate advice.

Our stormwater pipes and channels are not covered by this document. For information on stormwater assets, refer to the *Guidelines for building over or adjacent to Sydney Water stormwater assets*.

In addition to complying with the technical requirements, you must also:

- obtain any stipulated letter of requirements
- comply with the requirements set
- exercise due care when you build.

Our *Land development guide* and *Asset adjustment and protection manual* will guide you through the procedure. You can find these documents on our website.

These guidelines are to help you and your professional advisors, including architects, engineers and designers, to better plan and construct works that are near to our assets.

If you cause adverse impact to any of our assets, you'll have to pay the costs of returning them to serviceable condition.

## 1.2 What are building over and adjacent (BOA) works?

Any building works likely to adversely impact on our pipe assets are regarded as 'building over or adjacent to' (BOA) works. Building over and adjacent means over, under, or next to.

## 1.3 What are Sydney Water pipe assets?

Our pipe assets are buried or above-ground pipes and conduits of various size, shape and form. They were made of a variety of materials common at the time of construction. Some date back to the 19th century. Some pipes operate under internal pressure while others do not.

Some of our critical pipe assets are protected by acquired easements over land, but we have many critical assets that don't have easements. Whether or not there's an easement, you must give due care to protect our assets and ensure access for our operation and maintenance purposes.

### 1.3.1 What are Sydney Water maintenance structures?

Our maintenance structures are the means by which we access our pipe assets for maintenance and repair. They vary in size and shape and usually have an access cover at ground level. Wastewater (sewer) maintenance structures can include maintenance holes, maintenance chambers, maintenance shafts, rodding points and lamp holes.

For clarity, this guide shows one type of maintenance hole to represent maintenance structures in general.

## 1.4 What are building works?

Any new buildings and structures, or modification to existing buildings or structures, and any work that changes the current form and shape of the ground are 'building works'.

Building works may include residential dwellings, commercial and industrial buildings, swimming pools, carports, non-habitable sheds, decks, fences, retaining walls, driveways, pavement, drains, landscaping, roads, utilities, infrastructure works and temporary works.

Demolition of disused buildings and structures, temporary works, excavation and boring are also building works.

You may need to consider the impacts of future excavation to our asset, or a possible failure of our asset, on your temporary or permanent works and plan accordingly. Relocation of your works or our asset may be a preferred alternative.

## 1.5 What pipes can you build over?

We'll consider allowing you to build certain structures over our reticulation sewers with diameters 300 mm and smaller.

Building over or adjacent to larger sewers with diameters up to 750 mm is not preferred. If you wish to build over these pipes, talk to us early as we may impose substantial restrictions and you'll need a specialist engineering assessment.

### 1.5.1 What pipes can't you build over?

We won't allow you to build over the following assets:

- Pressure pipes for water supply and wastewater (sewerage), including pressure and vacuum sewer pipes or stormwater pressure pipes.
- Wastewater (sewer) property connection points and maintenance structures.
- Non-pressure wastewater (sewer) pipes that have diameters equal to or greater than 750 mm, and other critical assets such as tunnels, oviforms and our heritage listed assets.
- Easements.

## 1.6 What pipes can you build adjacent to?

We'll allow you to build adjacent to our assets and easements if you:

- satisfy us that you'll do all the necessary temporary and permanent works required to protect the assets from damage
- demonstrate that your development won't impede access to the assets for their maintenance, repair or replacement.

## 1.7 What is a service location diagram?

A service location diagram shows our pipe assets, but only indicates the presence of our pipes. It doesn't pinpoint the exact physical location.

You can purchase the diagram through *Sydney Water Tap in* on our website. It can also be obtained through the national referral service *Dial Before You Dig*.

## 1.8 What is a service protection report?

A service protection report identifies and pegs out on-site Sydney Water assets. It enables the accurate plotting of these assets onto your building plans. Only Sydney Water listed Service Protection Reporters can prepare these reports. You can find the list on our website.

## 1.9 What are building plans?

Your building plans must describe in detail your proposed works and the location of Sydney Water pipe assets. If necessary, plans showing the extent and method of supporting excavation in the ground should be included. The plans may also include the construction sequence, dewatering or temporary works required during construction.

## 1.10 What is a specialist engineering assessment?

Where directed by these guidelines or where your works do not meet the requirements shown in these guidelines, or involves building over or adjacent to assets greater than 300 mm, a specialist engineering assessment will be required and your works may need to be amended. Refer to *Sydney Water Procedure - Specialist Engineering Assessment (SEA)* for specific requirements.

All specialist engineering assessment submissions must be prepared by engineers meeting our *Engineering Competency Standard*. Some submissions will require independent verification. All submissions will involve a report and a completed *SEA Submission Checklist* to be submitted for our acceptance. You can find these documents on our website.

## 1.11 What are temporary protection works?

Temporary protection works are those required to protect our pipe assets during your construction works. They may include supports, barriers or other construction control measures.

## 1.12 What are permanent protection works?

Permanent protection works are those required to be constructed to protect our pipe assets on a permanent basis. They may include strengthening or rehabilitation works and will remain after construction is complete.

## 1.13 What is a monitoring plan?

A monitoring plan outlines how you will monitor the impact of your building works on our pipe assets. Your plan must contain warning thresholds to allow enough time to implement actions to avoid damage or failure of our assets. Your plan may also include dilapidation surveys.

## 1.14 What is a contingency plan?

A contingency plan outlines the control measures that can reduce the consequences if your work causes our pipe asset to fail or disrupts our service to customers.

The plan may show alternative construction systems, provide for cut-off barriers or alternative construction equipment or change the sequence of work. It may also include providing emergency resources or repair materials, such as special pipe couplings or clamps.

## 1.15 What is the zone of influence?

The zone of influence (ZOI) for external loading is the notional envelope within which an external vertical load would exert stress on a pipe or structure (**Figures 1, 1.1 and 1.2**). The zone is defined by the lines from the bottom projection of the pipe or structure extending upwards at an angle of 45° to the ground surface. Where the pipe is currently concrete encased or will be encased, these lines extend from the bottom edge of the encasement.

The stress created in the soil by a vertical load on the ground surface lessens with depth. So, pipes buried deeper are generally less affected than shallower ones.

The ZOI for other impacts such as excavation for your works and dewatering near our pipes are considered in diagrams 18 – 21.

The ZOI for impacts on your works due to possible future excavation of our pipes are considered in diagrams 13, 16.1 and 17.1.

Figure 1 - Unencased pipe, Zone of influence in sandy and clayey soils

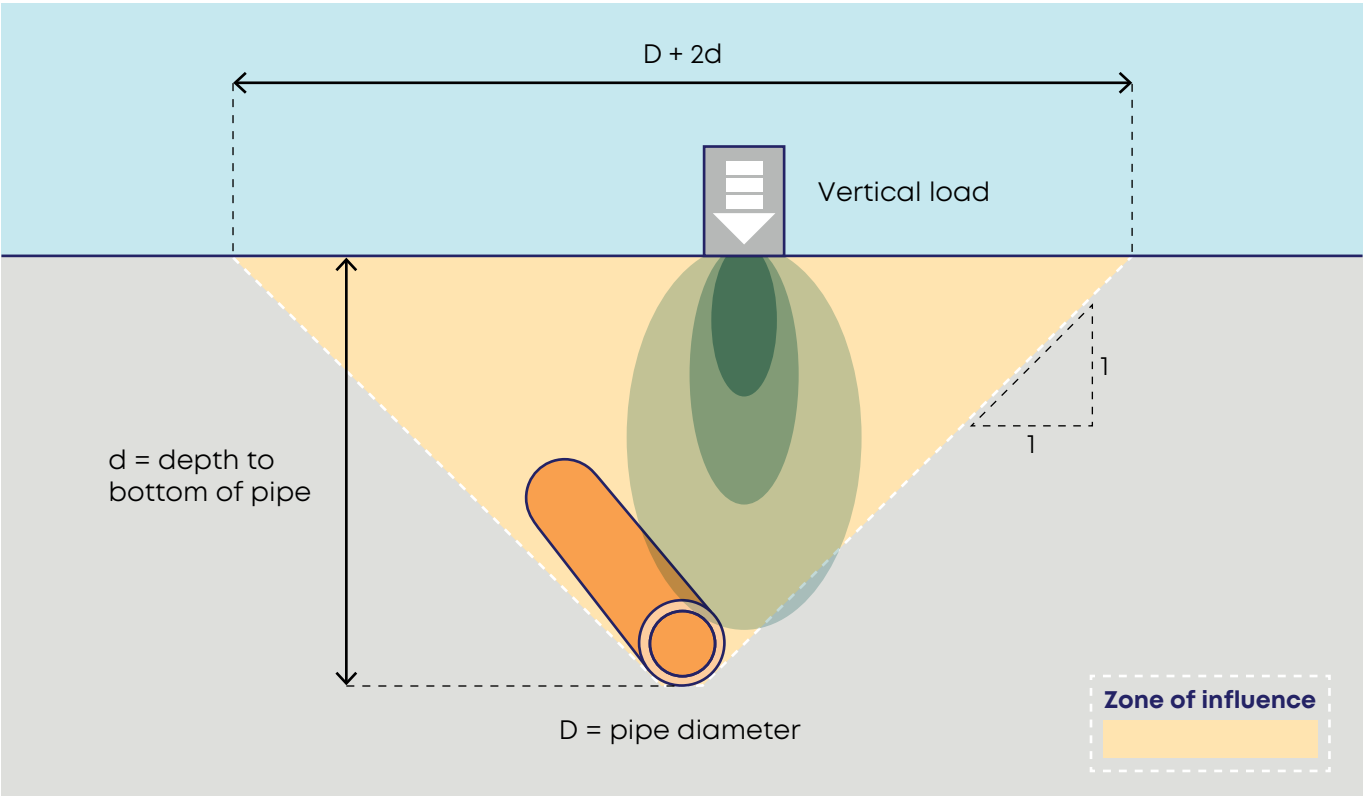
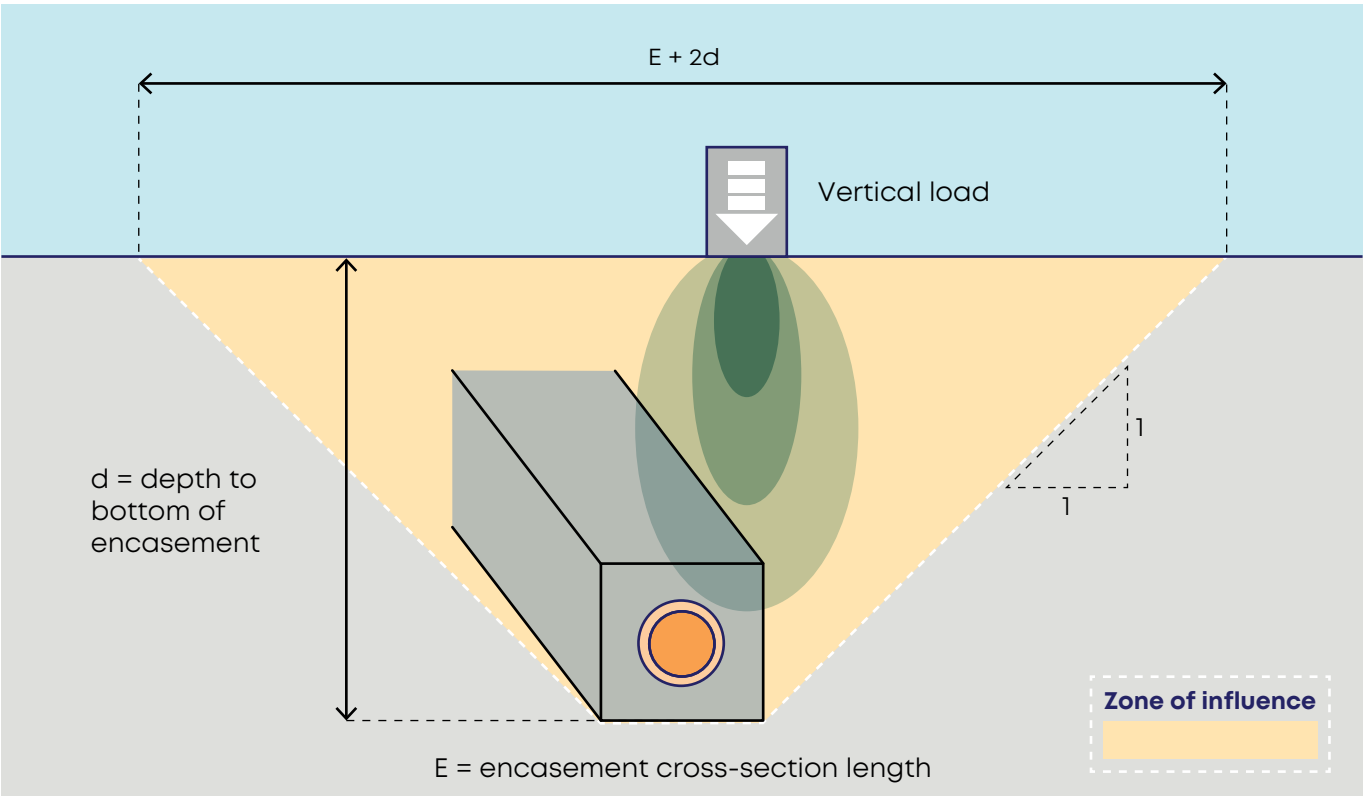
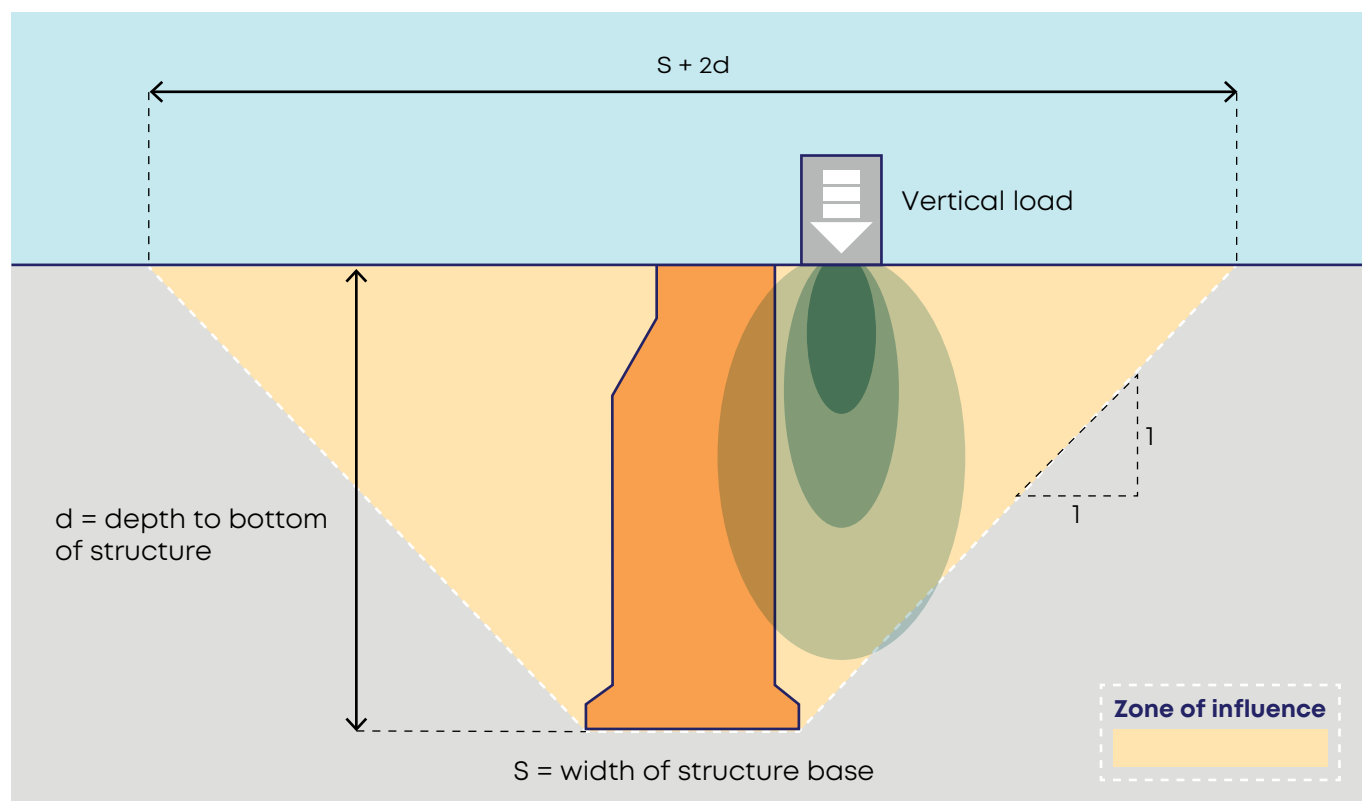


Figure 1.1 – Encased pipe Zone of influence in sandy and clayey soils



**Figure 1.2 – Structure Zone of influence in sandy and clayey soils**



## 2 Protecting pipe assets

### 2.1 Free and full access

#### 2.1.1 General

We must be able to reach our pipe assets. We need access to and working space around surface fittings and access points for routine operation and maintenance. We may also require construction and excavation space for repair or renewal.

Free access is safe 24-hour access so we can manage incidents without delay. If your building works are likely to restrict free access and impede emergency response, you'll need to make appropriate alternative access arrangements that we must agree with and accept.

Full access includes safe passageway for appropriate plant and equipment.

Access through foyers, habitable spaces and staircase is not considered to be safe, free and full access.

#### 2.1.2 Reticulation wastewater (sewer) maintenance structures

You must not build over wastewater (sewer) maintenance structures.

For us to access reticulation wastewater (sewer) maintenance structures, we need an unobstructed passageway with a minimum width of 900 mm and minimum clear headroom of 2.4 m. A maintenance vehicle must be able to park not more than 50 m from the maintenance structures.

To set a tripod at a maintenance hole, we need a working space of at least 1 m around the rim of the cover with minimum headroom of 2.4 m above. For a maintenance shaft or maintenance chamber, the working space may be reduced to 600 mm around the rim of the cover.

#### 2.1.3 Other pipe assets

Operating headroom clearance and working space requirements for other pipe assets vary according to asset type. It's important to consult Sydney Water early to obtain our specific requirements for your site.

Generally, we require minimum headroom of 2.4 m above pipe access points.

### 2.2 Understanding the pipe asset

Additional loadings, vibration or ground movement will increase stress in a pipe asset. This may compromise the built-in safety factor, shortening service life and durability in the long-term. In severe cases, the increased stress could damage or collapse the pipe.

The ability to resist new loads depends on the type and existing service condition of the pipe asset. Older pipes with defects are more prone to damage than new ones. Lead-jointed cast iron pipes are vulnerable to damage by small ground movement. Wastewater (sewer) pipes corrode internally more severely than other pipes because of gases inside the pipe. Aggressive soil and groundwater attack the external protective coating of buried pipes.

If necessary, the service condition of an existing pipe asset is usually assessed by:

- CCTV inspection
- opening up the ground for visual inspection.

#### 2.2.1 Pressure pipes

Pressure pipes for water, wastewater (sewer) and some stormwater have large stored energy. At certain fittings and bends, these forces are balanced by thrust or anchor blocks in the ground. Take care to find out if these are present if building or excavating near them and take precautions to ensure they're not disturbed.

## 2.3 Temporary and permanent protection works

When BOA works are affecting our pipe asset, temporary or permanent protection works will be required. If pipe assets are built over or adjacent obstructing free and full access, they may need to be strengthened or made more robust.

Temporary protection methods may include erecting temporary barriers, adapting construction methodology, and controlling vibration and ground movement.

Permanent protection methods are typically relocation of the asset away from building works, concrete encasement, internal lining and bridging slabs. The table below explains when these methods are used.

| Purpose          |                                                                                                                      | Concrete encasement | Lining – non-structural | Lining – structural | Bridging slab |
|------------------|----------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------|---------------------|---------------|
| Maintenance-free | To provide a more robust installation to reduce likelihood of damage                                                 | ✓                   |                         |                     |               |
| Strengthening    | To provide additional structural capacity to the pipe to resist additional external loading                          |                     |                         | ✓                   |               |
| Rehabilitation   | To rehabilitate a deteriorated pipe to stop internal corrosion and prevent soil/water entering through broken joints |                     | ✓                       | ✓                   |               |
| Load isolation   | To isolate the pipe from excessive loading                                                                           |                     |                         |                     | ✓             |

## 2.4 Maintenance-free concrete encasement

Encasing a pipe in concrete will make the installation more robust. It provides additional protection to the pipe from unexpected external load and movement, reducing the risk of damage and consequently the need for repairs. However, visual inspection and future access to the pipe will be permanently impeded. So, it must be used with caution.

Examples of maintenance-free concrete encasement are:

- at major road, rail, creek or stormwater crossings
- when a structure or part of a structure is built directly above the pipe and is impeding future open-cut excavation access to the pipe.

Encasement may be used for steel pipes, cast iron or ductile iron pipes, PVC, PE, GRP and clay pipes. In flexible-jointed pressure mains, the encasement must not cover more than two rubber ring joints. At both ends of the encasement, short rocker pipes with flexible joints must be incorporated at the terminal faces.

Concrete encasement is not appropriate for:

- mechanical joint couplings, flanged joints and lead joints
- pipes with external corrosion or damage. Replacement of pipes is required before encasement
- cast iron and ductile iron pipes in non-pressure wastewater (sewer) situations. Replacement of pipes is required before encasement
- cement mortar jointed clay pipes. Replacement of pipes is required before encasement

- pipes in poor or unstable ground or mine subsidence areas
- deep pipes
- pipes in a deteriorated state.

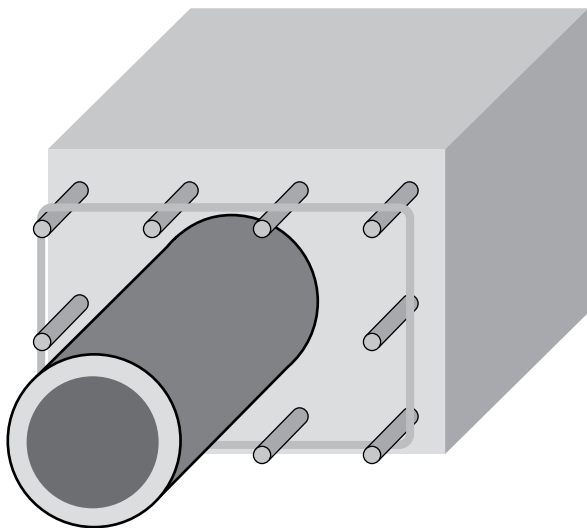
Maintenance-free concrete encasement takes the form of an articulated plain concrete surround for non-pressure wastewater (sewer) pipes in good ground conditions where external loads are not excessive. To ensure full compaction of concrete under the pipe, you must first place concrete on one side and vibrate it until it emerges from under the pipe on the other side.

Reinforcement is required for maintenance-free encasement for large diameter pipes and pressure pipes to control cracking of the concrete.

## 2.5 Reinforced concrete encasement

When additional loads are imposed on a pipe beyond its capacity, you may use reinforced concrete encasement to strengthen the installation (**Figure 2**). This must be designed by a competent structural engineer.

**Figure 2 - Reinforced concrete encasement**



## 2.6 Lining

You may install an internal lining to prevent deterioration of the pipe from corrosion. Lining may also help prevent exfiltration, infiltration of groundwater and migration of soils into the pipe. For small pipes it may be possible to install a structural lining to take additional loading. This must be designed by a competent structural engineer.

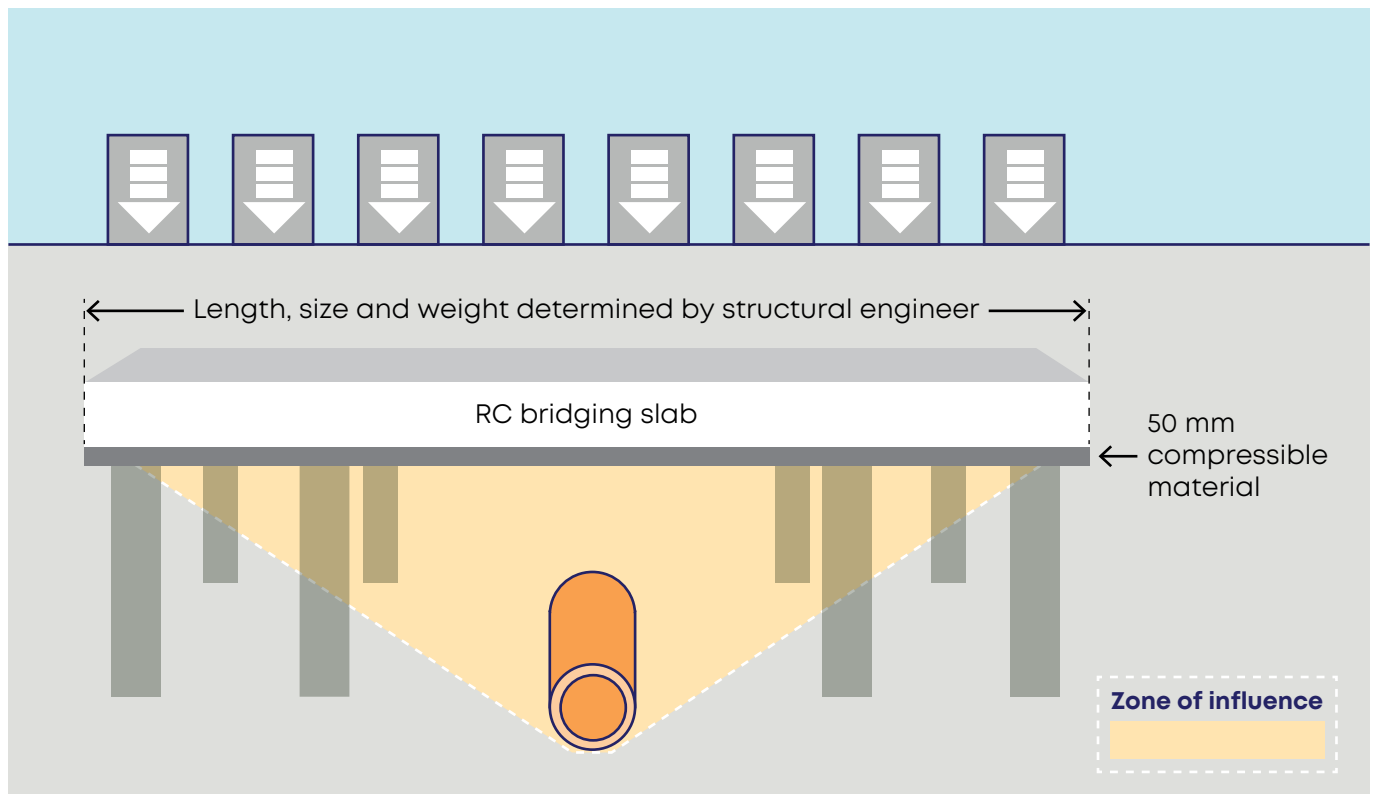
It's common to install linings using trenchless techniques, such as slip lining, cured-in-place lining and spirally wound liners for the whole pipe length between maintenance holes. You'll need a specialist engineering assessment if proposing lining.

## 2.7 Bridging slab

You may use a reinforced concrete bridging slab to protect the buried non-pressure pipe assets from additional loading. The slab spans over the pipe for a distance determined by the zone of influence of the pipe as shown in **Figure 3**. Place a layer of compressible material underneath the span of the slab.

The slab may often be made of precast units for removal. A competent structural engineer must prepare design and construction details.

**Figure 3 - Reinforced concrete bridging slab**



## 2.8 Protecting pipe assets from construction plant loadings

Buried pipe assets can be subject to construction plant loading in construction sites. The pipe relies on the cover of soil above the crown to protect it from damage.

You must locate and peg out the position and line of our pipe assets on-site before starting any site work. Exercise extreme care during construction. If you have any doubt on the service or physical condition of any pipe asset, contact us as soon as possible.

### Shallow pipes

For pipes with less than 0.45 m cover, no construction plant may pass or be positioned within the zone of influence (**Figure 4**). If you need to traverse the pipe, you must put protection measures in place. You must complete a specialist engineering assessment and prepare a work method statement for our acceptance. For pipes with soil cover more than 0.45 m, light construction plants such as forklifts, small

excavators, wheel loaders and the like are usually allowed (**Figure 5**). For non-reticulation pipes, you must prepare a specialist engineering assessment for our acceptance.

### Deep pipes

Generally, we permit construction plant for pipes with soil cover over 1.2 m. However, these plants are limited to those with individual wheel load not exceeding 80 kN, or axle load not exceeding 160 kN (**Figure 6**). Examples of these plants are registered vehicles permitted on public roads and construction plant under 25 tonnes.

For non-reticulation pipes, you must prepare a specialist engineering assessment and a work method statement for our acceptance.

### Heavy plant

Heavy construction plant must not traverse pipes or be positioned within the zone of influence. Heavy construction plant includes piling rigs, cranes, rollers and the like (**Figure 7**).

If you need to place heavy construction plant above our pipe assets, you must prepare a specialist engineering assessment and a work method statement for our acceptance.

Figure 4 - Construction plant not permitted within zone of influence for shallow pipes

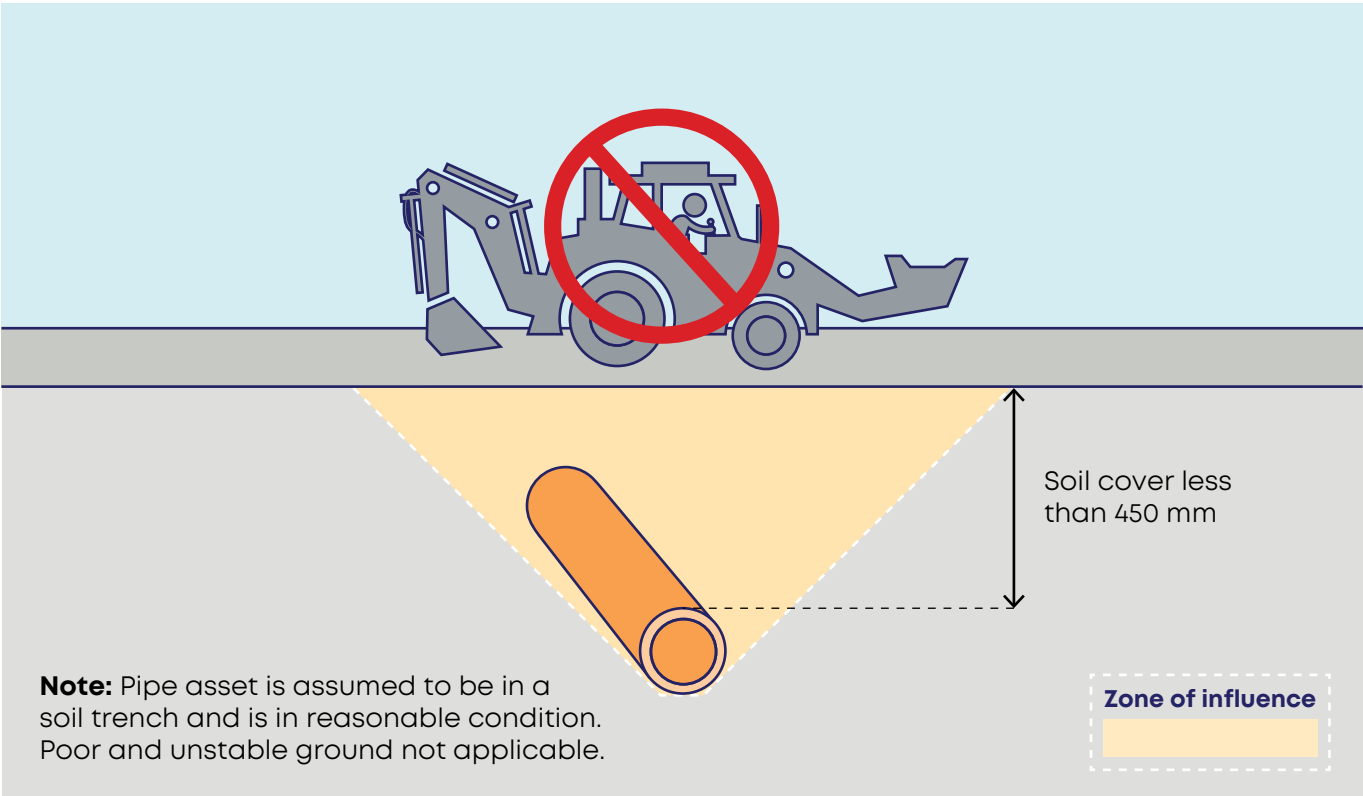
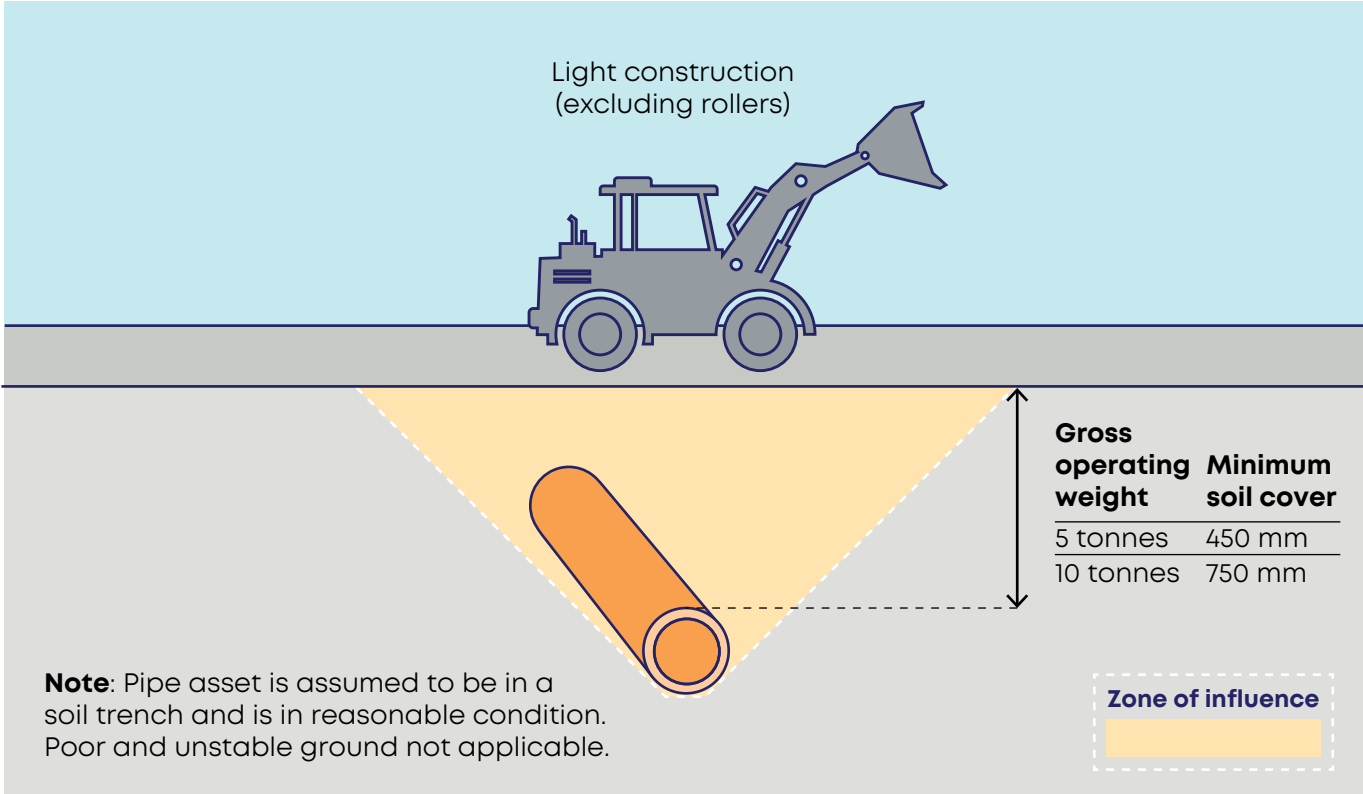
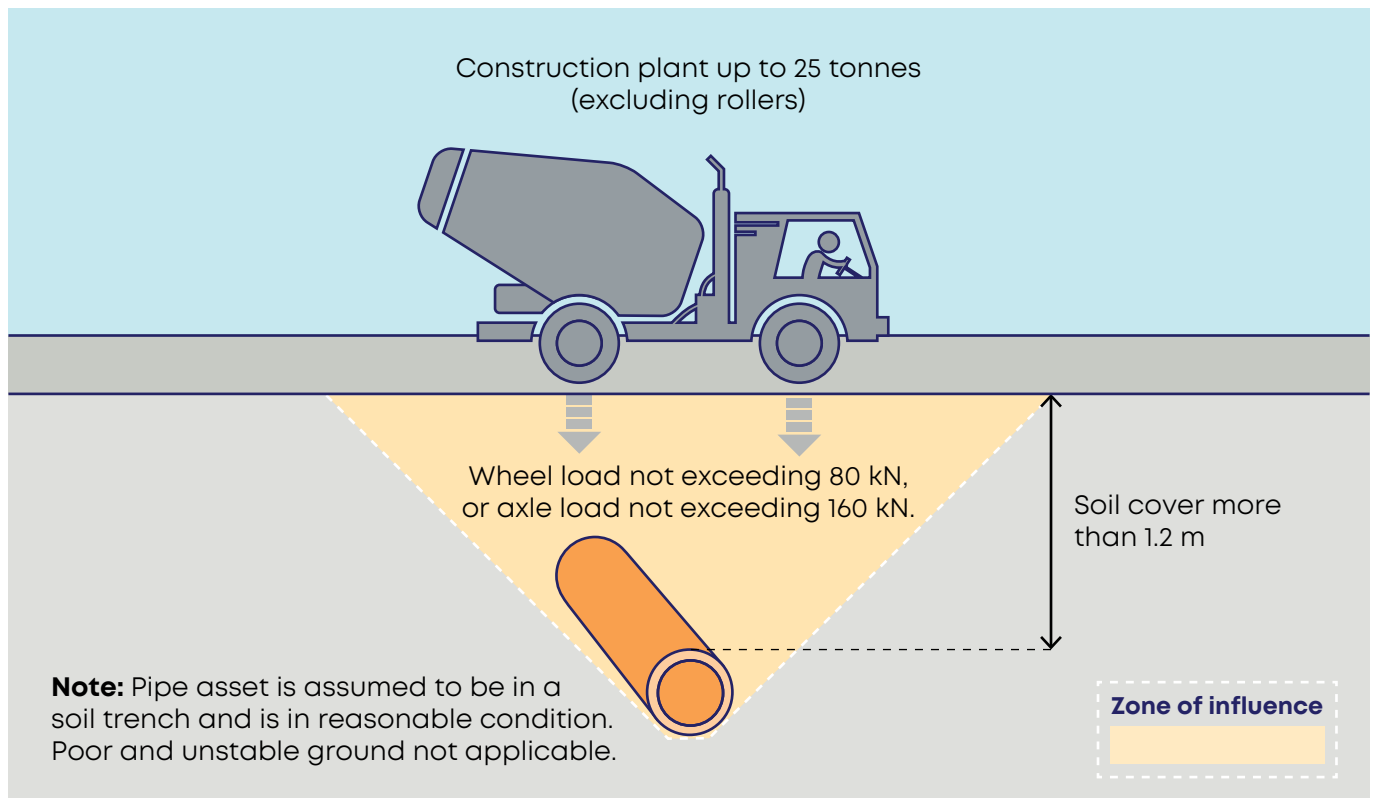


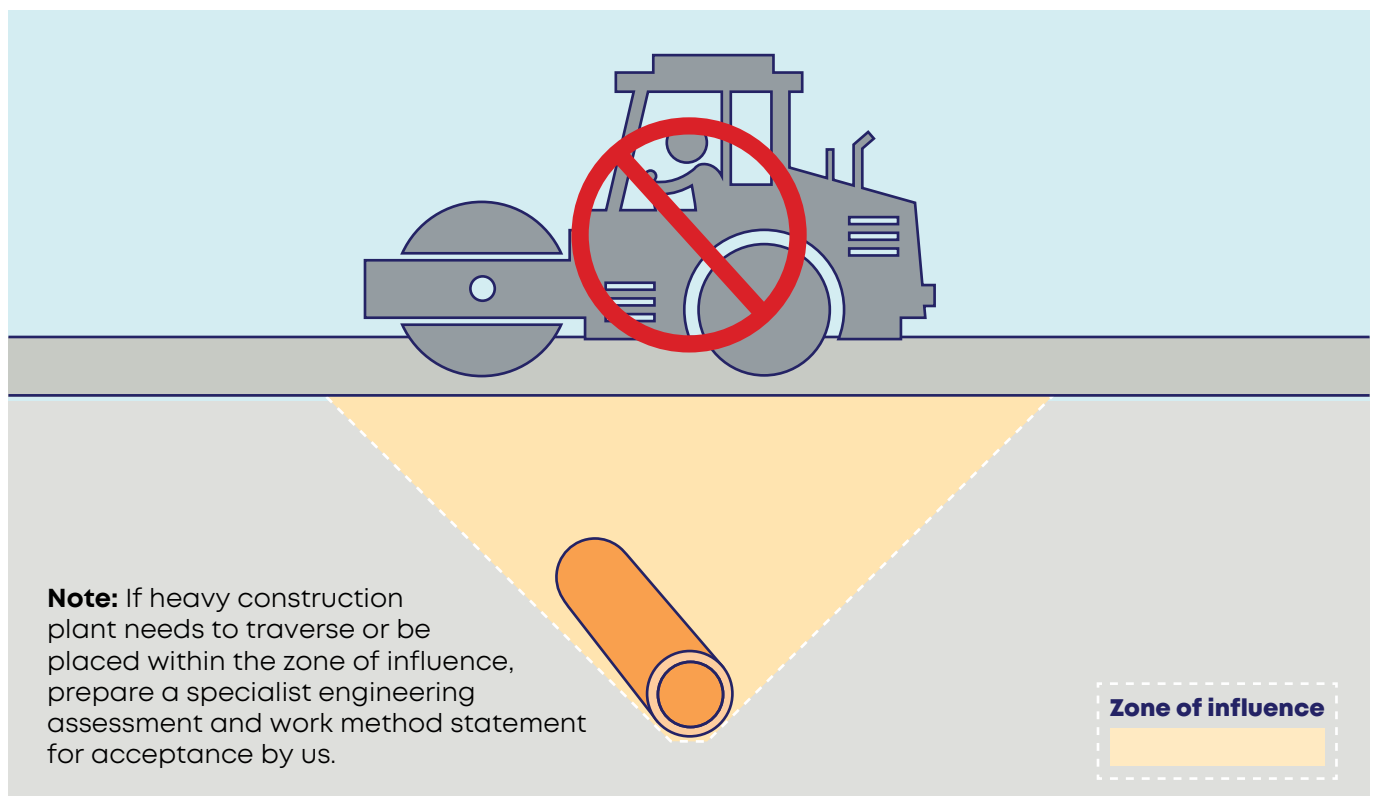
Figure 5 - Light construction plant permitted within zone of influence



**Figure 6 - Construction plant permitted within zone of influence for deep pipes**



**Figure 7 - Heavy construction plant not permitted within zone of influence**



## 2.9 Clearances between underground services

Where services are proposed near our underground pipes, minimum clearances apply, as shown in the clearances tables below.

These are minimum clearances between our existing buried pipes and new utility services to be installed by conventional trench methods. For trenchless methods, a specialist engineering assessment (SEA) is required and may result in greater clearances being needed. Clearances

between our existing buried pipes and new water or wastewater (sewer) services to be installed are addressed in our codes for the installation of those services.

Our buried pipes may also have appurtenances such as valves, hydrants, and cubicles that we need to access and operate at ground level and sometimes replace. A minimum of 2.4 m vertical and 2 m horizontal clearance above ground is required between these appurtenances and buildings, traffic light kiosks, car charging stations, power poles, bus shelters and other structures.

### Horizontal clearance

| Utility                                                        | Pressure water pipes<br>≤DN 200 /<br>>DN 200 to<br>≤DN 375 | Non-pressure wastewater (sewer) pipes<br>≤DN 300 | Pressure and vacuum wastewater (sewer) pipes<br>≤DN 200 |
|----------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------|
| Gas pipes ≤DN 200                                              | 300 <sup>7</sup> / 600                                     | 300                                              | 300 <sup>7</sup>                                        |
| Gas pipes >DN200                                               | 500 / 600                                                  | 500                                              | 500                                                     |
| Telecommunication conduits and cables                          | 300 <sup>7</sup> / 600                                     | 300                                              | 300 <sup>7</sup>                                        |
| Protected low and high voltage electricity conduits and cables | 1000 <sup>8</sup>                                          | 500 <sup>8</sup>                                 | 1000 <sup>8</sup>                                       |
| Extra high voltage electricity conduits and cables             | SEA <sup>8</sup>                                           | SEA <sup>8</sup>                                 | SEA <sup>8</sup>                                        |
| Stormwater pipes                                               | 300 / 600                                                  | 300                                              | 300                                                     |
| Kerbs                                                          | 300 <sup>3</sup> / 600 <sup>3</sup>                        | N/A                                              | 300 <sup>3</sup>                                        |

### Vertical clearance

| Utility                                                        | Pressure water pipes<br>≤DN 375 | Non-pressure wastewater (sewer) pipes<br>≤DN 300 | Pressure and vacuum wastewater (sewer) pipes<br>≤DN 200 |
|----------------------------------------------------------------|---------------------------------|--------------------------------------------------|---------------------------------------------------------|
| Gas pipes ≤DN 200                                              | 300                             | 300                                              | 300                                                     |
| Gas pipes >DN200                                               | 500                             | 500                                              | 500                                                     |
| Telecommunication conduits and cables                          | 300                             | 300                                              | 300                                                     |
| Protected low and high voltage electricity conduits and cables | 600 <sup>8</sup>                | 300 <sup>8</sup>                                 | 600 <sup>8</sup>                                        |
| Extra high voltage electricity conduits and cables             | SEA <sup>8</sup>                | SEA <sup>8</sup>                                 | SEA <sup>8</sup>                                        |
| Stormwater pipes                                               | 300                             | 300                                              | 300                                                     |
| Kerbs                                                          | 300                             | N/A                                              | 300                                                     |

### Notes for clearances tables:

1. All dimensions are in millimetres (mm).
2. Measure clearances between the outer edge of conduit, face of protection barrier and pipe barrels except:
  - i. for welded steel pressure pipes, where the nearest point of another utility to the centre line of a welded steel water pipe must be at least half the required minimum trench width for the pressure pipe plus 600 (to provide access for welding)
  - ii. when a utility or pipe is or will be concrete encased, measure clearance from the outside face of the encasement.
3. Measure clearances from kerbs from the outside of the pressure or vacuum pipe barrel to the nearest point of the kerb. Where these pressure pipes are  $\leq$ DN 375, clearances can be progressively reduced until the minimum of 300 is reached for pipe  $\leq$ DN 200.
4. Clearances are indicative absolute minimums and don't consider the possible presence of anchor blocks for pressure pipes, or other site constraints. Horizontal clearances apply for pipes and conduits laid at a similar level only. You must assess site specific factors, installation methods and safety of future maintenance activities when determining suitable clearances.
5. The table should not be relied upon for locating existing services in lieu of checking service owner records and the use of safe service locating practices.
6. You must also refer to affected utility owners for their specific requirements which may include special protection and backfill.
7. For installations such as poles, pits and small structures, you may reduce horizontal clearances to a pressure pipe to 150 for distances along the pipe of up to 2,000 provided there is no risk of future maintenance excavation work on the pressure pipe, or failure of the pressure pipe, destabilising the structure. This does not apply for electricity conduits and cables.
8. For electricity conduits and cables over or adjacent to our assets, you must organise a specialist engineering assessment (SEA) to find a suitable solution.
9. For all other pipes and utilities outside the size range and types shown, you must organise a specialist engineering assessment (SEA) to find a suitable solution.

## 3 BOA diagrams

### 3.1 General

You may use these diagrams to understand the technical requirements that apply. The diagrams describe common situations where works are built over or adjacent to our pipe assets. These technical requirements are based on:

- usual ground condition – pipes were commonly laid in trench in sandy or clayey soils. When laid in rock trench, tunnels, poor or unstable grounds, such as mine subsidence areas, special consideration and other requirements may apply.
- reasonable pipe service condition – pipe assets deteriorate over time. Those close to the end of their service life are more vulnerable to damage. Old cast iron and brick pipes are easily damaged by ground movement. When pipes are known to be vulnerable to damage, special consideration and requirements may apply.

If your building works don't fall under the situations described in these diagrams, consult us early and work with us to avoid damaging our assets.

### 3.2 Design responsibility

The design of your building works depends on site conditions and the method of construction. The designer must also comply with appropriate statutory requirements and meet our *Engineering Competency Standard*.

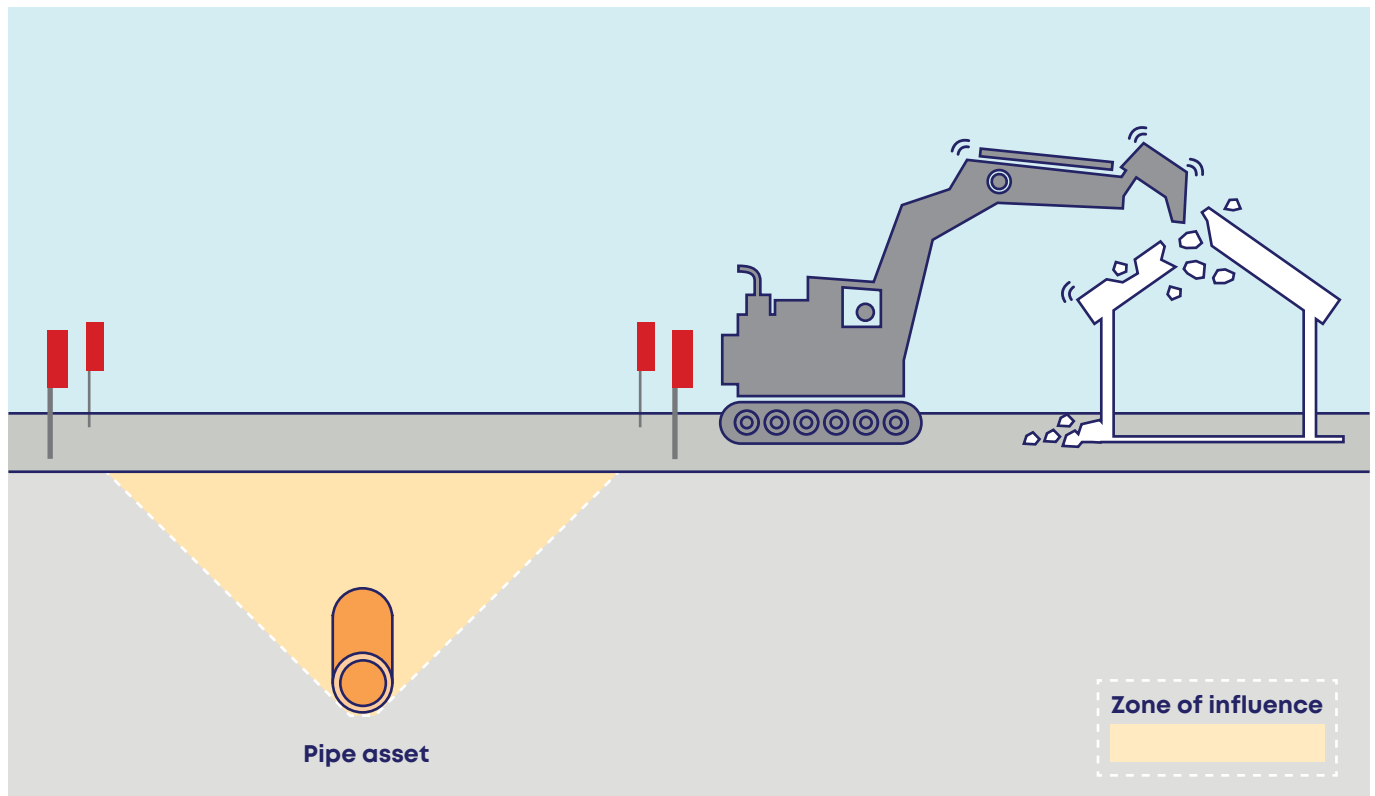
These diagrams inform you of the minimum requirements that we'll apply in dealing with BOA works. The stipulated requirements don't mean that any design work implied by the diagrams is adequate and sufficient. In no case do these diagrams lessen the designer's responsibility to ensure the proposed works are fit for purpose for both your own use and to protect our assets.

You must seek professional advice if you don't understand fully the intent of these diagrams. If you damage any of our assets, you'll have to pay the costs of returning them to serviceable conditions.

### 3.3 Acceptance

In addition to complying with the technical requirements, you must also refer to our *Land development guide* and *Asset adjustment and protection manual* for guidance. You can find these documents on our website.

## Diagram 1 – Demolition works



### Notes:

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

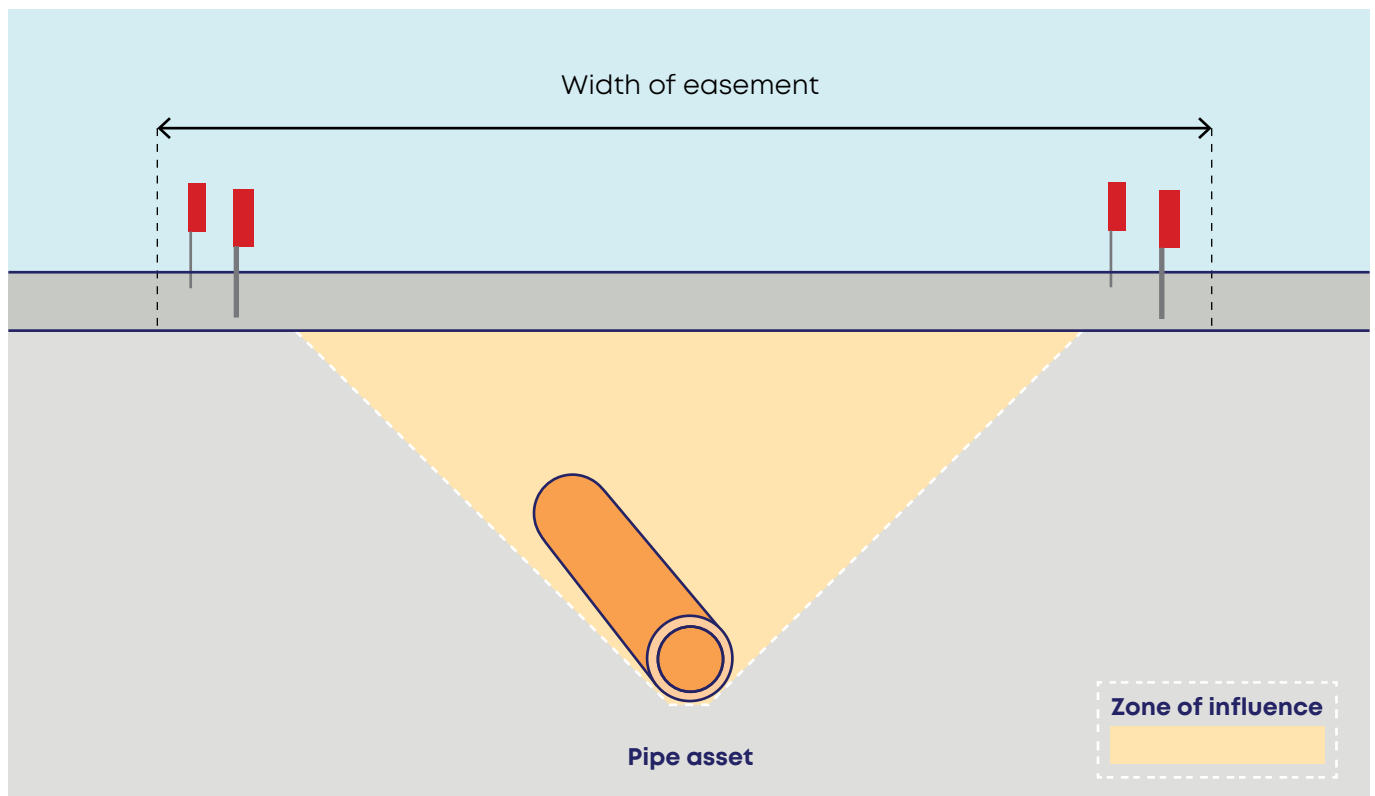
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### BOA technical requirements:

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- 1 Obtain a service location diagram.
- 2 Locate the pipe asset and determine its depth. Peg out the zone of influence on-site.
- 3 Exclude or restrict construction plant loading within the zone of influence (See Section 2.8).

## Diagram 2 – Building next to easements



### Notes:

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

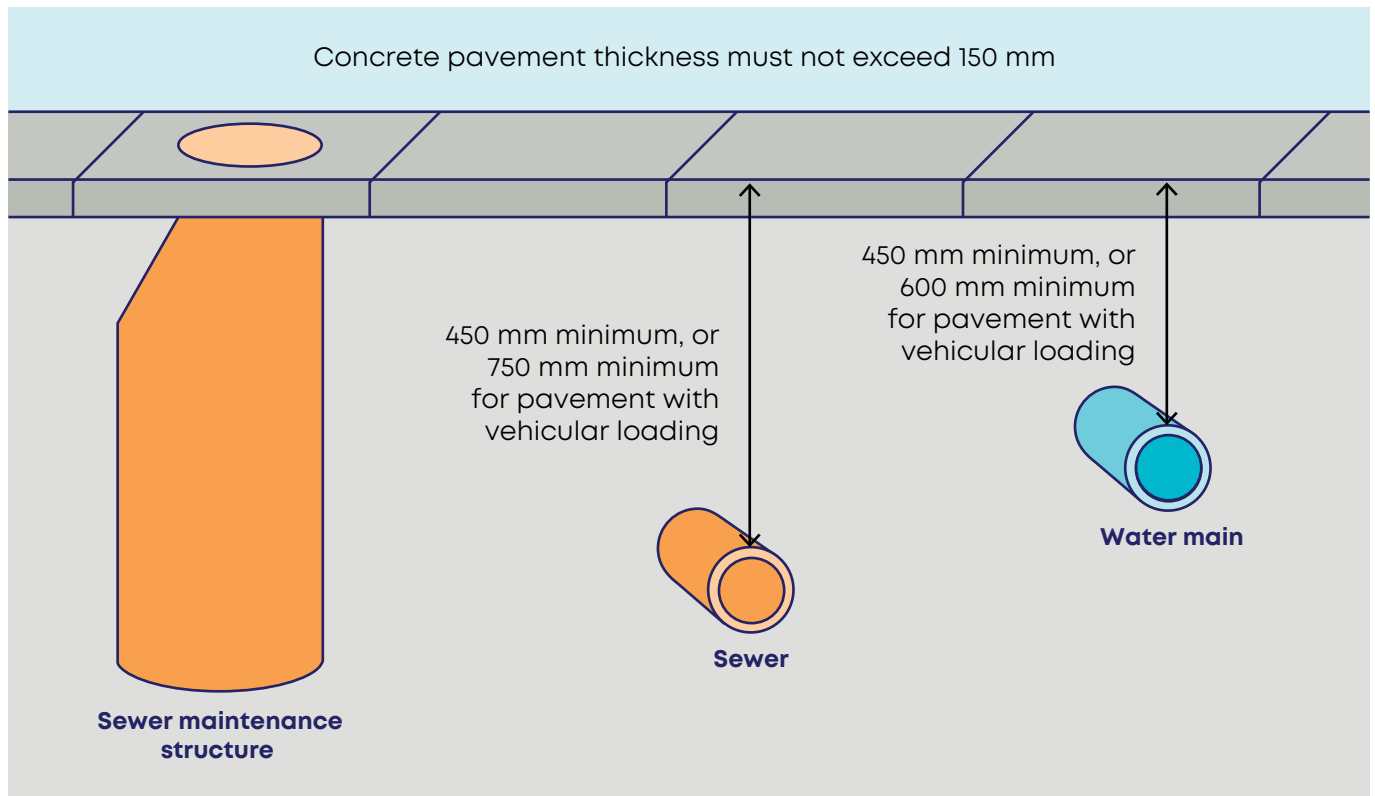
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### BOA technical requirements:

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- 1 Obtain a service location diagram.
- 2 Submit a building plan application and obtain acceptance.
- 3 Locate the pipe asset and determine its depth. Peg out the zone of influence on-site.
- 4 No temporary or permanent building works are allowed on, above and below easement land, without our specific acceptance.
- 5 Maintain free and full access to easement.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Exclude or restrict construction plant loading within the zone of influence (See Section 2.8).

### Diagram 3 – Pavements on residential lots



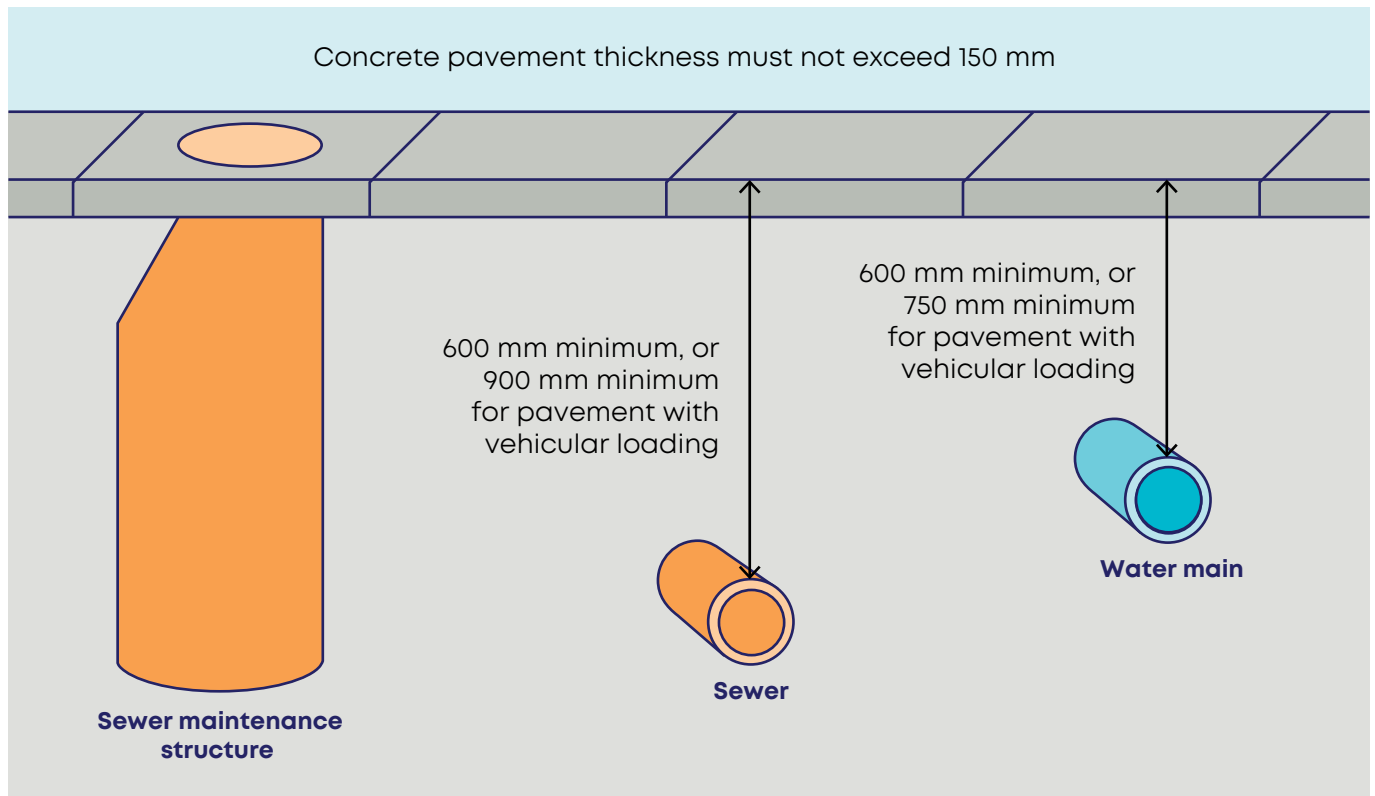
#### Notes:

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

#### BOA technical requirements:

- 1 Obtain a service location diagram.
- 2 Locate the pipe asset on-site and determine its depth.
- 3 Maintain free and full access.
- 4 Don't alter the existing ground level without our acceptance.
- 5 Don't adjust the cover level of any wastewater (sewer) maintenance structure or other surface fittings without our acceptance.
- 6 Verify maintenance structure and access cover arrangement is suitable for vehicular loading and adjust where necessary.
- 7 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.

**Diagram 4 – Pavements on commercial or industrial lots**



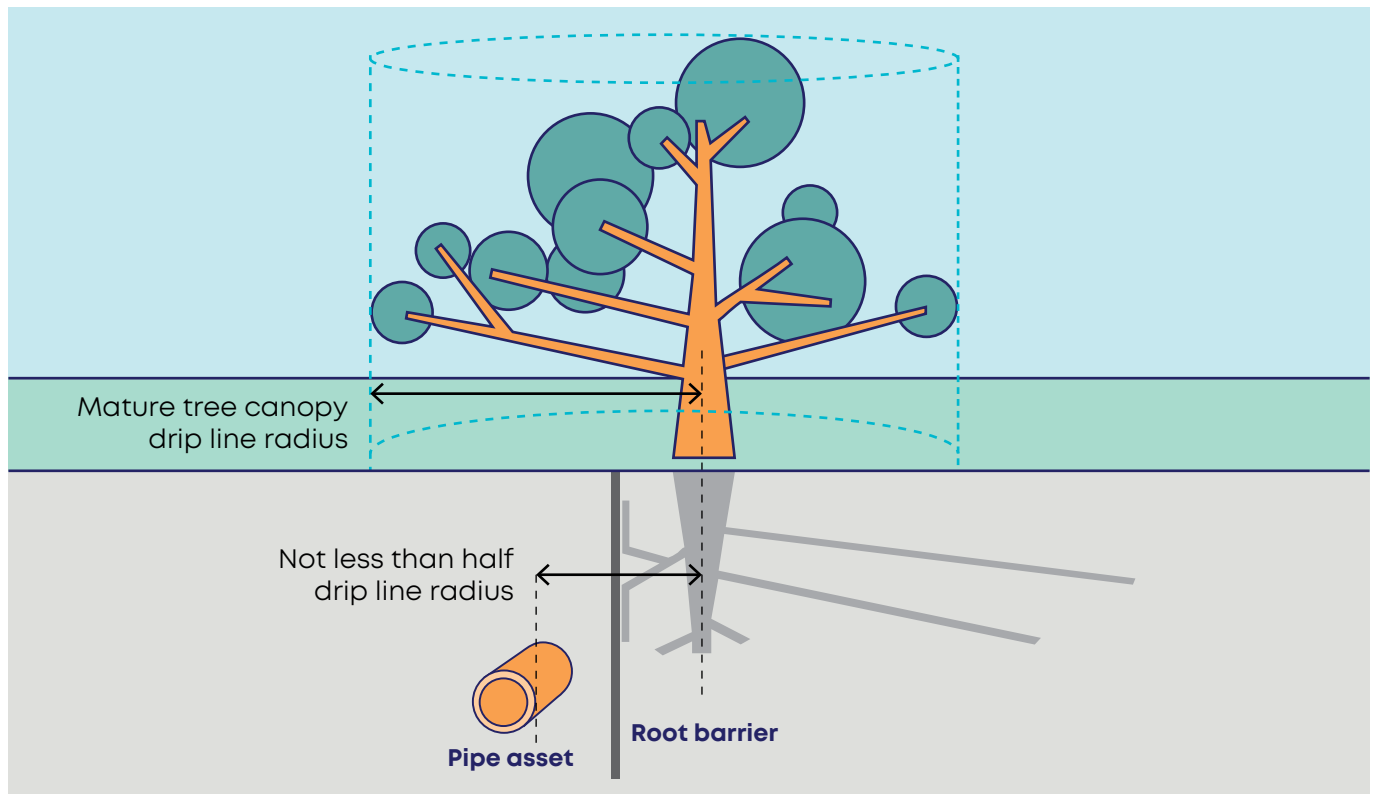
**Notes:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Obtain a service location diagram.
- 2 Locate the pipe asset on-site and determine its depth.
- 3 Maintain free and full access.
- 4 Don't alter the existing ground level without our acceptance.
- 5 Don't adjust the cover level of any wastewater (sewer) maintenance structure or other surface fittings without our acceptance.
- 6 Verify maintenance structure and access cover arrangement is suitable for vehicular loading, adjust where necessary.
- 7 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.

## Diagram 5 – Planting trees



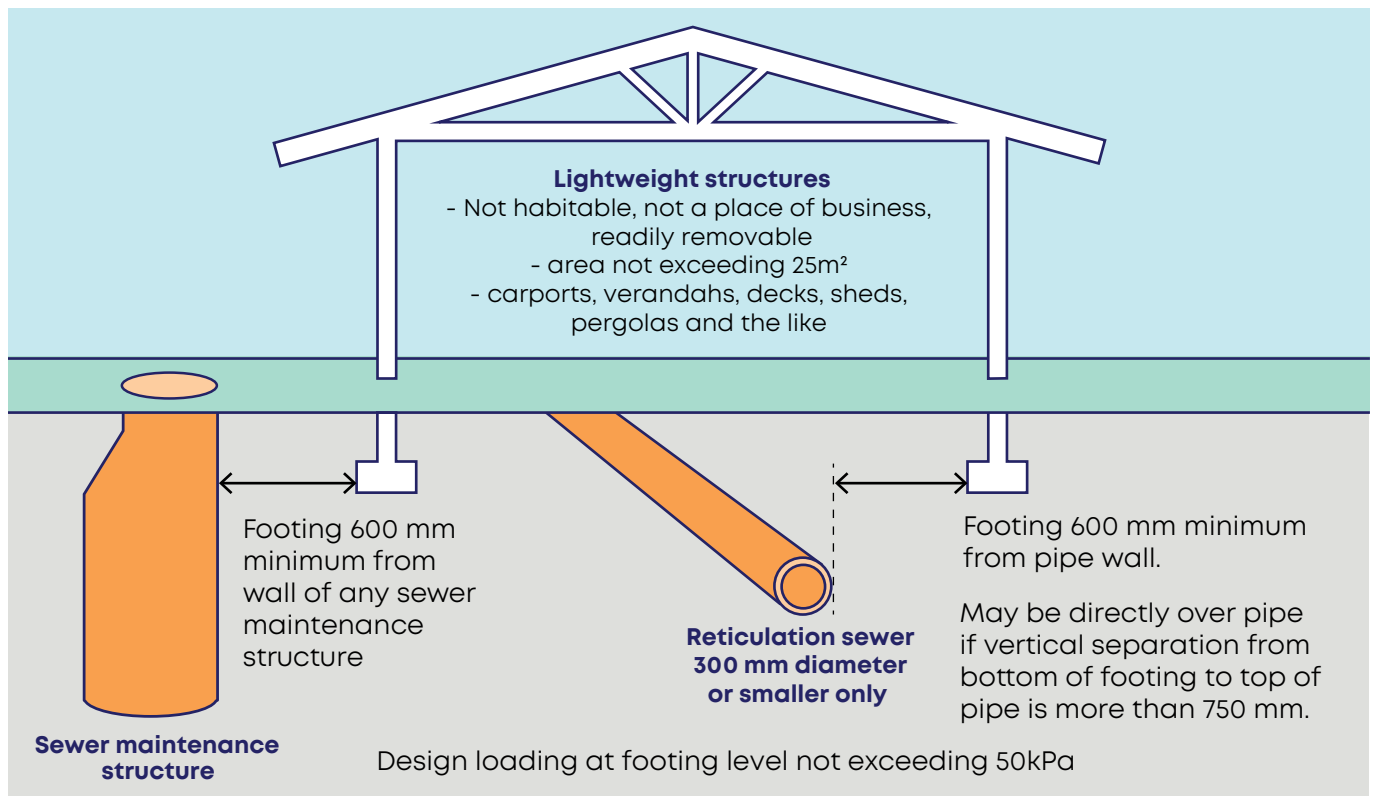
### Notes:

1. If you don't understand the intent of this diagram, seek technical advice or consult us.

### BOA technical requirements:

- 1 Obtain a service location diagram.
- 2 Locate the pipe asset on-site and determine its depth.
- 3 Maintain free and full access.
- 4 Don't alter the existing ground level without our acceptance.
- 5 Consult us or a tree specialist for suitable species and how far to plant them from pipe asset. Further information is available on our website.
- 6 Don't plant trees closer than half the mature tree canopy drip line radius to the pipe.
- 7 Provide a tree root barrier if the pipe is under the future mature tree canopy. Install the barrier along the length of the pipe to the full extent of the canopy drip line.

**Diagram 6 – Lightweight structures over reticulation sewers**



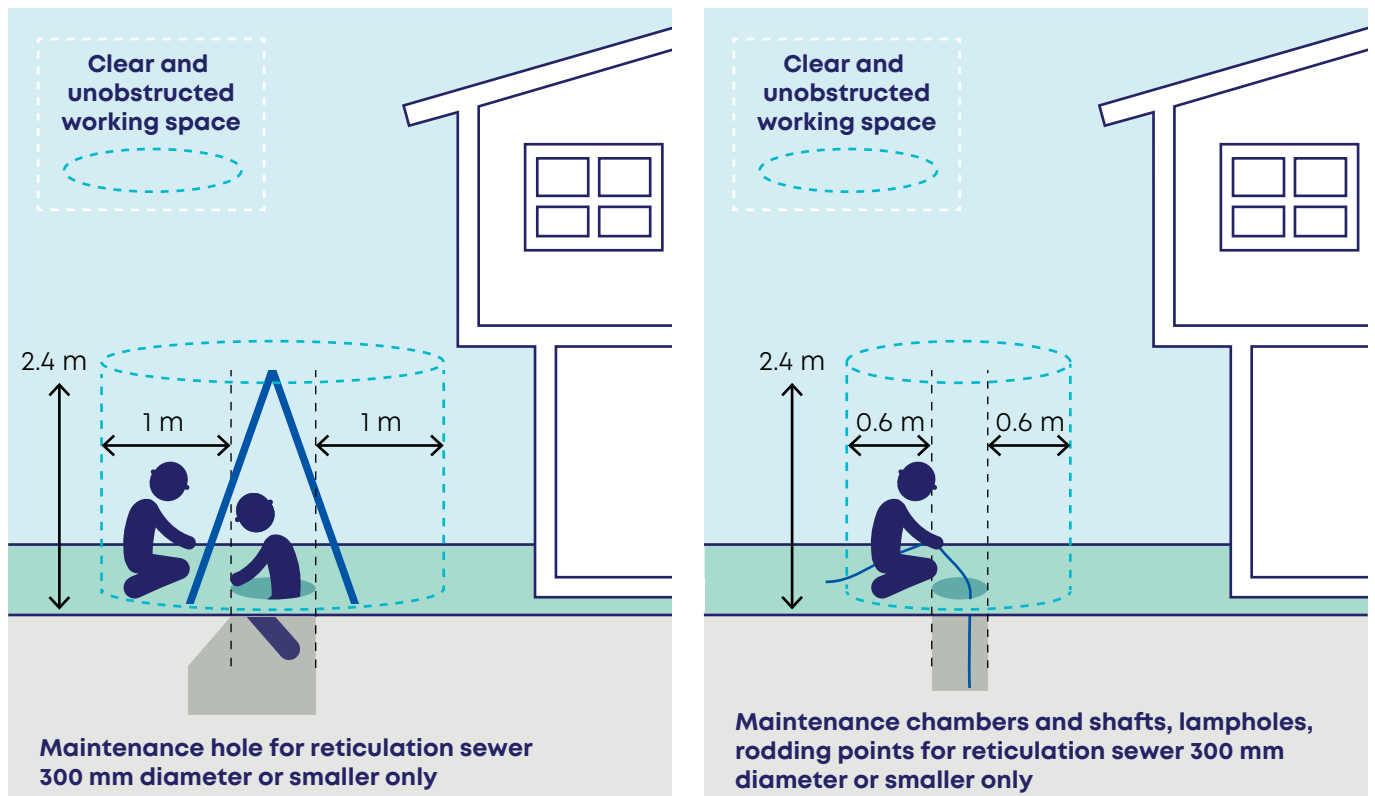
**Notes:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is currently concrete-encased, clearance is to the nearest face of the encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine depth of pipe asset. We don't allow building over wastewater (sewer) maintenance structures or wastewater (sewer) property connection points.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Don't adjust the cover level of any wastewater (sewer) maintenance structure or other surface fittings without our acceptance.
- 8 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.

**Diagram 7 – Working space and clearances around wastewater (sewer) maintenance structures**



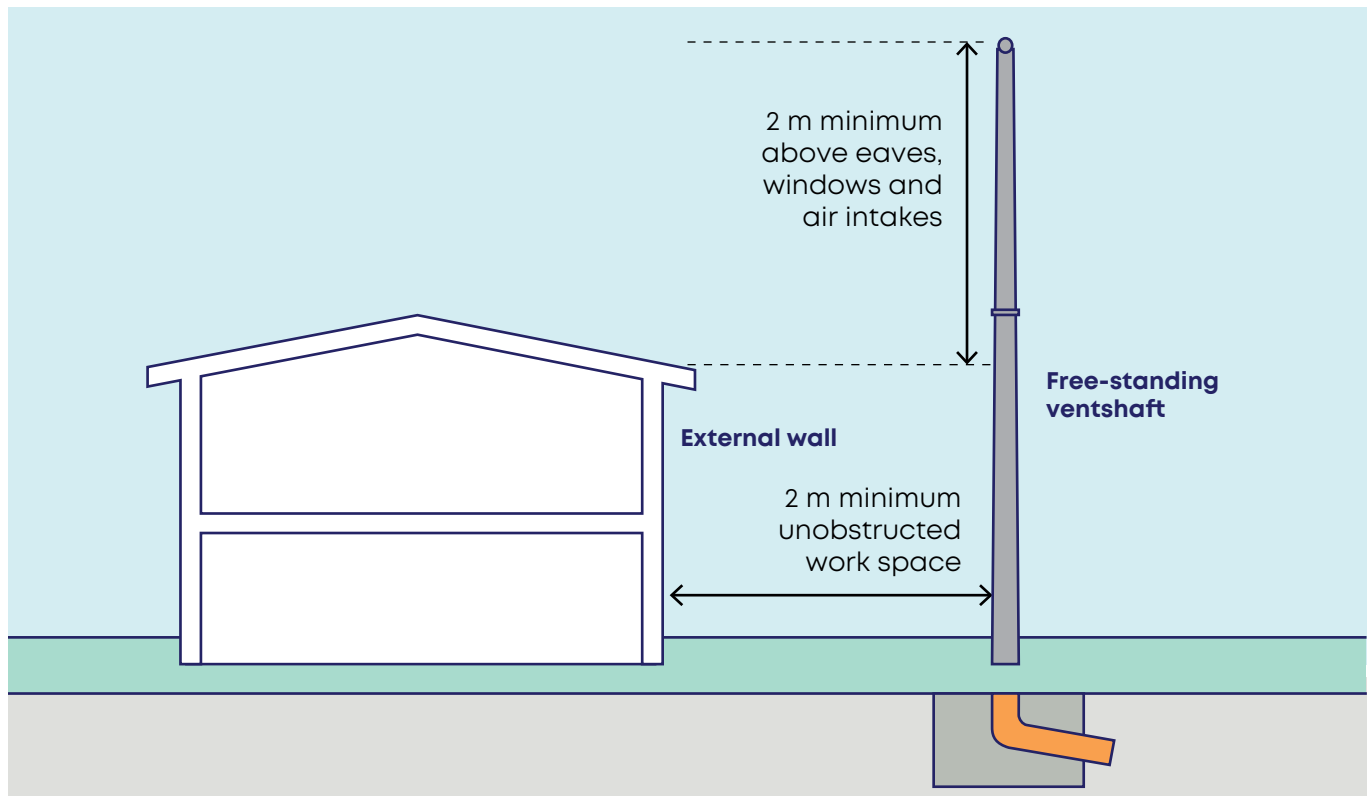
**Notes:**

1. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Obtain a service location diagram.
- 2 Submit a building plan application and obtain acceptance.
- 3 Maintain free and full access.
- 4 Don't alter the existing ground level without our acceptance.
- 5 Don't adjust the cover level of any wastewater (sewer) maintenance structure or other surface fittings without our acceptance.
- 6 For wastewater pipes (sewers) larger than 300 mm diameter, you may need extra headroom and additional working space.

## Diagram 8 – Building near free-standing ventshafts



**Note:**

If you're building close to any ventshaft, you must consult us early.

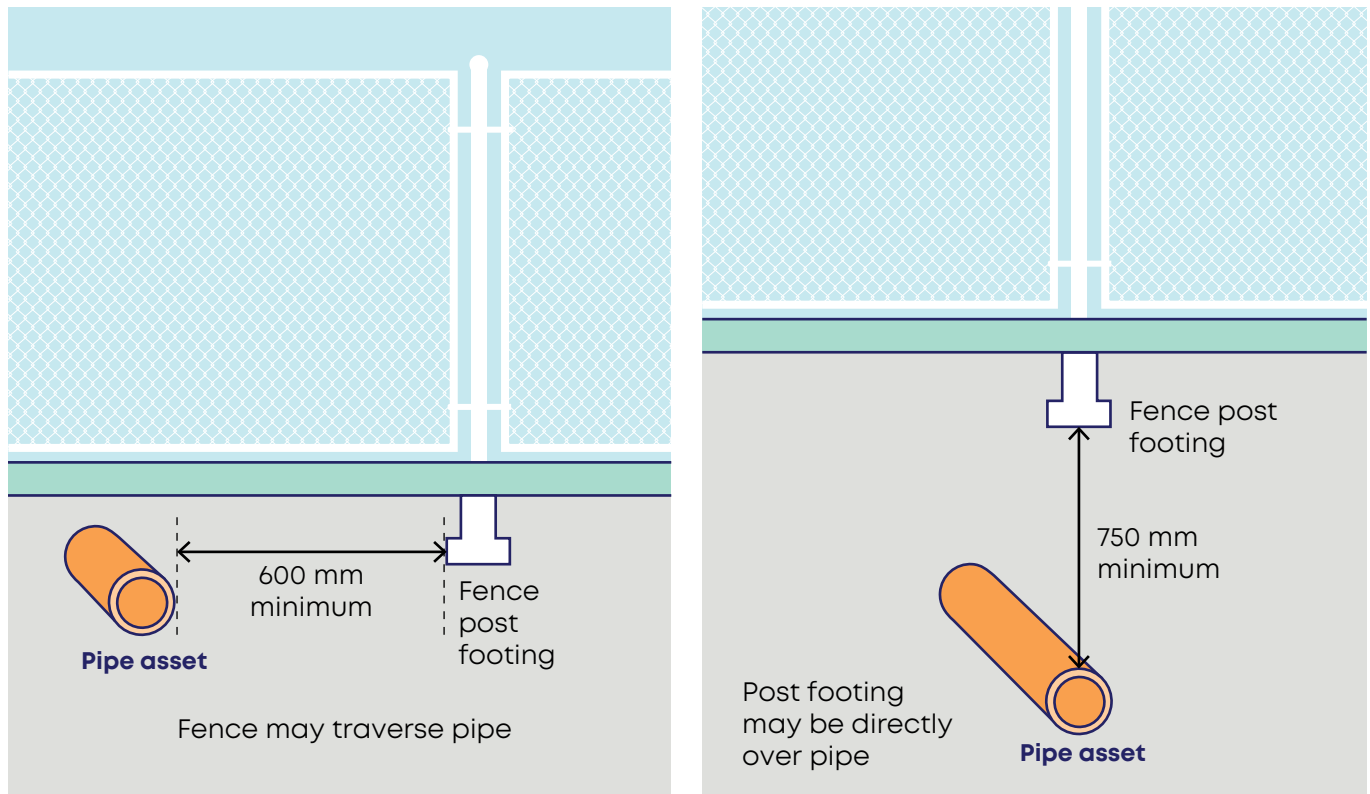
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### BOA technical requirements:

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- 1 For ventshafts over 300 mm diameter, other requirements may apply.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the ventshaft, its footing and underground pipework on-site.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Don't excavate near the ventshaft footing.
- 8 Erect a fence or barrier to protect the ventshaft from damage by construction plant.

**Diagram 9 – Paling, chain-link and palisade fences**



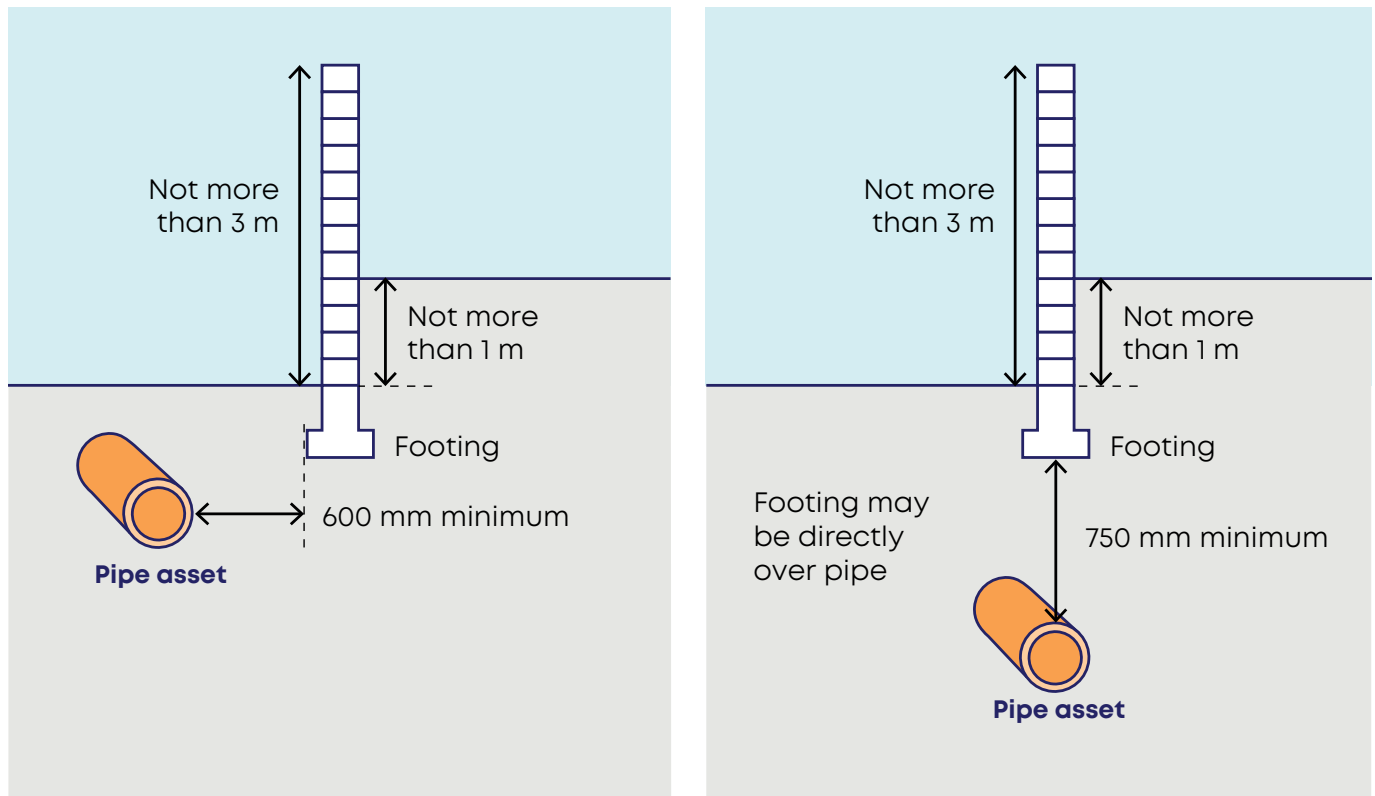
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is currently concrete encased, clearance is to the nearest face of the encasement.
- 2 Obtain a service location diagram.
- 3 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine depth of pipe asset. We don't allow footings over wastewater (sewer) property connection points.
- 4 Maintain free and full access.
- 5 Don't alter the existing ground level without our acceptance.
- 6 Exclude or restrict construction plant loading within the zone of influence (See Section 2.8).

**Diagram 10 – Short masonry walls**



**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

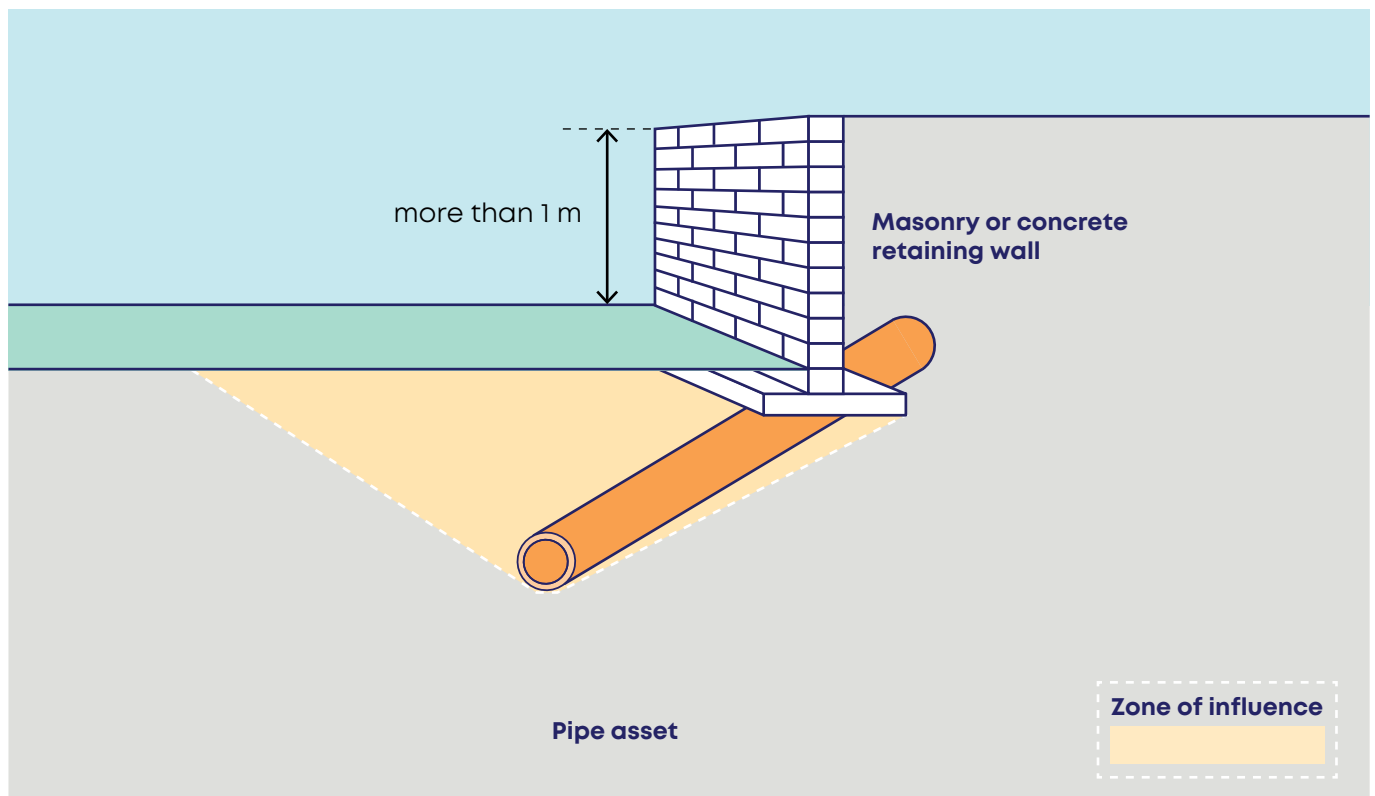
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**BOA technical requirements:**

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- 1 Where the pipe is currently concrete encased, clearance is to the nearest face of the encasement.
- 2 Obtain a service location diagram.
- 3 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine depth of pipe asset. We don't allow wall supports and footings over wastewater (sewer) property connection points.
- 4 Maintain free and full access.
- 5 Don't alter the existing ground level without our acceptance.
- 6 Exclude or restrict construction plant loading within the zone of influence of the pipe asset (See Section 2.8).

## Diagram 11 – Retaining walls



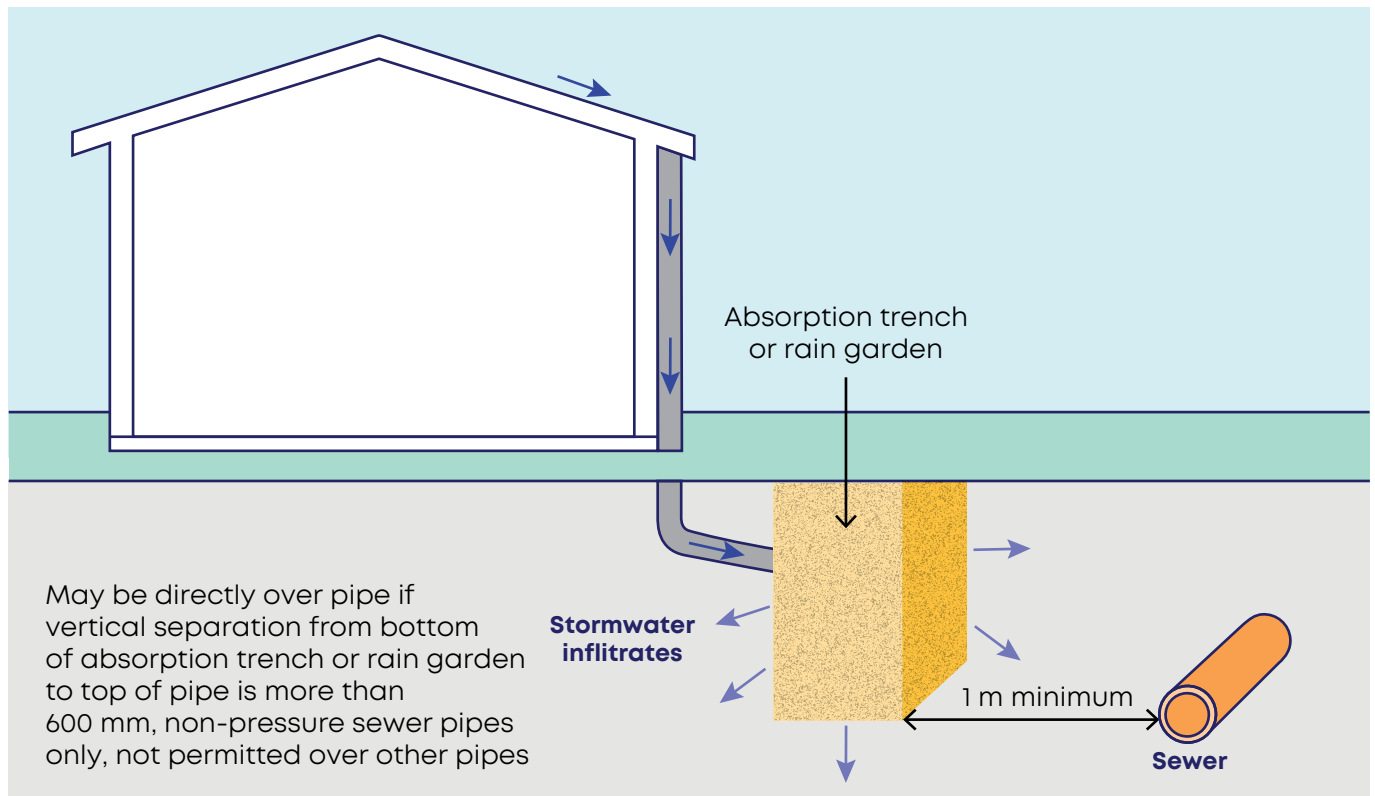
### Note:

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

### BOA technical requirements:

- 1 Obtain a service location diagram.
- 2 Submit a building plan and obtain acceptance.
- 3 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine depth of pipe asset. We don't allow retaining walls, their supports and footings over wastewater (sewer) property connection points.
- 4 Submit a specialist engineering assessment (SEA) report and completed SEA Submission Checklist for our acceptance.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Provide temporary and permanent protection works as required.
- 8 Exclude or restrict construction plant loading within the zone of influence of the pipe asset (See Section 2.8).

**Diagram 12 – Domestic stormwater absorption trenches, and rain gardens**



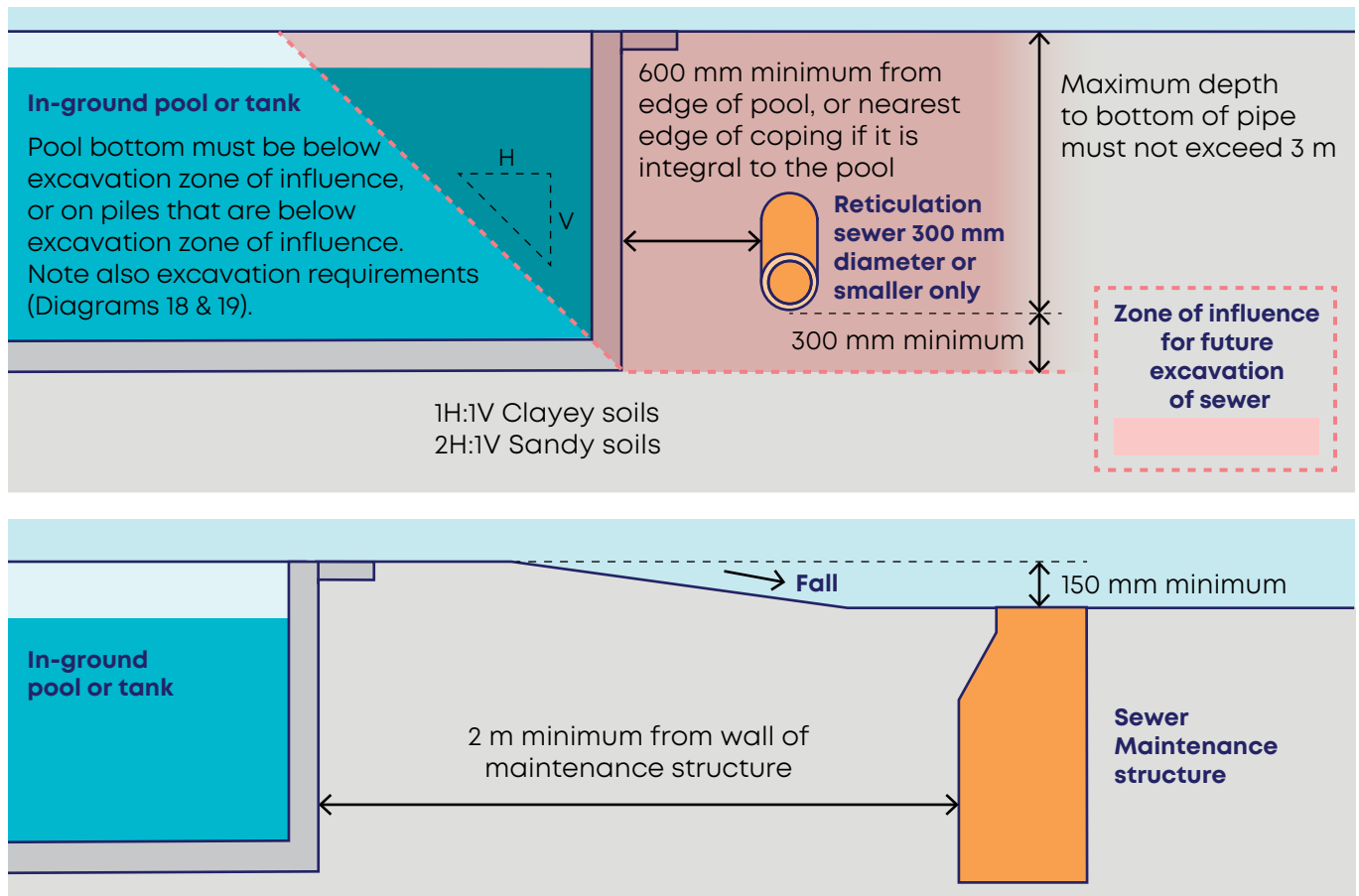
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is currently concrete encased, clearance is to the nearest face of the encasement.
- 2 Obtain a service location diagram.
- 3 Locate the pipe asset and property wastewater (sewer) connection point on-site. Where the pipe asset is underneath the absorption trench or rain garden, determine its depth. We don't allow absorption trenches or rain gardens over wastewater (sewer) property connection points.
- 4 Maintain free and full access.
- 5 Don't alter the existing ground level without our acceptance.
- 6 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.
- 7 Clearance is required from the wastewater (sewer) property connection point so that the customer sanitary drain can pass the absorption trench or rain garden with 1 m minimum clearance in plan view.

**Diagram 13 – Domestic swimming pools / water tanks adjacent**



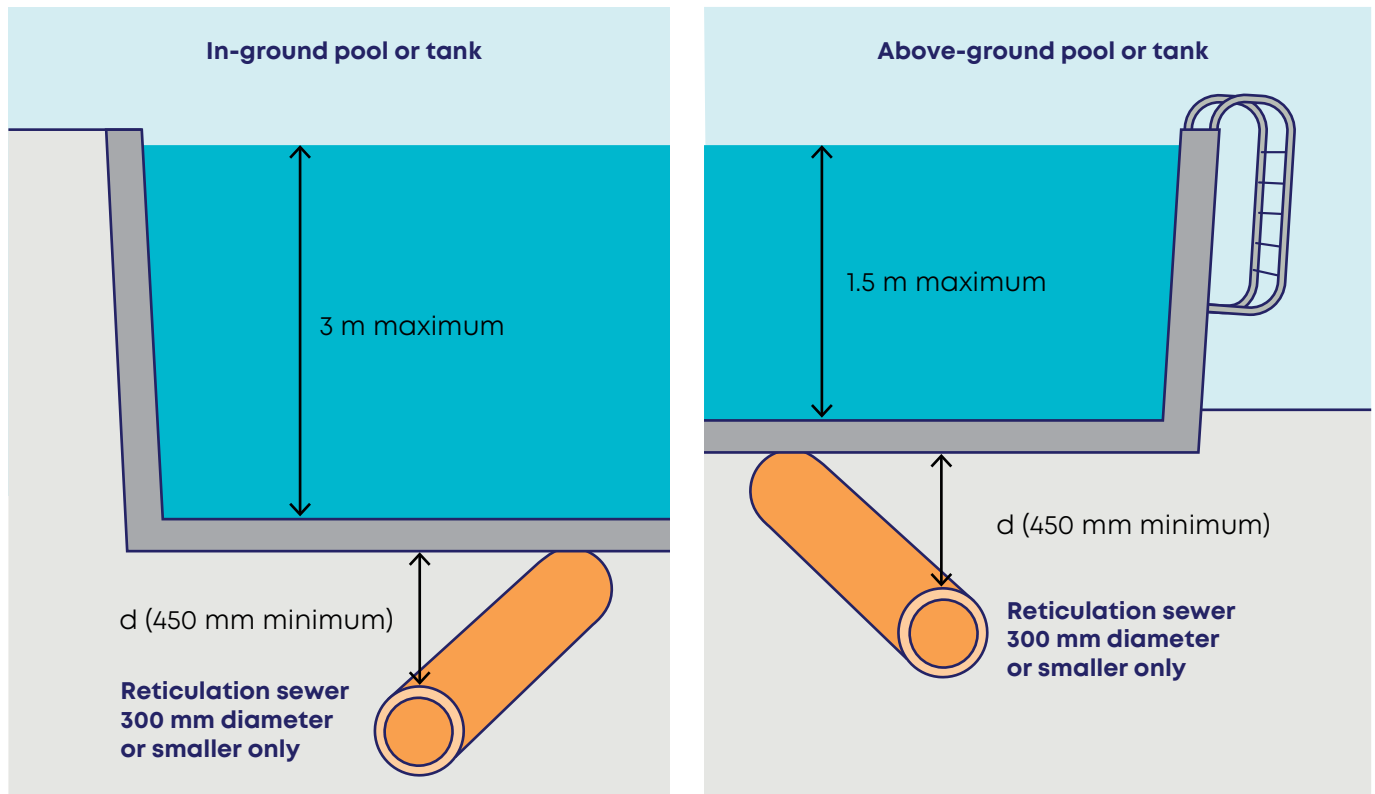
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is currently concrete encased, clearance is to the nearest face of the encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset. Locate the maintenance structure on-site.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Don't adjust the cover level of wastewater (sewer) maintenance structure or other surface fittings without our acceptance.
- 8 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.
9. Clearance is required from the wastewater (sewer) property connection point so that the customer sanitary drain can pass the pool with 1 m minimum clearance in plan view.

**Diagram 14 – Domestic swimming pools / water tanks over**



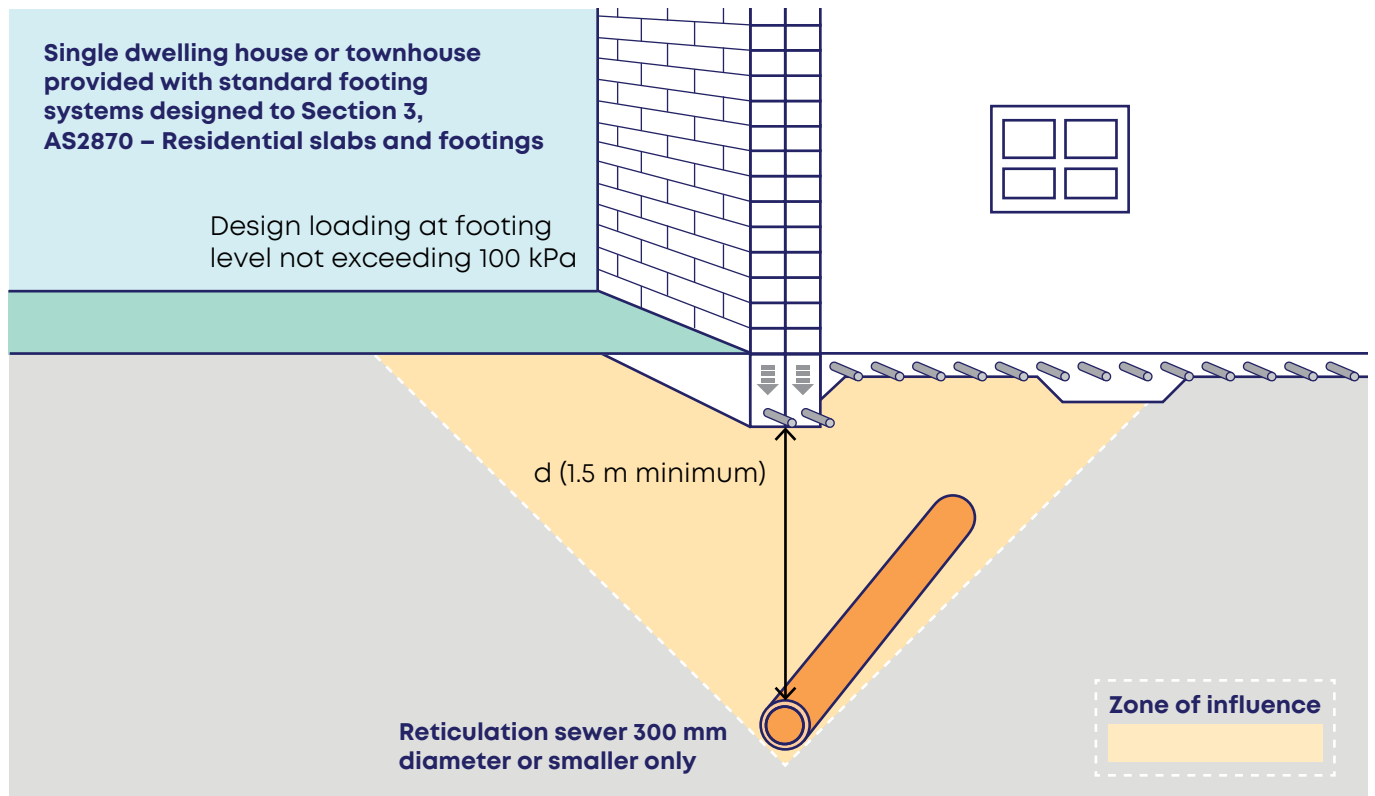
**Note:**

1. Pipe asset is assumed to be in soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Obtain a service location diagram.
- 2 Submit a building plan application and obtain acceptance.
- 3 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset. We don't allow pools over wastewater (sewer) property connection points.
- 4 Maintain free and full access.
- 5 Do not alter the existing ground level without our acceptance.
- 6 The dimension d must not be less than 0.45 m. Where the pipe is currently concrete encased or will be concrete encased, dimension d is to the top of the encasement. When d is between 0.45 m and 2.5 m, make the pipe 'maintenance free' by concrete encasement for the length under and extending 1 m beyond both ends of the pool/tank. If the pipe is cast iron, ductile iron, cement mortar jointed clay pipe or is in a deteriorated state, replace with PVC pipe before concrete encasement. No concrete encasement is required when d is greater than 2.5 m.
- 7 If d is greater than 2.5 m, inspect pipe using CCTV before starting site works. If rehabilitation is necessary, rehabilitate the pipe by inserting an internal lining or using another method.
- 8 Use only light construction plant. Don't run any construction plant over the pipe asset when the soil cover to top of pipe is less than 450 mm, see Figures 4 and 5.
- 9 Clearance is required from the wastewater (sewer) property connection point so that the customer sanitary drain can pass the pool with 1 m minimum clearance in plan view.

**Diagram 15 – Residential dwelling slabs and footings**



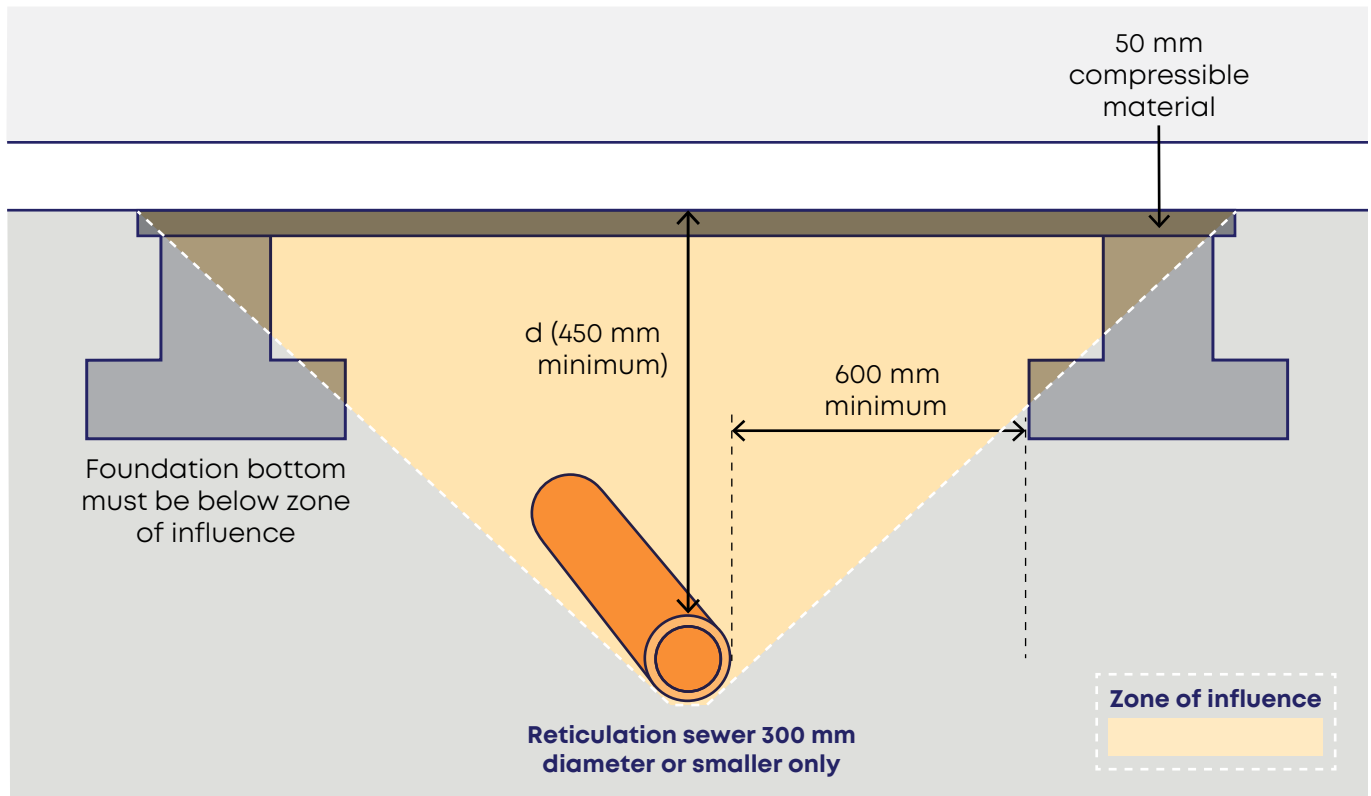
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Obtain a service location diagram.
- 2 Submit a building plan application and obtain acceptance.
- 3 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset. We don't allow building over wastewater (sewer) property connection points.
- 4 Maintain free and full access.
- 5 Don't alter the existing ground level without our acceptance.
- 6 The dimension d must not be less than 1.5 m. Where the pipe is currently concrete encased or will be concrete encased, dimension d is to the top of the encasement. When d is between 1.5 m and 2.5 m, make the pipe 'maintenance free' by concrete encasement for the length under and extending 1 m beyond building line at both ends. If the pipe is cast iron, ductile iron, cement mortar jointed clay pipe or is in a deteriorated state, replace with PVC pipe before concrete encasement. No concrete encasement is required when d is greater than 2.5 m.
- 7 If d is less than 1.5 m, refer to diagrams 16 or 17 or consult us.
- 8 If d is greater than 2.5 m, inspect pipe using CCTV before starting site works. If rehabilitation is necessary, rehabilitate the pipe by inserting an internal lining or another method.
- 9 Exclude or restrict construction plant loading within the zone of influence (see Section 2.8).
- 10 Clearance is required from the sewer property connection point such that the customer sanitary drain can pass the building with 1 m minimum clearance in plan view.

**Diagram 16 – Building foundations below the zone of influence (building over)**



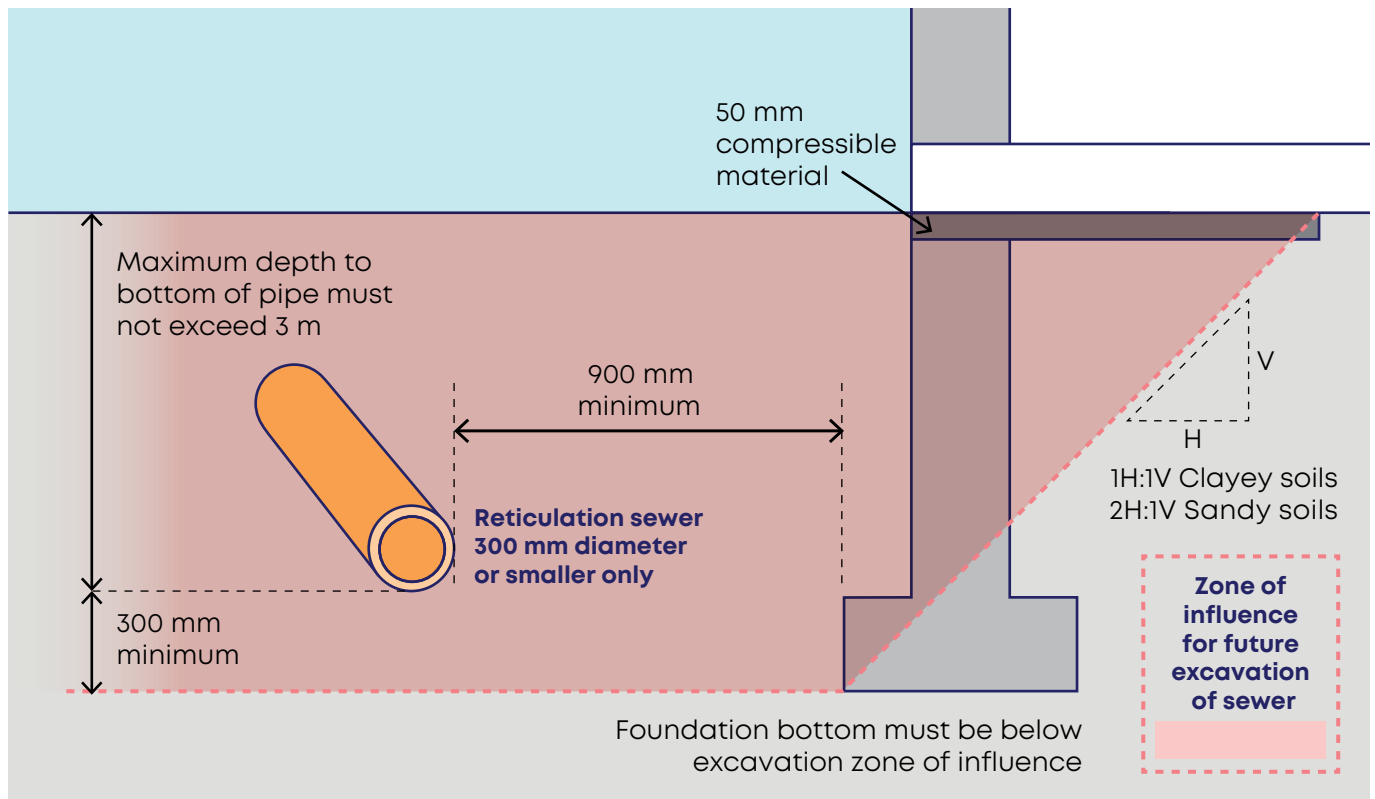
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is concrete encased, clearances are to the nearest face of encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset. We don't allow building over wastewater (sewer) property connection points.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 The dimension d must not be less than 0.45 m. Where the pipe is currently concrete encased or will be concrete encased, dimension d is to the top of the encasement. When d is between 0.45 m and 2.5 m, make the pipe 'maintenance free' by concrete encasement for the length under and extending 1 m beyond building line at both ends. If the pipe is cast iron, ductile iron, cement mortar jointed clay pipe or is in a deteriorated state, replace with PVC pipe prior to concrete encasement. No concrete encasement is required when d is greater than 2.5 m.
- 8 If d is greater than 2.5 m, inspect pipe using CCTV before starting site works. If rehabilitation is necessary, rehabilitate the pipe by inserting an internal lining or another method.
- 9 Exclude or restrict construction plant loading within the zone of influence (see Section 2.8).
- 10 Clearance is required from the wastewater (sewer) property connection point so that the customer sanitary drain can pass the building with 1 m minimum clearance in plan view.

**Diagram 16.1 – Building foundations below the zone of influence (building adjacent)**



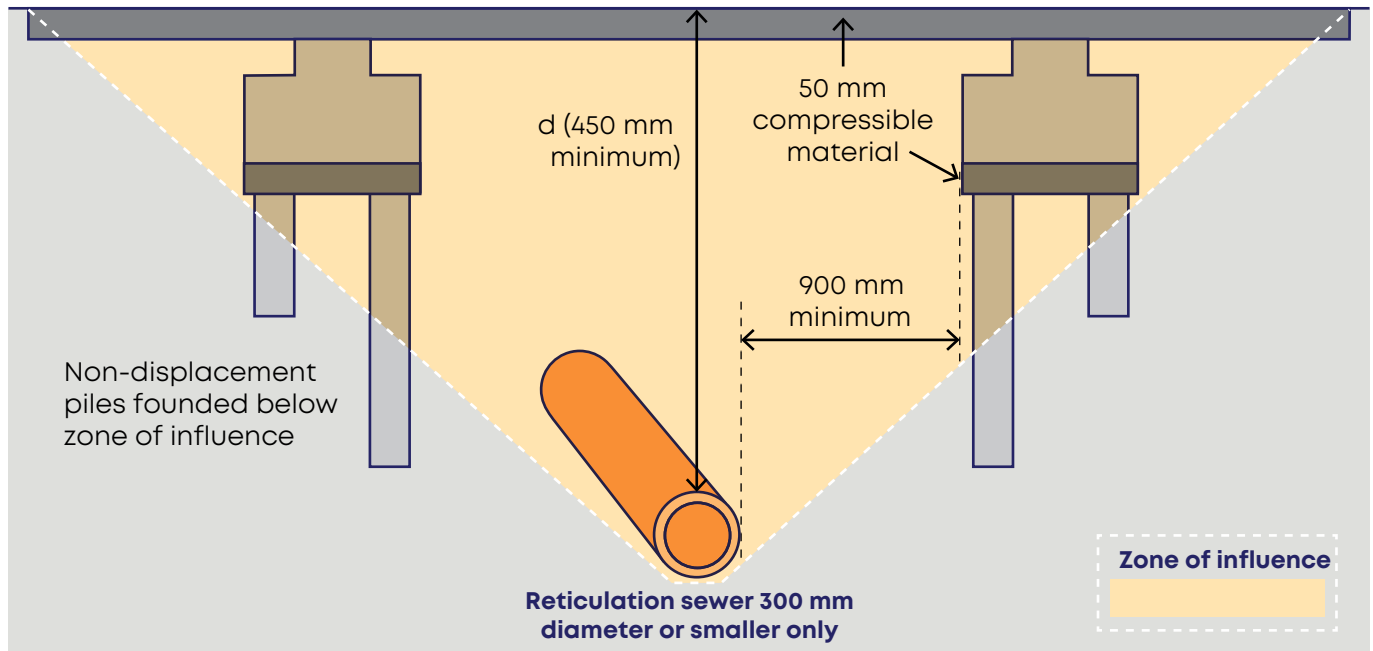
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Building is assumed to be self-supporting for future excavation of sewer. Other requirements will apply if this is not the case.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is concrete encased, clearances are to the nearest face of encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Exclude or restrict construction plant loading within the zone of influence (see Section 2.8).
- 8 Clearance is required from the wastewater (sewer) property connection point such that the customer sanitary drain can pass the building with 1 m minimum clearance in plan view.

**Diagram 17 – Building foundations on piles (building over)**



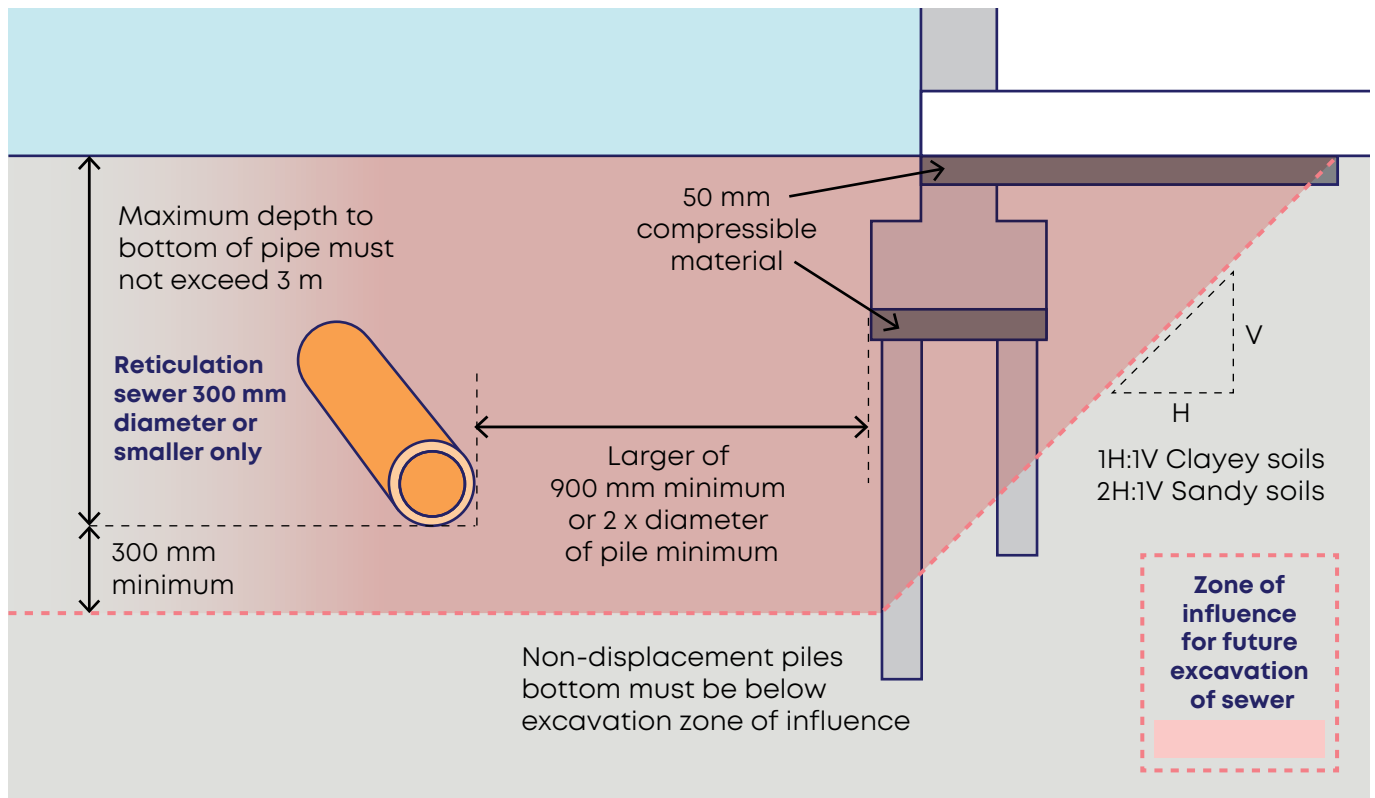
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is concrete encased, clearances are to the nearest face of encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of the pipe asset. We don't allow building over wastewater (sewer) property connection points.
- 5 Maintain free and full access.
- 6 Do not alter the existing ground level without our acceptance.
- 7 The dimension d must not be less than 0.45 m. Where the pipe is currently concrete encased or will be concrete encased, dimension d is to the top of the encasement. When d is between 0.45 m and 2.5 m, make the pipe 'maintenance free' by encasing it with concrete for the length, under and extending 1 m beyond the building line at both ends. If the pipe is cast iron, ductile iron, cement mortar jointed clay pipe or is in a deteriorated state, replace it with PVC pipe before concrete encasement. No concrete encasement is required when d is greater than 2.5 m.
- 8 If d is greater than 2.5 m, inspect pipe using CCTV before starting site works. If rehabilitation is necessary, rehabilitate the pipe by inserting an internal lining or another method.
- 9 Exclude or restrict construction plant loading within the zone of influence (see Section 2.8).
- 10 Clearance is required from the wastewater (sewer) property connection point such that the customer sanitary drain can pass the building with 1 m minimum clearance in plan view.

**Diagram 17.1 – Building foundations on piles (building adjacent)**



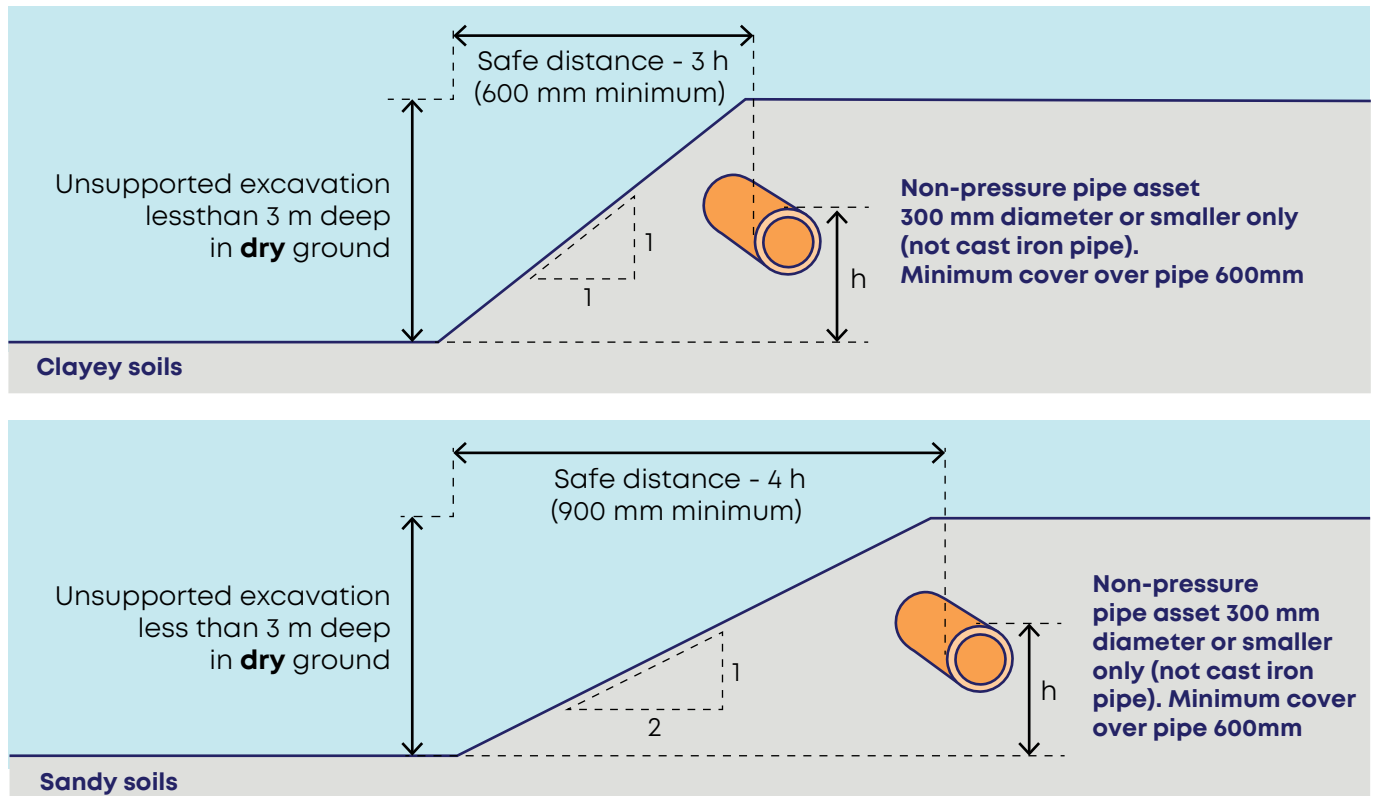
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Building is assumed to be self-supporting for future excavation of sewer. Other requirements will apply if this is not the case.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is concrete encased, clearances are to the nearest face of encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset and wastewater (sewer) property connection point on-site and determine the depth of pipe asset.
- 5 Maintain free and full access.
- 6 Don't alter the existing ground level without our acceptance.
- 7 Exclude or restrict construction plant loading within the zone of influence (see Section 2.8).
- 8 Clearance is required from the property wastewater (sewer) point so that the customer sanitary drain can pass the building with 1 m minimum clearance in plan view.

**Diagram 18 – Small temporary unsupported excavations**



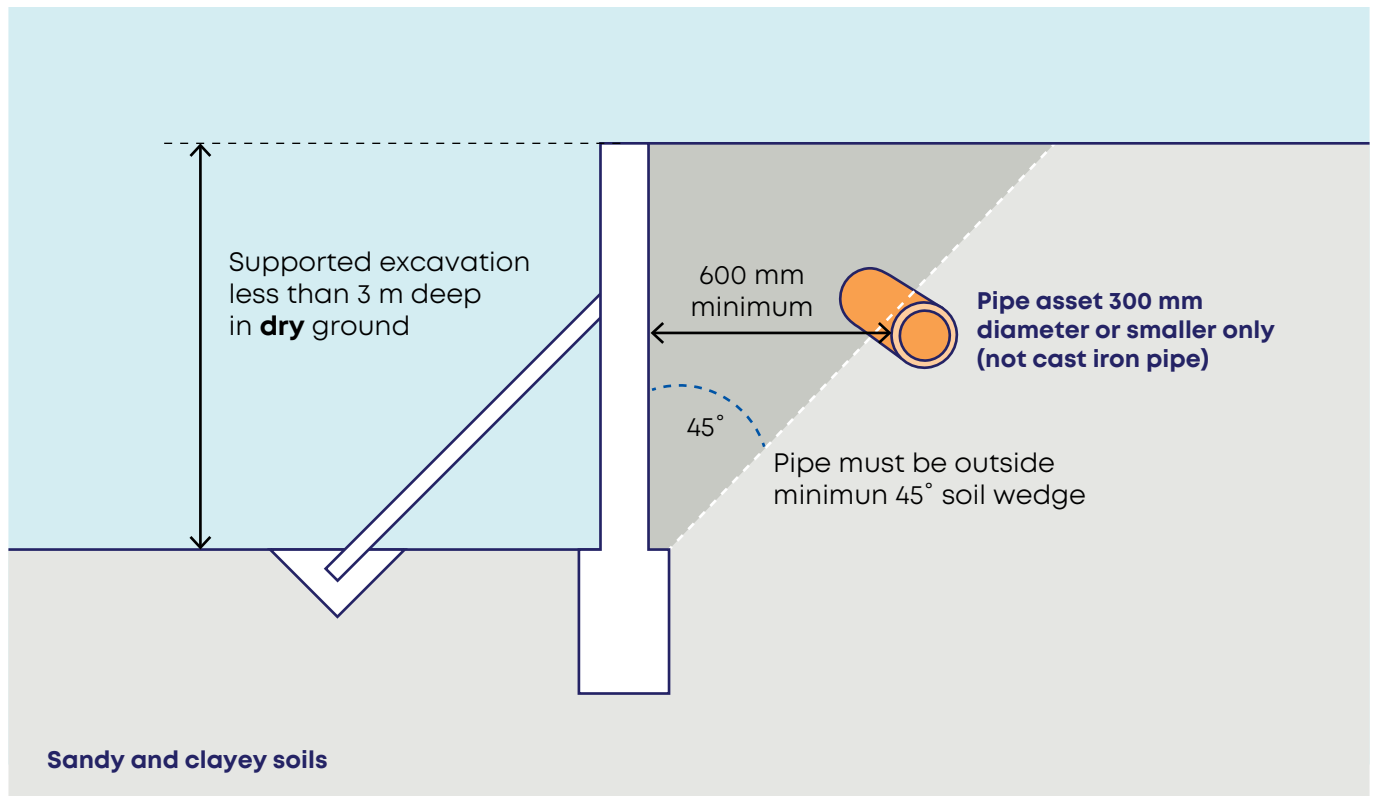
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Obtain a service location diagram.
- 2 Locate the pipe asset on-site and determine its depth.

**Diagram 19 – Small supported excavations**



**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

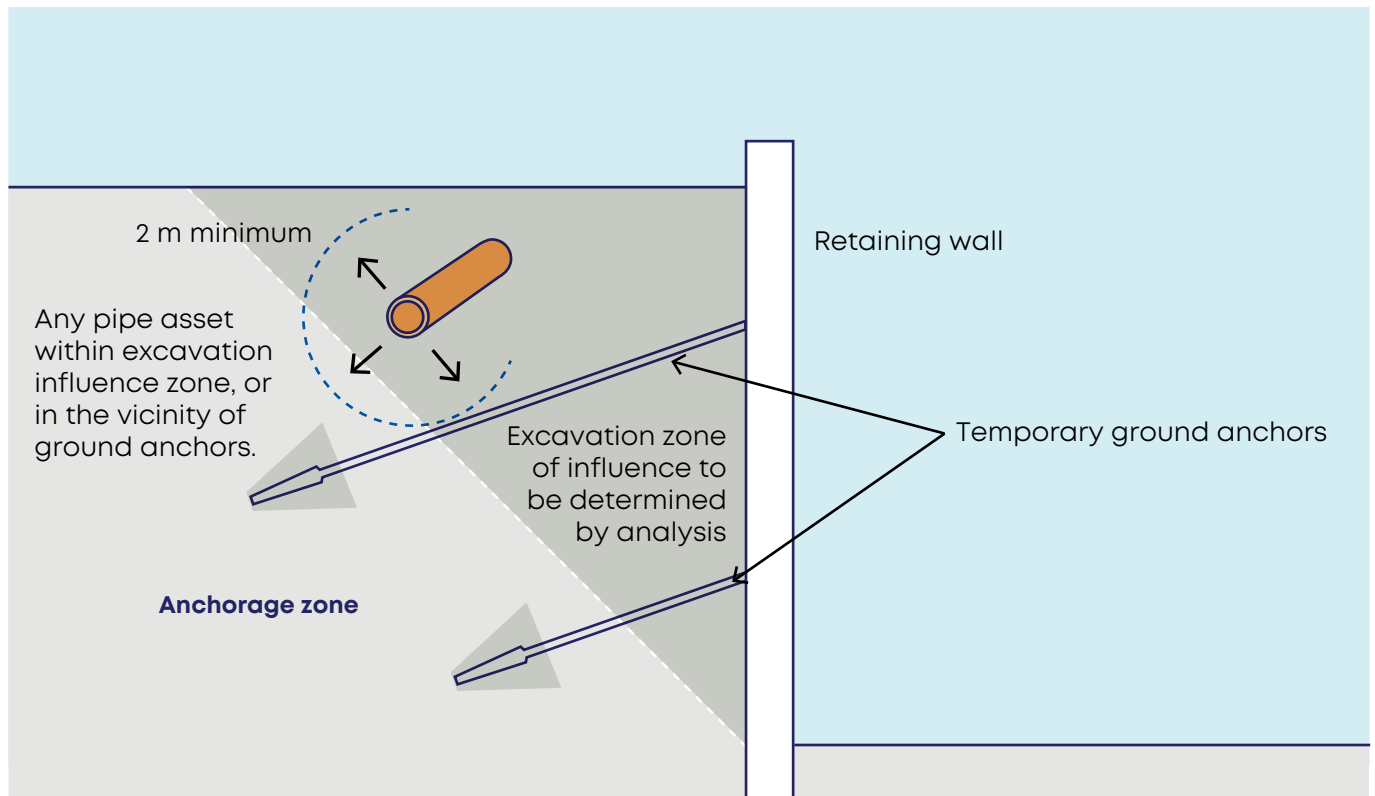
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**BOA technical requirements:**

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- 1 Obtain a service location diagram.
- 2 Locate the pipe asset on-site and determine its depth.

**Diagram 20 – Large excavations**



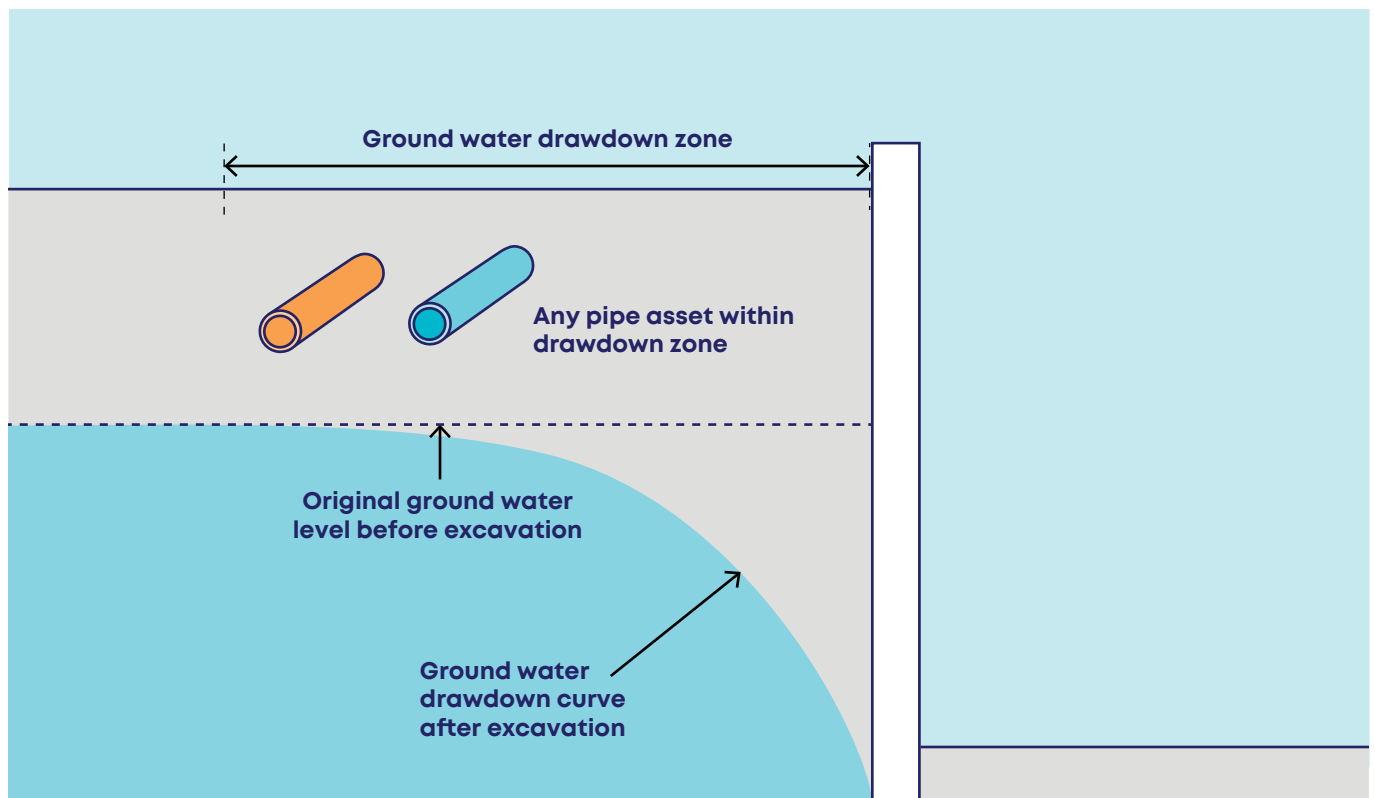
**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
  - 1.1 Greater exclusion zones may apply for larger pipes and tunnels.
  - 1.2 Ground anchors must not pass over the assets.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

**BOA technical requirements:**

- 1 Where the pipe is concrete encased, clearances are to the nearest face of encasement.
- 2 Obtain a service location diagram.
- 3 Submit a building plan application and obtain acceptance.
- 4 Locate the pipe asset on-site and determine its depth.
- 5 Submit a specialist engineering assessment (SEA) report and completed SEA Submission Checklist for acceptance.
- 6 Submit a work method statement for acceptance.
- 7 Provide temporary and permanent protection works as required.
- 8 Submit a monitoring plan for acceptance.
- 9 Submit a contingency plan for acceptance.

**Diagram 21 – Dewatering**



**Note:**

1. Pipe asset is assumed to be in a soil trench. Other requirements may apply for asset in a rock trench or tunnel, poor or unstable ground or mine subsidence areas.
2. Pipe asset is assumed to be in reasonable service condition. Inspect it if in doubt. Other requirements may apply for pipes vulnerable to damage.
3. If you don't understand the intent of this diagram, seek technical advice or consult us.

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**BOA technical requirements:**

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- 1 Obtain a service location diagram.
- 2 Submit a building plan and obtain acceptance.
- 3 Locate the pipe asset on-site and determine its depth.
- 4 Submit a specialist engineering assessment (SEA) report and completed SEA Submission Checklist for acceptance.
- 5 Submit a work method statement for acceptance.
- 6 Provide temporary and permanent protection works as required.
- 7 Submit a monitoring plan for acceptance.
- 8 Submit a contingency plan for acceptance.
- 9 Exclude or restrict construction plant loading within zone of influence (see Section 2.8).

## 4 Contact us

### Website

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