



## Purpose

Assets that reach the end of their service life or become redundant generally require some form of decommissioning to remove them from operation or are left in place for future use, should it be required. The purpose of this decommissioning guideline is to establish a consistent, safe, and efficient process for decommissioning of Watercare’s linear assets.

## Objective

A well-defined process helps ensure that decommissioned assets do not become a liability. The objectives of this guideline include:

- Establishing a clear and consistent strategy for decommissioning which helps to identify the most efficient approach, whilst mitigating potential risks associated when assets are decommissioned
- Safeguarding the public and protecting surrounding infrastructure.
- Ensuring compliance with regulatory standards.
- Optimising resources used and avoid unnecessary costs.

By implementing these objectives, Watercare can effectively manage a significant portion of its assets, minimising potential risks and ensure the safety and integrity of the network.

## Scope

The Scope of this document covers the decommissioning of pipes, manholes and ancillary chambers within the water and wastewater network (local and transmission).

Refer to *ESF-500-STD-304* for decommissioning guidance of the following non-linear assets:

- Water and wastewater treatment facilities and equipment
- Water and wastewater pumping stations and equipment including booster pump stations
- Water reservoirs



## Decommissioning Approach

The key stages involved with implementing a decommissioning activity are as follows:

- I. **Decommissioning optioneering:** A structured approach such as comparative risk assessment or MCA should be carried out to assess viable options and determine an appropriate decommissioning pathway e.g. putting it out of service/mothballing, abandonment in place or/and abandonment by removal. The criteria should include weighted risks, benefits, environmental impacts, technical risk, effect on other utilities and TOTEX.

Understanding the structural condition (estimated remaining life) of the asset will also help inform the preferred approach especially if the option requires an asset to be shutdown/deactivated or continue to remain deactivated for a period (months, years).

- II. **Engineering and planning:** To help ensure the efficient delivery of the decommissioning plan, the project team should:
  - Identify and engage with the relevant stakeholders
  - Gather the necessary information (e.g. condition assessment, sampling, monitoring, data analysis, gathering documentation including drawings etc), pipeline segment analysis.
  - Carry out a risk assessment
  - Develop a sound methodology
  - Obtain the necessary consents and maintain regulatory compliance

As part of the planning process, the project team should consult with parties that have a vested interest in the proposed methodology e.g. operators, maintenance and life cycle teams.

- III. **Decommissioning delivery:** Carry out decommissioning and handover activities. Ensure all decommissioning activities comply with relevant regulatory standards and guidelines (this should be identified during the planning stage). Task shall include a final inspection of the decommissioned site and asset information update. To facilitate continuous improvement, a lessons learnt session should be conducted to gather feedback from the team and stakeholders involved, documenting both positive learnings and challenges endured during the decommissioning process.
- IV. **Post decommissioning:** Decommissioned assets are handed over to the identified responsible team for ongoing periodic monitoring, inspection and maintenance as required.



## Decommissioning Options

When decommissioning an asset, there are two primary classifications and two sub-categories for abandonment which are:

1. Out of service state
2. Abandonment
  - a. In-place
  - b. Removal

Depending on the complexity of the facility, a combination of these classifications can be assigned to different areas or equipment.

### ***Out of service state***

An asset classified as out of service (mothballed) is left in place without significant alternations and can be reinstated or repurposed if required. An example of this is a pipeline being capped at both ends, but not grout filled.

This option is generally suitable for assets presenting a low risk to surrounding structures or that may have future value e.g. potential to be repurposed. The ownership and responsibility of periodic maintenance remain with Watercare to ensure these assets remain a low risk and can be reinstated or repurposed for future use (should it be required).

### ***Abandonment***

Where assets are to be abandoned, it is expected that they will not be put back into service or repurposed. This is generally the case with assets that are irreparable or where it has been confirmed with Watercare Planning and Operations that there is no foreseeable use of the asset going forward. Within the abandonment option, the asset can be abandoned in place or removed.

Pipes identified for abandonment require a specific risk assessment to consider the likelihood and consequence of failure, and what the implications of failure may include. This should inform a decision on the most appropriate abandonment technique to mitigate risk and liability in the event of failure. Refer to Section **Error! Reference source not found.** for guidance information regarding the risk assessment exercise.

#### ***Abandonment in Place***

Where a pipeline section is to be abandoned in place, risks associated with future ground subsidence, contamination of the soil or groundwater and any impact upon ongoing land use shall be identified and mitigated. Abandonment may include either fully grouting the length of the pipe internally or end capping, depending on the position and consequential risk of the asset.

#### ***Abandonment by Removal***

Where a pipeline section is to be removed, the site or alignment should be reinstated to a condition similar to the pre-construction of the asset.

An example of this would be extracting the pipeline and chamber(s) from the ground and reinstating the void with a suitably selected backfill material.



This option is typically selected when leaving the asset in place poses significant risks or when the asset owner chooses to eliminate future liability. The benefit of removal is that it makes the site (or alignment) available for other future works, in a world of congested services where infrastructure “real estate” is becoming increasingly challenging. Once the asset is removed, there is no further record of ownership to Watercare.

## Asset Information Update

Where applicable, the following information source shall be updated to reflect changes resulting from the decommissioning activity:

- As-built drawings (pdf, AutoCAD, BIM)
- GIS/IPS update
- Control system (SCADA screens and PLC or DCS programme).  
Refer to facilities decommissioning guidance notes (ESF-500-GDN-304), Abandonment by Removal Requirements, Control System Related Work section for requirement details.
- Asset register (via Asset Creation Sheet)
- Maintenance schedule
- Ownership transfer record and easement de-registration/relinquishment

Refer to below sub-section for further guidance on GIS update and ownership transfer if pipe is to be abandoned in privately owned land.

### ***Information Update for Abandoned Pipe in Private Land***

Ownership of abandoned Watercare pipe(s) located in private land shall be legally transferred to the property owner if they choose to build/develop over these assets. Watercare will advise the property owner of the abandonment method used for these pipe(s). The transferred pipe shall be marked in GIS as Removed and not displayed. The document/as-built that initiated the change of ownership will be linked to this asset for future reference.

### ***GIS/IPS Status Allocation***

A different GIS/IPS status is associated with each decommissioning option to reflect the disposal status. The status is listed in the table below.

**Table 1:** GIS/IPS status alignment with decommissioning options

Decommissioning Option	GIS/IPS Status	Comment
Out of service state	OUT	Operational not in use.
Abandonment in Place	AB	Abandoned, installed but unusable.
Abandonment by Removal	DISP	Disposed, no longer owned.

## Risk Evaluation for Abandonment Option

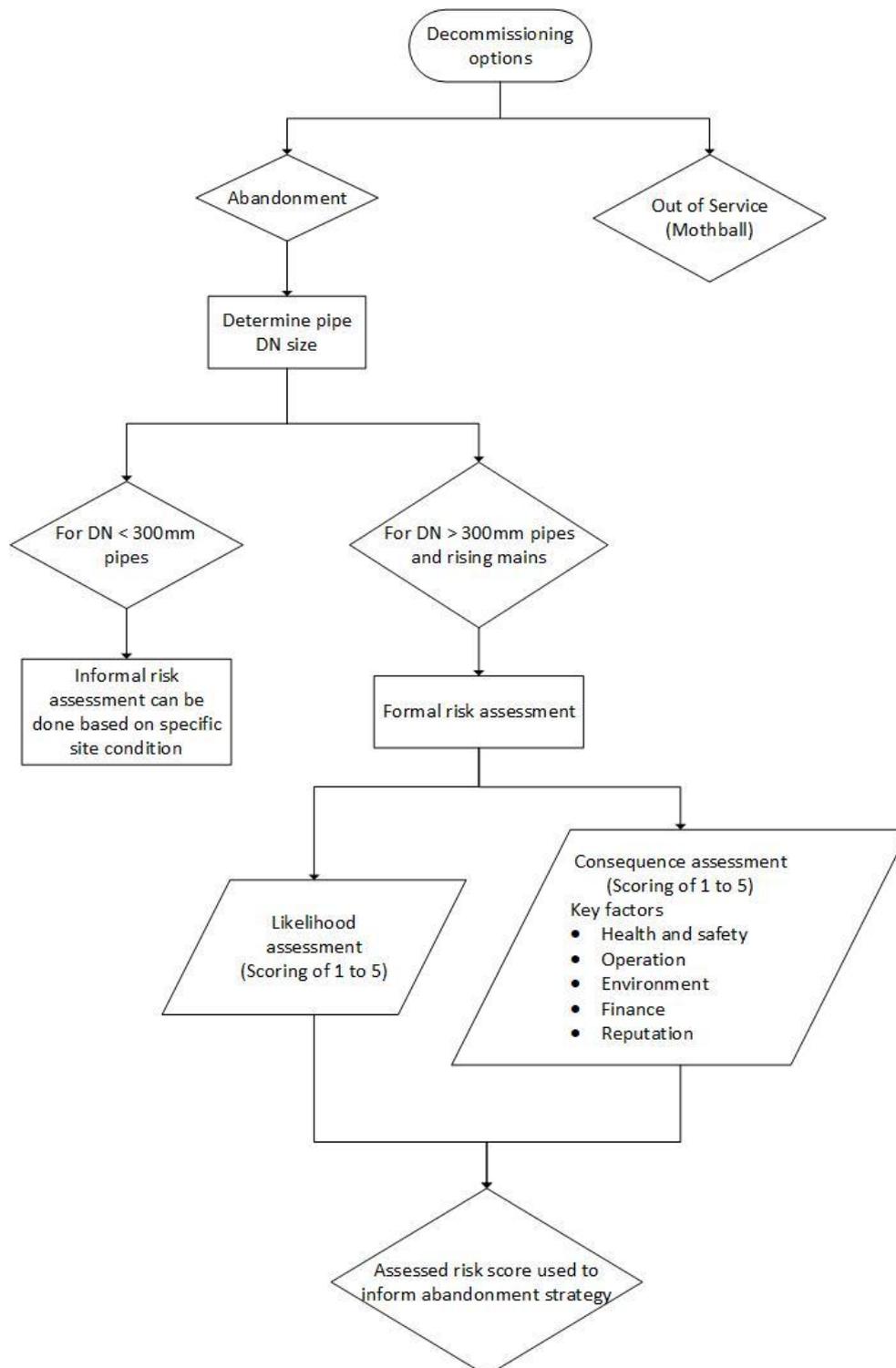
Risk is determined by evaluating the likelihood of failure and the consequences in the event of that failure. To assess the magnitude of the risk, a risk class is assigned by plotting the likelihood and consequences scores on a risk matrix. This classification ranges from very low to very high.

For the risk assessment, the likelihood of failure, based on the asset’s condition, and the consequence in the event of failure must be evaluated.



However, for pipes with a diameter of less than 300mm, the risk assessment may be disregarded unless specific concerns are identified. The primary reason for excluding pipes under 300mm from risk assessment is that they generally do not pose a significant risk to Watercare's network. As a result, a standardised decommissioning strategy can be applied without requiring case-by-case assessments.

The overall framework for the abandonment option risk assessment is illustrated in Figure 1.



**Figure 1:** Framework to manage pipe abandonment risk and determine the most appropriate abandonment strategy



## Failure Consequence Assessment

When assessing the consequence of an abandoned asset's failure, the following key factors should be considered:

- Health and safety
- Operations
- Environment
- Finance
- Reputation

These aspects are scored based on the risk management framework to assess the overall consequence. Appropriate weighting should be allocated based on relative importance between the factors. Weighting assignment is to be done case-by-case and in consultation with Watercare.

The severity can vary from insignificant (e.g. no significant impacts) to catastrophic (e.g. loss of life or high value financial implications due to damage to property), based on the potential consequences and outcomes.

### Health and safety

When leaving an asset in or above ground, it is crucial to ensure it poses no risks to public health, safety, or the environment. This includes evaluating the feasibility of removing the asset, as certain limitations may arise. For instance, large or collapsed pipes may be challenging to grout or remove effectively. In such cases, if the asset presents a significant health or safety risk, removal should be considered where reasonably practicable. All decommissioning decisions must carefully balance practicality with the need to maintain safety standards for both people and the surrounding environment.

Evaluating the location of assets is also essential when considering health and safety aspects. Assess whether assets are in berms, carriageways, private properties, parks, or reserves, and consider the potential for future development over the abandoned asset locations. Additionally, evaluate the depth of cover over the pipelines and inspect their structural integrity to assess the risk of collapse. For assessing the risk level based on the asset location refer to Table 2 for guidance. Each case is to be assessed on its own merits. The key risks noted here can contribute to other consequence factors risk level determination.

**Table 2:** Risk level assessment based on location

Location	Key Risks	Risk Level
Road reserve/carriageway	Pipes may collapse due to excessive loading and leaking pipes or joints can cause ingress of water and surrounding fines (ground), leading to sinkholes.	High
Under or nearby structures (including buildings)	Similar risks to those in road reserves, with the additional potential for damage to buildings and loss of life.	High
Crossing private properties	Pipes may collapse due to leaking pipes or joints can cause ingress of water and surrounding fines (ground), leading to sinkholes. This has potential to cause property damage and loss of life.  The probability of a failure maybe low depending on pipe type but consequence to health and safety is high	High
Berm/footpath	Settlement can affect the pavement structure above asset like pipes.	Medium
Fields and farmlands	Generally, no significant risks.	Low



### ***Operations***

Abandoned assets should be left in a way that would otherwise not damage other buried utilities or create a risk for future damage. It is crucial to consider impact to other utilities, such as stormwater pipes, electrical ducts, or telecommunications infrastructure (e.g. Chorus).

While the abandoned asset itself is no longer intended for use, its presence should not create physical obstructions or constraints that interfere with the integrity or installation of nearby services. Proper assessment and planning are required to ensure the asset does not compromise surrounding infrastructure now or in the future. Therefore, severity of the impact to those nearby services if an abandoned pipe does fail needs to be evaluated.

### ***Environmental impact***

An abandoned pipe can deteriorate over time, potentially leading to environmental impacts such as soil instability (voids in soil) due to collapse pipe, explosive risk if there is trapped gases within the failed abandoned pipe, impact to surrounding structure stability and soil and groundwater contamination. Un-grouted pipeline that is damaged and exposed to the natural environment, can result it becoming a groundwater conveyance pathway.

Therefore, severity of environmental impact should be evaluated including considering environmentally sensitive areas like waterways or vegetated zones and future use of the land.

### ***Financial impact***

As previously described, a failed abandoned asset can lead to creation of hazards to the surrounding environment and community. There will be direct cost involved to remedy the situation and indirect cost due to disruption posed onto the community and social impacts (e.g. business interruption, damaged structures, injuries and loss of life). The severity of the financial implications (direct and indirect) should be evaluated.

### ***Reputation***

Evaluation against this factor should be considered as decommissioning decisions can significantly impact Watercare's reputation, particularly if abandoned assets pose risks to the community or environment. Leaving assets in place creates potential hazards, such as collapse, contamination, or structural failure which can lead to public safety issues or environmental harm if the situation eventuates. Such incidents could harm Watercare's image as a responsible steward of critical infrastructure.

### ***Likelihood Failure Assessment***

Assessing the condition of an asset is a key step when determining the likelihood of failure. Risks may arise due to material deterioration, leaks, infiltration through joints, and migrating materials.

To accurately evaluate these risks, pipe or material samples should be collected and evaluated by a material scientist to determine the integrity, rate of deterioration to date, and expected remaining structural life. This process will provide insights into the remaining lifespan, structural integrity, and potential reuse opportunities of the assets, ensuring they meet performance expectations.

### ***Risk Level Assessment***



The risk level can be identified by scoring the criticality of failure consequences and the likelihood of failure on a scale of one to five. Here, a score of 1 represents insignificant failure, while 5 indicates a catastrophic failure. Similarly, a score of 5 for likelihood of failure means the asset is in very poor condition, whereas 1 suggests they are in very good condition.

The risk assessment matrix table presented in Appendix A can help identify the most suitable abandonment strategy. Depending on the failure consequences and the asset's condition, the optimal abandonment-approach will be selected:

- For **low risk scenarios**, a simple abandonment in place approach may be sufficient, such as end capping a pipe without filling.
- For **moderate risk scenarios**, pipes can be left in place, end capped and part of the section filled using grout (refer to the Section **Error! Reference source not found.**) or another approved material, such as lightweight aggregate, may be appropriate. Use of alternative materials should be confirmed by Watercare.
- For **high risk scenarios** or large-diameter pipes in sensitive areas, complete section grout filling combined with end capping is often recommended. If there is no suitable abandonment in place methodology, complete abandonment by removal maybe a viable option where risks or site conditions justify it.

Implementing a risk-based approach allows Watercare to take appropriate mitigation measures on abandoning asset. The strategy would enable:

- Prioritisation of sections based on a high likelihood of failure and the criticality of consequences.
- Mitigation of risks to surrounding infrastructure, particularly in sensitive areas, such as those near schools and residential properties.
- Minimization of environmental and economic impacts through cost-effective abandonment methods.

## Risk Evaluation Examples

The provided examples demonstrate the thought process for difference scenarios.

### ***Example 1: 200mm wastewater line (PVC material) under a footpath***

As the diameter is less than 300mm, a formal risk assessment is not required. However, considering the reported condition and the pipe's location beneath a footpath, the following abandonment strategy is recommended:

- End capping at both ends.
- Partial filling with inert material such as sand may be considered as well if additional ground support is required.

### ***Example 2: 140mm wastewater rising main (Small Rd WWPS, DPSML, existing rising main decommissioning plan)***

As the diameter is less than 300mm, no condition assessment and consequences failures were done. The existing Small Rd Wastewater Pumping Station (DPSML) rising was decommissioned due to capacity issues in the Forge Rd network. The rising main, constructed in 2022, has a length of 1,059m and an internal volume of approximately 11 m<sup>3</sup>. The decommissioning plan included flushing the rising



main, capping its ends, and recording the changes in as-built drawings. The methodology aimed to maximize the useful life of the asset by allowing it to remain as a potential duct for future use.

**Example 3: 760mm OD transmission watermain (concrete-lined steel pipe) under railway or significant structure**

Since diameter is greater than 300mm risk assessment is required:

- *Consequence of failure:* All relevant factors including health and safety, operations, environment, financial impact, and reputation must be considered. Given the pipe's location beneath critical infrastructure, the consequence of failure could be catastrophic.
- *Likelihood of failure (based on condition assessment):* The pipeline shows signs of corrosion but remains structurally sound in most sections. The likelihood of failure is rated as good to average, indicating some deterioration but no immediate risk of failure.

Recommended abandonment strategy:

- Sections located under critical assets (railway/buildings) should be filled completely with grout to avoid future collapse risks.
- Remaining sections away from critical infrastructure can be end capped and left hollow to reduce costs.

**Example 4: 225mm wastewater rising main**

Although the diameter is less than 300 mm, an overall risk assessment can be conducted to support decision-making.

- *Consequence of failure:* Major due to the pressurised nature of the rising main and the potential for environmental discharge in the event of failure.
- *Likelihood of failure (based on condition assessment):* High due to advanced deterioration observed, including external corrosion and indications of internal pressure loss. The pipeline is in poor condition, suggesting a high likelihood of failure if not addressed.

Recommended abandonment strategy:

- Complete grout filling of the main at location near sensitive areas (e.g., residential zones), with selective end capping for isolated sections that pose lower risks.

## Requirements Guideline

While this guideline provides general principles and strategies for decommissioning, it is essential to recognise that each project must develop its own site-specific decommissioning specification. The appropriate methodology can vary significantly depending on site conditions, asset type, and the surrounding environment. Each asset should be assessed individually to determine the most suitable, safe, and environmentally responsible decommissioning method.

The guidance provided in this document is intended to serve as a starting point, offering information to support project planning. However, these recommendations may not apply in all situations. Project teams are encouraged to deviate from these guidelines when necessary to account for specific site constraints, risks, or operational requirements.



## **Pipes**

Pipes are grouped into two main categories:

1. Water and wastewater transmission and network
2. Asbestos pipes

In developing the decommissioning plan of a buried pipe, a segment analysis should be completed to identify the lengths of pipe that should be abandoned in place and those that should be abandoned by removal.

### ***Water and wastewater transmission and networks***

The following sub-sections provides guidance on the two decommissioning options for non- asbestos cement pipes.

#### Out of service state

Out of service pipes shall be sealed using a concrete plug at all points where they are cut and at all structures. Concrete plugs shall have a minimum length, which is the greater of 500mm or the pipe diameter and be watertight.

#### Abandonment

Each transmission and network asset intended for abandonment should be assessed using a failure risk evaluation as discussed in the “Risk Evaluation for Abandonment” section and an appropriate abandonment methodology must be agreed upon before starting work. Decisions should be made based on a risk matrix.

In water networks, consideration shall be given to mitigate any potential hazards associated with cross-contamination or damage to other utilities.

Wastewater networks assets often pass through private properties, roads, and reserves, and are connected by concrete manholes or inspection chambers. These assets tend to be buried deeper than network water assets, posing a higher risk to Watercare if proper abandonment methods are not followed, this should be assessed in the failure risk assessment.

Where all pipes connecting to a manhole have been filled, the manhole shall be treated in accordance with the Manhole section below. The pipe can be filled with grout or an approved alternative material by Watercare. Refer to Grouting section for requirements.

Abandoned in place above ground pipeline should be clearly labelled to provide clear visual cue that it's no longer in use. “Abandoned” wording against background colour of green colour (for water), black (for wastewater) or yellow (gases) may be used. Refer to AS 1345-1995 for requirements.

Where abandonment by removal is required, the trench backfilled to the roading authority requirements. Abandoned laterals connecting to a main that has been removed shall be treated either by removal or filling to the private property boundary. Where all pipes connecting to a manhole have removed, the manhole shall be treated in accordance with “Manhole” section.

### ***Asbestos pipes***

Refer to Worksafe NZ Asbestos Management and Removal Guidelines for asbestos pipes which are to be abandon or removed.



## ***Assets Along Pipes***

This applies to assets such as Bulk Supply Point (BSP), pressure-flow monitoring sites and control valve location.

### ***Electrical and Instrumentation Related Work***

- a) Remove all associated equipment including antenna/antenna pole, earthing stake and above ground cable conduit.
- b) Disconnect the electricity meter and return to the Metering Equipment Provider (MEP) for final readings.
- c) Any penetrations or culverts left open shall be covered and make good to match surrounding finishes.
- d) Redundant cabling removed back to the cabinet.
- e) Reclaim (pull out) or earth any cables left in the field
- f) Cathodic protection system is to be removed including proper plugging/sealing of boreholes
- g) Remove unused cable containment and associated mounting brackets and hardware.
- h) Cut earth grid cables back to finished surface level where needed.
- i) Consult with Watercare's Operations and Maintenance Delivery team to confirm items that may be maintained for spares or reuse. Ensure that asset register is updated to reflect relocation of these assets.

### ***Control System Related Work***

- a) Control cabinets associated with the decommissioned asset should be removed. Any components within the cabinet including wiring or operational equipment shall be disconnected and safely removed. If removal is impractical, this must be assessed and addressed through consultation with Watercare.
- b) Consult with Watercare's Control System team to confirm items that may be maintained for spares or reuse. Ensure that asset register is updated to reflect relocation of these assets.
- c) Re-program control system as required to show the revised or new arrangement.
- d) Control logic removal. Complete removal of all control logic associated with the decommissioned equipment. This includes logic elements directly responsible for the monitoring and/or control of the equipment, as well as any indirect or external logic references, interlocks, or dependencies that interface with or reference the decommissioned system.
- e) Software Licensing Management. Verify that all software licenses associated with the decommissioned system are released and made available for reallocation or reuse within the control network.
- f) I/O Hardware and Addressing Reset. Following the removal of power and signal cabling for the decommissioned system, ensure that all associated Input/Output hardware and software addressing are reset, cleared, and made available for future use.
- g) Historical Data – Local Storage. Review locally stored historical data associated with the decommissioned equipment. Either delete the data or archive it securely off the host control system, in accordance with Watercare's data retention, cybersecurity, and operational continuity requirements.
- h) Historical Data – Remote Storage (Corporate AVEVA PI System). Review remotely stored historical data related to the decommissioned system. Either delete or archive the data off



the host control system, and disable or remove the corresponding tag points entirely to free up history point licensing capacity.

- i) Automated Reports and Analytics. Identify and modify all automated reports, dashboards, and analytics applications (including AVEVA PI Vision, Seeq, and SQL-based reporting) that reference the decommissioned equipment or system, to prevent invalid data queries and maintain reporting accuracy.

## ***Clashing Services***

Where abandoned services clash with new pipelines, they must be either cut and sealed or fully grouted, depending on the abandonment method adopted.

If the entire line is grouted, additional sealing at the cut points may not be required, subject to the approval of the relevant service authority and the engineer. Where sealing is required, the ends of abandoned pipelines should be sealed with watertight concrete plugs at all cut points and structures. These plugs must have a minimum length of 500mm or the pipe's diameter, whichever is greater.

## ***Manhole***

Manholes should be decommissioned based on the evaluated decommissioning risk, which may involve removing them, taking them out of service, or filling them. If filling is required, the process shall follow the roading authority's requirements.

All connections must be sealed with a concrete plug as outlined in the clashing services section. Before grouting, disconnect and cap the assets to separate them from the live network. GAP65 is suitable for manholes where compaction is possible, and contamination isn't a concern.

## ***Grouting***

Pipes shall be filled with a highly flowable grout or foam concrete. The grout strength shall generally be between 1.5MPa and 3.0MPa, with 2.0MPa flowable fill commonly used. However, the required strength shall be confirmed by a qualified engineer, as higher strengths may be specified depending on project requirements. Superplasticisers and other admixtures to aid flowability are acceptable. The grout should be stronger than the surrounding soil to prevent any settlement, providing stability and maintaining structural integrity. Abandoned laterals shall be exposed at the property boundary. The private property side shall be sealed with a concrete plug in accordance with clashing services section. The downstream side shall remain open to the atmosphere throughout the filling operation. A suitable construction methodology shall be provided to Watercare for approval. The approved methodology will include but not be limited to confirming how the total void, including all laterals to the private property boundary, will be filled.

When planning grout filling for large pipes, it's important to consider costs, environmental impacts like carbon footprint, potential loss of utility space in road corridors, and the elimination of future reuse options for the asset.

For evaluating the potential for repurposing abandoned assets for future water services or hosting other utility services, engage with relevant stakeholders to determine possible future uses. Repurposing is often impractical for certain types of pipes, especially smaller diameter pipes.

For large-diameter pipes, grout pumping requires careful planning with multiple excavation points to divide the pipe into manageable sections. Since grout cannot be pumped over long distances without



hardening, this ensures the entire pipe is filled effectively without leaving voids. Ensure via CCTV between entry points of grout that no voids exist.

Filling abandoned pipes with grout serves several purposes:

- **Structural stability:** It helps in preventing potential collapses and maintaining ground stability.
- **Mitigation of hazards:** Reduces risks associated with voids in the ground that could impact surrounding infrastructure.
- **Environmental protection:** Prevents contamination of groundwater by sealing off old pipelines that might contain residual substances. As an example, filling obsolete pipelines with special grouts seals off residual contaminants, preventing groundwater contamination and stabilising surrounding soil. This process ensures environmental protection and compliance with regulations by creating a solid barrier within the pipeline.

### **Grouting process**

**Preparation:** The pipe is initially inspected using CCTV to assess its condition. It is then thoroughly cleaned to remove any debris or hazardous materials, ensuring it is ready for the next steps.

**Sectioning:** For long pipes, the pipeline is divided into manageable sections to ensure complete filling. This often requires multiple injection points.

**Injection:** Grout must have a flowable and workable consistency to ensure it does not prematurely harden before reaching the full length of the section being filled. Controlled injection pressure is required to avoid pipe rupture and ensure even grout distribution throughout the pipe. For longer pipelines, the process should be carried out in sections with multiple injection points to ensure complete filling and to avoid segregation or blockages within the pipe. A project-specific grouting plan should be developed to address these considerations and outline the exact sequence, materials, and methodology to suit the specific site and pipe conditions. Continuous monitoring during injection is crucial to confirm that all voids are fully filled and that the grout remains workable throughout the process.

**Curing:** Depending on the type of grout used, the curing time can vary. Proper curing ensures that the grout achieves its designed strength and stability. To ensure proper curing, samples should be collected for every 50m<sup>3</sup> of grout. These samples should then be tested by a third-party lab to verify the grout's strength and density after 28 days.

### **Typical risk and control measures in grouting works**

Typical risks associated with grouting pipelines are outlined in the table below.

**Table 3:** Risk associated with grouting activity and control measures

Risk	Control Measure
Pipe cleaning/clearing requirements	All pipes should be cleaned and cleared prior to decommissioning.
Grout loss due to pipe damage or laterals	Pre-decommissioning inspections, such as CCTV surveys and physical checks, should be carried out to identify any existing pipe damage or unknown laterals. Findings should be documented and signed off before work begins.
Traffic management and access constraints	Areas requiring traffic management should be identified and included in the project plan. Allowances should be made for unexpected access issues not initially scoped.



Risk	Control Measure
<b>End cap design and installation</b>	End caps should be designed and installed by qualified personnel. Designs must be reviewed and approved, and a Temporary Works Certificate or equivalent documentation should be issued.
<b>Permits and regulatory approvals</b>	All necessary council permits, and regulatory documentation must be secured prior to starting work. These requirements should be planned into the project timeline.
<b>Material quality assurance (strength and density)</b>	A quality assurance process should be implemented to monitor material quality. This may include testing material samples (e.g. grout) at regular intervals (e.g., every 50m <sup>3</sup> ) to verify compliance with strength and density specifications.
<b>Pressure spikes during filling activities</b>	Pressure gauges should be installed at all injection inlets to monitor internal pipe pressure. Safe Work Procedures or a Site-Specific Safety Plan should address this risk.
<b>Water supply for grouting or cleaning</b>	An appropriate water supply source should be confirmed prior to works. This may involve engaging a third-party provider if required as no on-site resources will be provided by Watercare.
<b>Material supply and workability</b>	Ensure a stable supply chain and quality control for all fill materials. Service agreements with suppliers should confirm mix design, delivery schedule, and availability.

## Regulatory Requirements and Reference Documents

All work, materials and practices shall comply with requirements described in current Watercare, New Zealand and Australian legislation, standards and guidelines below. Where conflict or ambiguity exists, this guideline shall take precedence. Where there is conflict between referenced documents, the higher level of standard shall take precedence.

Watercare Services Limited

- No. CG Ver 1.1.: General Civil Construction Standard

National and international

- Health and Safety at Work Act 2015 (New Zealand)
- Health and Safety at Work (Hazardous Substances) Regulations 2017
- Building Act 2004 (New Zealand)
- Resource Management Act 1991 (New Zealand)
  
- AS 1345:1995 – Identification of the Contents of Pipes, Conduits and Ducts
- WorkSafe NZ – Asbestos Management and Removal Guidelines

## Appendix A Risk Assessment Matrix

Consequence of failure (Significance of failure)			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Catastrophic
Likelihood of failure (Asset Condition)	5	Very Poor	End capping and partial pipe section filling with grout or alternative materials.	End capping and partial pipe section filling with grout or alternative materials.	End capping and partial pipe section filling with grout or alternative materials.	End capping and complete section filling with grout. Consider pipe removal if residual risks remain high.	End capping and complete filling with grout. Consider pipe removal if residual risks remain high.
	4	Poor	End capping and no filling.	End capping and partial pipe section filling with grout or alternative materials.	End capping and partial pipe section filling with grout or alternative materials.	End capping and complete section filling with grout. Consider pipe removal if residual risks remain high.	End capping and complete section filling with grout. Consider pipe removal if residual risks remain high.
	3	Average	End capping and no filling.	End capping and no filling.	End capping and partial pipe section filling with grout or alternative materials.	End capping and complete section filling with grout. Consider pipe removal if residual risks remain high.	End capping and complete section filling with grout. Consider pipe removal if residual risks remain high.
	2	Good	End capping and no filling.	End capping and no filling.	End capping and no filling.	End capping and partial pipe section filling with grout or alternative materials.	End capping and partial pipe section filling with grout or alternative materials.

Consequence of failure (Significance of failure)			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Catastrophic
	1	Very Good	End capping and no filling.	End capping and no filling.	End capping and no filling.	End capping and partial pipe section filling with grout or alternative materials.	End capping and partial pipe section filling with grout or alternative materials.