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Pr9790 - Specification for Pipe Ramming

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1 Purpose

The intent of this document is to outline the minimum deliverables and standards that the contractor needs to comply with when performing pipe ramming works on Unitywater projects.

Its purpose is to ensure consistency across all projects delivered by Unitywater and that the safety, quality, environmental & design objectives required by Unitywater are achieved.

This Specification shall be read in conjunction with relevant project drawings (where applicable), Project Scope of Works and supplementary specifications.

2 Scope

The process of pipe ramming involves direct driving of a steel enveloping pipe in a similar fashion to pile driving, however, usually in the horizontal plane.

The forces generated to drive the pipe into the ground are usually pneumatic converted to mechanical. The driven pipe is usually hollow allowing the ground to fill the pipe as it progresses from pit to pit. The driven pipe is usually fitted with a cutting band or cutting edge on the leading edge to both protect the leading edge and to aid the pipe to travel through the ground.

Pipe ramming is a cyclical process where additional pipes are lowered into the entry pit and welded/attached to the previous pipe. The ramming process is then continued to the target location and then the process of removing the ground from within the pipe is commenced.

In heavily swelling plastic soils the application may not be possible and in rock it is not possible. In water-bearing soils, the process is advantageous as the method doesn't present challenges such as ground loss due to differences in pressure between the ground and the machine.

2.1 Order of Precedence

Where a discrepancy exists between the Drawings, this Specification, the project Scope of Works and the other Unitywater specifications the Contractor shall seek clarification from the Superintendent.

2.2 Principal/Standard Drawings

Where the form of Contract is 'Design and Construct' the Principal Drawings are a high level concept design of the Principal's project requirements. The Contractor is to use these drawings as a guide upon which to base the preliminary and final design. The Principal Drawings will typically illustrate the following elements:

- Site constraints;
- An indicative trenchless alignment according to best practice;
- Pits, shaft or tie in locations;
- Approximate drive lengths; and
- Jacking/enveloper/casing pipe and carrier pipe details.

Where the form of Contract is 'Construct only' the Principal Drawings are a prescriptive representation of exactly what is to be constructed under the Contract. These drawings will include the minimum information that the Contractor will require to build the works. Any changes required or ambiguities found must be discussed with the Principal immediately.

3 Project Preliminaries

3.1 Approvals

Project approvals are usually obtained by Unitywater; however, in some instances approvals may be the responsibility of the Contractor. The Contractor is to refer to the Project Specific Scope of Works for required approvals.

No work is to begin, either onsite preparation or with Pipe Ramming activities, until all relevant permits and approvals have been gained and signed off by the relevant authority. The following authorities may be required to authorise the works:

- Queensland Government Department of Transport and Main Roads;
- Queensland Rail and / or other rail infrastructure owners;
- Local Government; and
- Private land owners.

The Contractor shall be required to adhere to any approval conditions that the Principal or asset owner specifies.

3.2 Design

The Contractor shall be responsible for the design and construction of all aspects of the pipe ramming works, including any temporary works and temporary pit/shaft supporting structures.

All design assumptions regarding subsurface conditions, equipment requirements, groundwater and other factors are the responsibility of the Contractor and shall be fully documented.

Based on the alignment shown in the Principal Drawings, the Contractor shall design and size the excavated profile to accommodate all temporary and permanent works.

The design is to be certified by a RPEQ engineer and shall be submitted to the Superintendent for review prior to commencement of work.

The Contractor shall not proceed with any work until the Contractor's design has been accepted by the Superintendent.

Acceptance of the Contractor's design by the Superintendent in no way diminishes the responsibility of the Contractor for the design.

The Contractor is responsible for submitting the following design elements for approval prior to commencing work:

- The design of all temporary works associated with the trenchless construction, including but not limited to the pit / shaft support (including access ladders and pipe fixings), crane pads and access roads or laydown areas;

- Where the permanent works are to accommodate thrust arrangements, these shall be designed to ensure the permanent works are not damaged in operation;
- The pipe ramming bore alignment;
- Collaboratively working with the Principal's permanent infrastructure functionality and permanent design team to ensure the overall project achieves the intent;
- The ramming support frame, recoil straps and shaft must be designed to withstand the maximum forces expected for the ramming system while ensuring that these forces are within the allowable forces and deflection tolerances for the ramming pipe;
- The design and execution of the pipe ramming equipment and processes;
- Verifying the suitability of the specified pipe and cutting edge for the methodology proposed with respect to pipe ramming;
- The design of the means of excavation to be used and the associated ground extraction method;
- The planning and use of pipe ramming consumables (if required);
- The setup of the ramming support frame to enable the designed alignment to be best achieved;
- Thrust block calculations;
- Theoretical settlement and heave calculations to be produced;
- The operation of the trenchless equipment needs to conform to the established settlement and/or heave allowance;
- Any design amendments necessary to ensure that the construction techniques proposed are in compliance with the permanent design.
- The pipe ramming design shall take account of all potential impacts on all existing infrastructure and underground features, including but not limited to:
- Impacts from ground movement, seismic activity, clearance to features, settlement/heave; and
- Any changes in the groundwater table resulting from the works, either temporarily during construction or permanently as a result of the construction.

All designs shall ensure the safe operation and use of plant, equipment and materials handling under all expected loadings such as ground pressure, superimposed loads and ramming forces.

Table 1 below outlines the required design drawings for the works under the Contract. It also details the RPEQ sign off.

Table 1 – Design Drawing Requirement

Drawing Details	Plan / Elevation	RPEQ Sign Off
Site Layout	Plan	☐
Shaft Construction	Plan + Elevation	☑
Shaft Layout	Plan + Elevation	☐
Finished Pipeline General Arrangement	Plan	☑
Finished Pipeline Alignment	Plan + Elevation	☑

3.2.1 Pipe Rammer

A pipe rammer shall be selected based on the calculated ramming force requirements.

The pipe rammer shall be suitable for the ground conditions expected, and be complete with retraining straps, compressor and supporting frame (if required).

3.2.2 Ramming Pipe (enveloper)

Pipes used for ramming are subjected to a repetitive dynamic (impact) force during the ramming operation.

Under each application of the force, kinetic energy is transferred from the pipe rammer to the pipe and the soil.

Thus, in addition to the calculations of required ramming force, minimum pipe dimensioning and buckling safety of the pipe, consideration needs to be given to the effects of kinetic energy on the material structure of the pipe and on the earth pressure.

Prior to construction, the Contractor shall submit to the Superintendent's Representative for approval, calculations showing the anticipated installation forces to be imposed on the ramming pipe.

The Contractor shall take all precautionary measures to avoid damaging the ramming pipe during the installation process. In particular, the Contractor shall ensure that the magnitude of loadings imparted onto the pipe do not result in buckling or damage of the pipe.

The installation of a Cutting Edge or Cutting Shoe will help protect the leading edge of the ramming pipe.

Wall thickness shall be appropriately sized to withstand the installation forces calculated.

3.2.3 Carrier Pipe

The carrier pipe is the pipe employed to fulfil the permanent functionality of the infrastructure. This pipe is usually specified and supplied by the Principal.

The Contractor shall submit to the Superintendent's Representative for approval details showing the transportation, handling, storage, installation and testing of the carrier pipe. All details must adhere to the manufacturer's guidelines and ensure that the carrier pipe is not overloaded at any stage of the installation process.

3.2.4 Design Collaboration

The Contractor and Principal shall collaboratively work to ensure that all pipeline design aspects have been adequately considered and analysed across the two key project phases: Microtunnelling Installation and the Infrastructure's Permanent Operation.

3.3 Governing Documentation

As a minimum, and in addition to the documentation required in the Contract documentation, the Contractor must submit for approval the following governing documentation as outlined in Table 2, Table 3 and Table 4 below.

Table 2 – Work Plans

Plan	Submission
Settlement Monitoring Plan	4 weeks before work
Major Lift Plan(s)	4 weeks before work
Plant Suitability and Maintenance Plan	4 weeks before work
Risk and Contingency Management Plan	4 weeks before work

Table 3 – Work Procedures

Procedure	Submission
Site establishment	4 weeks before work
Construction of the crane/excavator support slab/pad (if applicable)	4 weeks before work
Pit/shaft construction (if applicable)	4 weeks before work
Pipe Ramming including the ramming pipe (enveloper) jointing	4 weeks before work
Spoil removal from rammed pipe	4 weeks before work
Carrier pipe welding (or jointing) (if applicable)	4 weeks before work
Carrier pipe installation	4 weeks before work
Man access (if applicable)	4 weeks before work
Annulus grouting between the ramming pipe (enveloper) and the carrier pipe	4 weeks before work
Hydrostatic, vacuum and chlorination testing (if applicable)	4 weeks before work
The demobilisation of the equipment and site	4 weeks before work

Table 4 – Safe Work Method Statements

Safety Work Method Statements	Submission
Operation of a crane / excavator	4 weeks prior to works
Operation of the Pipe Rammer and equipment	4 weeks prior to works
Working at heights	4 weeks prior to works
Work in a confined space (if applicable)	4 weeks prior to works
Hot works	4 weeks prior to works
Work at night under artificial light	4 weeks prior to works
Lifting	4 weeks prior to works

NOTE: These time frames may be varied either by written agreement or nominated in the Project Scope of Works.

3.4 Risk and Contingency Plans

The Contractor shall prepare and implement an approved contingency plan dealing with the key project or Pipe Ramming risks identified. As a minimum the Contractor shall have defined plans complete with equipment and materials on standby to mitigate against the following pipe ramming risks:

- Shaft/pit collapse;
- Ramming pipe collapse / buckling;
- Shaft/pit flooding;
- Major equipment mechanical failure;
- Settlement or heave scenarios;
- Working at heights;
- Working in close proximity of suspended loads;
- Serious safety or environment incidents;
- Higher ramming forces than expected.

3.5 Geotechnical Information and Risk

A Geotechnical Investigation will be commissioned by/carried out for the Principal for the project and the resulting information will be provided to the Contractor in the form of a Geotechnical Data Report (GDR) or complete Geotechnical Baseline Report (GBR). The level of geotechnical investigation shall be determined by, but not limited to the following inputs:

- Proposed methodology;
- Local site geology;
- Local site hydrogeology;
- Project capital value.

The Report will cover a minimum set of requirements/criteria to aid and guide the Contractor to assess the project and specifically make informed decisions with regards to:

- Equipment Selection;
- Penetration Rates;
- Jacking Pipe selection;
- Carrier pipe selection;
- Time and Cost.

The Contractor shall inform themselves thoroughly and draw their own conclusions as to the difficulty of maintaining required excavations and of undertaking other work affected by the geology and hydrogeology of the Site.

Where the Contractor considers it necessary that additional site or subsurface investigations are required, the Contractor shall bring this to the attention of the Superintendent's representative in a timely manner.

4 Procurement

4.1 Approved Suppliers

The Contractor must provide materials that have previously been approved for use as per the SEQ WS & S D & C Code Infrastructure Products and Materials (IPAM).

If the Contractor proposes to utilise non pre-approved products these are to be submitted to the Superintendent's Representative for consideration.

4.2 Principal Supplied Materials

The Contractor shall document the receipt of any Principal supplied materials formally with the Superintendent's Representative. The receipt of materials by the Contractor accepts the suitability of these products for inclusion in the Works.

All principal supplied materials shall be handled strictly in accordance with the manufacturer's written instructions at all times.

4.3 Storage and Security of Materials

The Contractor shall provide security for the Site and Works including the construction facilities, plant and equipment. Materials shall also be secured by the Contractor to prevent their removal by unauthorised personnel.

4.4 Personnel

Appropriately trained and experienced personnel are required for the delivery of the works. Details of key personnel experience shall be provided to the Superintendent's Representative for approval before the works commence.

A site supervisor who is thoroughly knowledgeable of the equipment and pipe ramming procedure is to be present at the job site at all times. The site shall be present to address immediate pipe ramming construction concerns, health and safety and environmental issues.

4.5 Plant

All pipe ramming construction operations shall be performed using specialist equipment.

All plant must be of a good standard and the Superintendent's Representative shall be permitted to inspect the proposed plant.

All plant must pass the Principal's equipment assessment/inspection criteria prior to site mobilisation. The key Principal's equipment assessment/inspection criteria are listed below:

- Plant is required to be in good safe working order;
- Plant is required to have a good service history;
- Plant is required to be fit for purpose.

The Contractor's Management Plans and Procedures must detail a system for daily checking and resolving of issues with the supplied plant and equipment. The Contractor must supply key critical spares to ensure that the all equipment achieves a 90% working availability target.

4.6 Materials

Permanent materials are to fully comply with this specification and the documents referenced herein. The Contractor shall prepare and submit supplier's certificates for all permanent materials to be included in the works.

Any deviation is to be approved in writing by the Superintendent's Representative.

The Contractor shall appropriately choose a ramming pipe jointing system to suit the pipe's purpose and the pipeline alignment. The Contractor is to consider these important design and operable features of the ramming pipe when completing the design.

The Contractor shall handle the ramming pipe as per the relevant specifications and manufacturers guidelines.

5 Project Execution

The Contractor shall maintain control of site operations at all times.

5.1 Site Setup

The Contractor is to set the launch and reception sites up in accordance with the approved site layout drawing which as a minimum must cover the following key aspects:

- Perimeter fencing in the allowed location;
- Site topsoil stockpile complete with erosion and sediment control;
- Entry and exit points;
- Pedestrian walkways and appropriate exclusion zones around cranes or moving plant;
- Equipment locations and movement zones;
- Any underground or overhead power lines and the appropriate exclusion zone;
- Shaft/pit location;
- Traffic guidance systems.

The Contractor shall conduct a pre-launch survey by the surveyor and be a hold point in the ITP. Associated check sheets are to be signed off on site by the Contractor, Client representative and Surveyor.

The Contractor shall submit a pre-launch sheet template for approval prior to works.

5.2 Existing Services

The Contractor shall note the presence of overhead and underground services on the works site. Special care shall be taken in the vicinity of electricity services.

The locations of some underground services are indicated on the drawings and are based on information supplied by the respective Authorities where such information is available.

It is emphasised that information supplied regarding these services is tentative only with respect to both details of services shown and the existence of other services not shown.

Neither the Principal nor the Superintendent warrant the completeness or accuracy of the information given and the Contractor is required to make enquiries into the presence and location of underground services with the relevant Authorities.

The attention of the Contractor is drawn to the fact that private underground and overhead services and individual services to premises from public utility mains are not shown on the drawings.

The Contractor shall verify the position of each underground service before commencement of excavation. The Contractor shall pre-locate the services as to depth, alignment and extent or size, so as to ensure such services are not adversely affected. Hand excavation may be necessary to close proximity to services until the exact location is determined.

a. For services that are owned by Queensland's Department of Transport and Main Roads, contact planroom@tmr.qld.gov.au for locations of DTMR's existing services.

b. For services that are owned by Queensland Rail refer to QR's web site, https://www.queenslandrail.com.au/forbusiness/thirdpartyaccess.

Trenches containing underground services shall be backfilled so that the subgrade is restored as nearly as possible to its original state of compaction.

Where selected backfill has been placed by other utilities and has had to be removed, it shall be replaced by the same type of selected material.

All backfill shall be carefully deposited in the trench and around the utility service in layers and adequately compacted by proper hand rammers and tampers or by use of effective mechanical equipment.

Extra care shall be taken by the Contractor to re-compact excavations near existing underground pipework, so that foundations of that pipework are restored and more especially when re-compacting in the vicinity of low flexibility pipework.

The Contractor shall be held responsible for any damage caused to existing overhead or underground services.

In case of failure or damage, the Contractor shall immediately notify the relevant service provider and arrange for repairs to be undertaken.

If there is any delay, the Superintendent will arrange for repairs to be carried out by the Principal or others and the full cost of such repairs shall be borne by the Contractor.

If, in the opinion of the Superintendent, the failure or damage causes an emergency situation, then remedial action will be taken by the Principal and the full cost of such action shall be borne by the Contractor.

Only those persons qualified to undertake repairs on the relevant services shall be permitted to perform the work with the prior approval of the service authority.

Where it is necessary to carry out alterations to existing overhead or underground services, this work will be arranged by the Contractor unless otherwise specified.

The Contractor shall allow to co-ordinate and work around service authorities where relocations are necessary during the Contract.

The Contractor shall promptly advise the Superintendent of any services affecting the works which were not shown on drawings so that appropriate action can be taken.

5.3 Dilapidation Reports

The Contractor is responsible for all pre-construction and post-construction property assessments. These assessments shall be a means of determining whether and to what extent, damage has resulted from the Contractor's operations during the Works. Any damage identified shall be made good at the Contractors expense.

The Contractor shall be responsible to identify any critical structures relevant within a 10m or less proximity of proposed Auger Boring works (Discuss with UW). Critical structures shall include but not limited to:

a. Bridges
b. Tunnels
c. Buildings and housing
d. Infrastructure assets

As a minimum the dilapidation reports shall capture:

- All work sites and any surrounding area likely to be impacted by the construction activities, including heavy vehicle traffic;
- A minimum distance of 3 x the depth of any shaft measured radially from its perimeter;
- A minimum distance of 2 x the depth to invert level measured from the centreline of any pipe installed by trenchless methods;
- Any area within the settlement trough or zone of influence as defined by the Contractors prediction of ground settlement;
- The report must capture the condition of all aspects of the natural and built environment within the nominated areas, including but not limited to inside buildings, public utilities and plant, roadways and landscaping.

5.4 Monitoring and Reporting

A reporting and auditing schedule must be prepared as part of the approvals process prior to commencing the Works.

The Contractor shall provide daily pipe ramming reports and access to live records on site at the discretion of Unitywater site representative.

5.4.1 Daily Site Record

Records shall be maintained describing the major works being carried out on Site for each day of the Works and be available for inspection by the Superintendent's Representative at any time (as per Table 5 below).

Table 5 – Pipe Ramming Reporting

Pipe Ramming Record / Report	Details
Ramming data – hammer frequency, hammer pressure, line, level, advance rates, overcut volume	Daily
Quantities of consumables used	Weekly
The diameter and type of pipe and pipe joint used	Weekly

5.4.2 Surface Settlement or Heave

The Contractor shall provide a Settlement Management Plan which shall include but not limited to:

a. Theoretical predicted surface settlements in the vicinity of the tunnel alignment
b. Verification of compliance with Main Roads applicable specifications
c. Verification of compliance with Queensland Rail applicable specifications
d. Verification of compliance with relevant Council applicable specifications

The Contractor shall provide information on the permissible subsidence or heave at the ground surface, considering the use of the area, structures and systems in the sphere of influence of the works and taking into consideration the subsoil and groundwater conditions and the depth of cover.

5.5 Lifting

The Contractor shall provide a lifting procedure to demonstrate safe lifting of the all machinery and equipment in and out of the shaft, the casing pipe into pit and removal of materials from pit.

5.6 General Earthworks

General earthworks requirements shall conform to the requirements of Unitywater's Specification for Civil and Earth Works (Pr9902).

5.7 Pipe Ramming

5.7.1 Excavation

The Contractor shall ensure that the pipe rammer is firmly secured to the pipe to ensure that full and even impact is transmitted to the pipe.

Once the pipe has been rammed into place the pipe rammer is removed, the excavation of the material within the pipe ramming pipe (enveloper) shall be removed until the crossing is completed.

The earth core entering the pipe is usually pushed out, flushed out hydraulically, or drilled out mechanically after having completed the ramming. Pushing out by means of compressed air is only permitted up to an internal diameter of 500mm subject to a suitable risk assessment and supporting mitigation measures.

Once the spoil has been removed installation of the carrier pipe may commence.

5.7.2 Carrier Pipe Installation

Upon completion of the tunnelling works, the Contractor shall undertake carrier pipe installation as a separate operation where required.

Generally, the Contractor shall install the pipes in pretested lengths utilising an excavator, crane or other suitable lifting equipment. The carrier pipe shall be centralised in the bore using casing spacers at a minimum of 1.5 m intervals or as specified by the manufacturer to support the weight of the pipe.

Pipe installation shall be generally carried out using the following procedures:

- Pit/shaft made safe either using shoring box, structural support or by benching and battering;
- Ensure suitable area is available for trench and pipe string;
- Suitable length trench to be excavated on line and level required for installation of pipe;
- Pipe launch cradle to be installed in the pit to assist in pipe alignment;
- Site specific lift plan to be developed prior to pipe installation commencing;
- Pipe to be lifted into trench using suitably sized equipment;
- Casing spacers to be installed onto carrier pipe at manufacturer recommended spacing;
- Pipe to be loaded into casing pipe using suitably sized equipment;
- The pipe is to be tested and accepted in line with Section 6 prior to grouting the carrier pipe in place.

5.7.3 Grouting of Inner Annulus

The Contractor shall provide a grout procedure in advance of any works.

The calculated pour volumes shall be calculated in advance, noted on the ITP and verified with the works being complete. Allowances shall be made for calculated vs actual and site verified to ensure the variation is justifiable at the discretion of Unitywater.

Once the carrier pipe is installed, centred, continuity tested (if required) and hydrostatically tested (if required), the Contractor shall grout the inner annulus of the enveloper pipe.

The grout shall be an approved minimum 1 MPa mix which has been submitted to the Superintendent's Representative for approval.

The mix shall have historical and actual NATA laboratory testing to confirm its suitability.

The grout mix design and pumping equipment shall be suitably matched to ensure complete filling of the annulus without issues onsite.

The gap between the ramming pipe (enveloper) and the carrier pipe will be sealed at each end of the Ramming Pipe. A breather pipe will be installed at each end with the end of the pipe at least 1 m above the lowest obvert of the pipe.

Grouting shall commence from the downhill end of the pipe.

Grout shall be added into the void, under gravity pressure or by pump, through the pipe until grout is visible and bleed water is expelled from the breather pipe at the upper end.

The quantity of injected grout shall be recorded on a concrete pour card and that quantity shall be compared to the calculated theoretical volume.

6 Testing and Commissioning

6.1 Hydrostatic Testing

The Contractor is required to conduct the hydrostatic test of each carrier pipe within the works under the Contract **prior** to grouting operations taking place.

The Contractor shall engage a NATA accredited testing authority to conduct the hydrostatic testing.

The carrier pipe testing must conform to the relevant SEQ Water Supply Code for pressure pipe, or the SEQ Sewerage Code for non-pressure pipe.

6.2 Water Quality Testing

For water mains, the Contractor may be required to conduct water quality testing of each carrier pipe within the works. Water quality testing shall be conducted in accordance with Pr9032 - Procedure for Managing Water Quality During Mains Commissioning.

7 Project Completion and Handover

Throughout the construction of the project the Contractor shall complete and submit all records mentioned in the above sections of this document. In addition to these documents the Contractor shall submit the as-built package in hard copy and electronic format.

The Contractor shall keep records of all trenchless operations, and all such data as directed by the Superintendent. These records will form part of the As-Constructed data. As-Constructed information shall be prepared in accordance with the SEQ WS&S D&C Code – Asset Information Specification.

All records are to be approved by the Superintendent and submitted in accordance with Unitywater specifications listed within the contract documentation.

The Contractor is required to submit as-constructed records in CAD format. The Contractor must also submit Red Line Drawings detailing all relevant as-built records. All submitted records are to be approved by the Superintendent's Representative.

7.1 Documentation Submittals

The Contractor shall liaise closely with the Superintendent during the documentation of survey work and shall provide the Superintendent with adequate opportunity to verify any measurement or detail the Contractor considers necessary prior to the commencement of reinstatement operations.

7.2 Post-Construction Dilapidation Report

The Contractor is responsible for all pre-construction and post-construction property assessments. These assessments shall be a means of determining whether, and to what extent, damage has resulted from the Contractor's operations during the Works.

8 Typical Pipe Ramming Inspection and Test Plan (ITP)

The Contractor shall prepare and submit for approval by the Principal at least four (4) weeks (or at the timeframe nominated within the Project Scope of Works) prior to the commencement of auger boring works, an Inspection and Test Plan (ITP) for the works in accordance with the requirements of the relevant specifications.

Table 6 below details the typical activities that trigger a visual inspection, witness point verification or hold point release. This list is to be used as a minimum guide for the Contractor to develop their ITP.

The Contractor must provide the Principal at least 8 hrs notice (or at the timeframe nominated within the Project Scope of Works) of a required visual inspection, witness point verification or hold point release.

Table 6 - Inspection and Test Plan

		Contractor Responsibilities			Principal Responsibilities		
Project Elements	Activity	Visual	Witness	Hold	Visual	Witness	Hold
Project Documentation	Company HSEQ System Project Safety Plan	☐	☐	☒	☐	☐	☒
	Project Safety Plan	☐	☐	☒	☐	☐	☒
	Project Environmental Plan	☐	☐	☒	☐	☐	☒
	Project Quality Plan	☐	☐	☒	☐	☐	☒
	Site Establishment Plan	☐	☐	☒	☐	☐	☒
	Settlement Plan	☐	☐	☒	☐	☐	☒
	Pipe Ramming design – Coordinated with permanent works design	☐	☐	☒	☐	☐	☒
	Pipe Ramming Procedure	☐	☐	☒	☐	☐	☒
	Pipe Installation Procedure	☐	☐	☒	☐	☐	☒
	Grouting Procedure	☐	☐	☒	☐	☐	☒
	Lift Plans (Pipe Ramming Equipment, Pipes)	☐	☐	☒	☐	☐	☒
	Commissioning Procedure	☐	☐	☒	☐	☐	☒
Design Documentation	Crane Pad	☐	☐	☒	☐	☐	☒
	Pit / Shaft	☐	☐	☒	☐	☐	☒
	Restraint / Reaction Frame	☐	☐	☒	☐	☐	☒
	Pipe Ramming Equipment (Available ramming force, alignment Methodology)	☐	☐	☒	☐	☐	☒
	Settlement / heave Calculations	☐	☐	☒	☐	☐	☒
Project Execution	Site Set Up To Plan	☐	☒	☐	☒	☐	☐
	Crane / Excavator Pad Installation To Design	☐	☒	☐	☒	☐	☐
	Shaft Mark Out To Design	☐	☒	☐	☒	☐	☐
	Shaft Built To Design	☐	☒	☐	☐	☒	☐

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		Contractor Responsibilities			Principal Responsibilities		
Project Elements	Activity	Visual	Witness	Hold	Visual	Witness	Hold
	Ramming Pipe Built To Design	☒	☐	☐	☐	☐	☒
	Ramming Support Frame Set Out	☐	☐	☒	☐	☒	☐
	Pre-launch survey	☐	☐	☒	☐	☐	☒
	Settlement/Heave Monitoring and Review	☐	☐	☒	☐	☒	☐
	Pipe Ramming Equipment Commissioning (mechanical, electrical and pneumatics)	☐	☐	☒	☐	☒	☐
	Pipe Ramming Equipment and Ramming Pipe Alignment Checks	☐	☐	☒	☐	☐	☒
	Ongoing Ramming Forces	☒	☐	☐	☐	☐	☐
	Ongoing Pipe Ramming Alignment Checks	☐	☒	☐	☐	☐	☐
	Annulus Grouting Setup Checks	☐	☐	☒	☐	☒	☐
	Ramming Pipe Internal Clean	☐	☐	☒	☐	☐	☒
	Carrier Pipe Installation	☐	☐	☒	☐	☐	☒
	Carrier Pipe Grouting Records	☐	☐	☒	☐	☐	☒
Commissioning and Hand Over	Hydrostatic Testing (if required, NATA)	☐	☐	☒	☐	☐	☒
	Leakage Testing (if required, NATA)	☐	☐	☒	☐	☐	☒
	CCTV Inspection if Required	☐	☐	☒	☐	☐	☒
	Red Line Drawing	☐	☐	☒	☐	☐	☒
	As Built Survey	☐	☐	☒	☐	☐	☒
	Submission of all Project Records	☐	☐	☒	☐	☐	☒

Appendices

Appendix A – Definitions, Acronyms Abbreviations

The following definitions, abbreviations and acronyms are used throughout this specification.

Definitions

Term	Definition
Act	The Work Health and Safety Act 2011 (QLD)
Carrier Pipe	A pipe installed for the conveyance of water, gas, sewage, and other products and services. In pipe rammed installations it is usually installed inside an enveloper (ramming) pipe.
Contract	The legally binding agreement between two or more parties for doing or not doing something specified.
Contractor	An organisation that is bound to carry out and complete the works under the Contract.
Contingency Plan	A plan to mitigate the risk of an activity. The plan usually allows for backup procedures, emergency response and post-disaster recovery.
Drawings	Drawings prepared by the Designer(s) for the purpose of illustrating the design requirements for the works under the Contract.
Designer	A professional engineer (RPEQ) who is appointed by the Contractor to carry out design and to issue instructions regarding standards, specifications and techniques to be observed in the construction of this project.
Design Documentation	Drawings, specifications and other design documentation (including design standards, design or durability reports and calculations) in computer readable and written forms prepared by the Designer for the purposes of the Trenchless works under the Contract.
Enveloper Pipe (Ramming Pipe)	Pipe installed by pipe ramming to house the carrier pipe.
Geotechnical Baseline Report (GBR)	The GBR describes the ‘Ground Reference Conditions’ at the location (alignment as shown in the GBR) of the proposed alignment. The Baseline Conditions presented in GBR represent what is assumed to be encountered for the purpose of defining ‘indications of the Contract’. The provision of a baseline in the Contract is not a warranty that the baseline conditions will, in fact, be encountered. It is therefore not appropriate for the Principal or Contractor to conclude that baseline statements are warranties.

Term	Definition
Geotechnical Data Report (GDR)	The GDR describes the factual ground conditions at the locations nominated in the GDR. Typically these are close to the proposed trenchless alignment. The conditions presented in the GDR represent what observed during field investigations by the suitably experienced geotechnical engineer engaged by the principal. The provision of this information is not a warranty that the conditions will, in fact, be encountered. It is therefore not appropriate for the Principal or Contractor to conclude that the geotechnical statements made are warranties.
Launch pit or shaft	An excavation at the commencement point of a rammed section of pipeline, in which the ramming structure and other equipment is installed and from which the pipe ramming operations are carried out.
Lift (shaft/pit)	The incremental construction height completed as the shaft/pit progresses downward.
Operator	Suitably trained or qualified person who operates machinery, an instrument or other equipment.
Permit	A document that controls an activity that is considered high and not able to be commenced without completing important requirements.
Pipe Ramming	Non-steerable method of forming a bore by driving a steel casing, usually open-ended, with a percussive hammer from a drive pit. The soil may be removed by augering, jetting or compressed air. In appropriate ground conditions a closed casing may be used.
Principal	For infrastructure being delivered as Unitywater funded and managed projects, **Unitywater.** For developer donated infrastructure being delivered under an approval issued by Unitywater Development Services, the **Developer's Principal Consulting Engineer** (RPEQ, suitably qualified and experienced).
Principal Drawings	Drawings issued to the Contractor forming part of the Contract. These drawings are owned by the Principal and are to be used to guide or govern the work under the contract.
Project Manager	A person nominated by the Contractor responsible for the construction of the contract.
Ramming Support Frame	A frame designed to carry the weight of the pipe rammer. Generally only required for large installations.
Recoil Straps	A safety device to limit the recoil movement of the pipe rammer. Rated chains, slings or fabric straps should be used in line with good rigging practice. These shall be sized appropriately using the pipe rammer manufacturer's data, or project specific engineers calculations.
Red Line Drawings	Original, as constructed drawings marked up in red detailing the as-built data.

Term	Definition
Safe Work Method Statement	A document summarising the work required for an activity. This document summarises the hazards and the required measures to control minimise safety risk.
Scope of Work	A document summarising the works to be completed under the Contract.
Specification	This document, that specifies, in a complete, verifiable manner, the requirements, design, behaviour or other characteristics of a system, component, product, result, or service and often, the procedures for determining whether these provisions have been satisfied.
Superintendent	An individual appointed by the Principal to perform two functions: Be the Principal's agent for the works under the Contract. Administer the Contract fairly and perform certain certifier requirements.
Superintendent's Representative	A person nominated by the Superintendent to act on behalf of the Superintendent
Trenchless Construction	Installation of new or replacement of underground infrastructure with minimal disruption to surface environment, traffic, business and other activities.

Abbreviations and Acronyms

Acronym	Description
ASTT	Australasian Society for Trenchless Technology
AS/NZS	Australian / New Zealand Standard
ASS	Acid Sulphate Soils
AS	Australian Standard
CCTV	Closed Circuit Television
BYDA	Before You Dig Australia https://www.byda.com.au/ (Important: Department of Transport and Main Roads and Queensland Rail are not members of BYDA)
GBR	Geotechnical Baseline Report
GDR	Geotechnical Data Report
GRP	Glass Reinforced Plastic
HDPE	High Density Polyethylene Pipe
ID	Inside Diameter
IFC	Issued for Construction
ISO	International Standards Organisation

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Acronym	Description
ITP	Inspection and Test Plan
NATA	National Association of Testing Authorities
N/A	Not Applicable
OD	Outside Diameter
QA	Quality Assurance
RPEQ	Registered Professional Engineer Queensland

Appendix B – References

General

All work carried out under this Specification shall comply in all aspects (i.e. in design, construction, testing and performance) with the latest relevant Australian (AS), British (BS) and IEC Standards and standards in the following sections.

Reference to specific clauses of the various codes is intended to highlight those points and shall not be taken to imply a lesser importance for all other applicable clauses.

All the works shall conform to the Rules and Regulations of the Statutory Authorities having jurisdiction over the Site.

If the requirements of this Specification do not comply with the minimum requirements of the statutory regulations and standards, the latter shall apply. If the requirements of this Specification are more exacting than the minimum requirements of the statutory regulations and standards, the former shall apply.

All Materials, fittings, accessories and equipment supplied by the Contractor shall be new and the best obtainable of their kind and shall comply in all respects with the requirements of the relevant Standards Australia specifications.

All works shall be completed in accordance with this Specification, the Job Specification and stated supplementary specifications.

The Contractor shall undertake his own assessment as to the type of material to be excavated and sub-surface conditions and shall allow for any dewatering, timber shuttering and shoring that may be required.

Unless otherwise specified, the equipment covered by this Specification shall be designed, manufactured, installed and tested in accordance with the following, listed in order of precedence:

- The Project Contract documents;
- Requirements of the Statutory Authorities having jurisdiction over all or part of the manufacture, installation or operation of the plant;
- The SEQ WS&S D&C Code;
- All relevant Australian and governing Queensland standards where applicable;
- Water Services Australia (WSAA) national codes.

In the absence of relevant SEQ WS&S D&C Code, WSAA or Australian codes or standards, relevant industry, international (ISO), European or British standards shall be followed. International standards shall take precedence over European or British standards. The Contractor shall obtain approval from the Superintendent prior to using any non-Australian standards not nominated in the equipment specifications, schedules, datasheets or associated drawings.

Where local or international standards do not exist, the manufacture and installation of equipment shall be in full compliance with the manufacturer's own recognised standards. Manufacturer's standards, where used, shall be submitted to the Superintendent by the Contractor for review and acceptance shall be obtained by the Contractor from the Superintendent prior to commencement of manufacture.

All equipment shall comply with relevant Federal and State Acts, Regulations and Codes including, but not necessarily limited to, the following:

- *Work Health and Safety Act 2011* (Qld);
- *Work Health and Safety Regulation 2011* (Qld);
- Work Health and Safety Queensland Codes of Practice.

The version of any applicable standard or regulation shall be the revision in place at the date of invitation of contract packages.

The Contractor shall have in place a dedicated quality system that conforms to ISO 9001.

Quality control procedures for management, inspection, review and evaluation of all materials, manufacture, workmanship and testing of all products shall be planned and implemented by appropriately skilled and qualified persons to ensure that requirements of the quality procedures are met and that high quality is maintained.

The Contractor shall ensure that all equipment supplied/installed under this Specification is the product of a manufacturer who is fully experienced, reputable, qualified and regularly engaged for at least five years in the manufacture of the equipment to be supplied/installed.

Applicable Legislation and Regulation

At least the following legislation and related regulation shall apply:

a. *Work Health and Safety Act 2011* (Qld);

b. *Work Health and Safety Regulation 2011* (Qld);

c. *Water Supply (Safety and Reliability) Act 2008* (Qld);

d. *Environmental Protection Act 1994* (Qld);

e. *Queensland Building and Construction Commission Act 1991* (Qld);

f. *Professional Engineers Act 2002* (Qld).

Codes of Practice (ratified by Legislation)

SEQ Water Supply and Sewerage Design and Construction Code

The requirements of the South East Queensland Water Supply and Sewerage Design and Construction Code (SEQ WS & S D & C Code) shall supersede the requirements of this specification where advised in the Job Specification. In this case the requirements of this specification shall only apply where no requirement is provided in the SEQ WS & S D & C Code.

If the Job Specification does not reference SEQ WS & S D & C Code, the requirements of SEQ WS & S D & C Code shall apply where no requirements are stated in this specification.

Other Codes of Practice that apply to works carried out under this Specifications are:

a. Workplace Health and Safety Queensland Code of Practice, *Managing noise and preventing hearing loss at work* 2021;

b. Workplace Health and Safety Queensland, *Confined Space Code of Practice* 2021;

c. Workplace Health and Safety Queensland, *Scaffolding Code of Practice* 2021.

Codes of Practice (not ratified by Legislation) and Industry Guidelines

The following Codes of Practice and industry guidelines apply to works carried out under this Specification:

a. Safe Work Australia, *Guide for Tunnelling Work* (November 2013);

b. Australasian Society for Trenchless Technology, *Guidelines for Horizontal Directional Drilling, Pipe Bursting, Microtunnelling and Pipe Jacking* (Rev 1, February 2010);

c. Pipe Jacking Association (UK*), Guide to Best Practice for the Installation of Pipe jacks and Microtunnels* (1995).

Unitywater Technical Specifications

This Specification makes reference to a number of Unitywater's technical specifications, including but not limited to the following:

Specification #	Title
Pr9032	Procedure for Managing Water Quality During Mains Commissioning
Pr9085	Pressure Testing of Sewer Rising and Gravity Mains Work Instruction
Pr9087	Pressure Testing of Water Mains Work Instruction
Pr9693	Specification for Mechanical Installations
Pr9825	Specification for Shafts
Pr9875	Specification for Non Pressure Pipe Construction
Pr9902	Specification for Civil and Earth Works
Pr9903	Specification for Building and Structural Works
Pr9904	Specification for Pressure Pipe Construction
Pr9380	Specification for Electrical Installations at Network Sites