Code of Practice for Commissioning

No. COP-03

Ver. 1.1

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Revision	Description	Released by	Date
0.1	First draft	J de Villiers	16/08/2016
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Rev. 1
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Summary of changes

Version	Section	Description of revision
1.1	3.2	Electrical certificate of conformity correction
	14	Addition of thermal testing for pumps and blower cable terminals

Table of contents

Abbreviations

CAR	Change Authority Request for control systems
CSRP	Change to system risk profile
DCS	Distributed control system
ERMA	Enterprise risk management academy
FAT	Factory acceptance testing
FD	Functional description
IP	Ingress protection
I/O	Input/output
MCC	Motor control centre
P&ID	Piping and instrumentation diagram
SAT	Site acceptance testing
SIT	Site integration testing
QA	Quality assurance
QC	Quality control

1. Introduction

This code of practice provides guidance and the tools for commissioning of electrical, process and mechanical plant. Commissioning is the process of bringing equipment and systems into operation. Whilst testing and certification is required through the construction and installation process, this is not adequate to demonstrate that the infrastructure will operate as intended. The commissioning process validates the operation against design parameters and is used to complete the configuration before it is handed over to Watercare for operation.

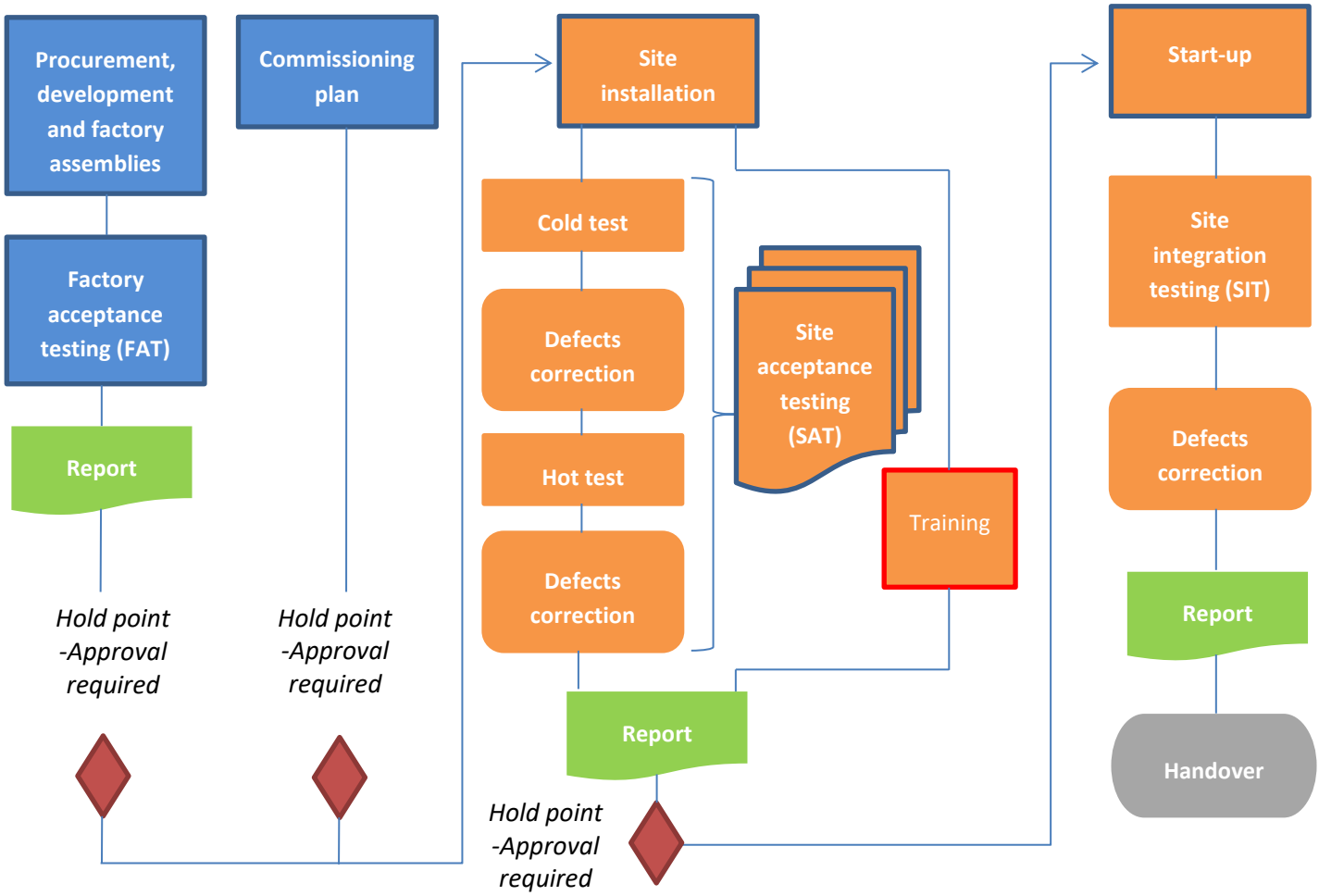
The code highlights the processes and staging of activities, roles and responsibilities. A number of templates are included in Section 14 with minimum fields for completion during commissioning. These templates can be added to as required for a specific project.

None of the tools are intended to replace quality assurance processes or any other requirements that are required from other Watercare standards, or the project specific requirements.

This guide is to highlight key considerations and provide a consistent approach to produce commissioning plans.

2. Commissioning framework

The following framework demonstrates the high level stages of commissioning. The stages can be expanded on in a specific commissioning plan to suit the project requirements.



3. Commissioning plan

3.1 General

The commissioning plan is the covering strategy document that describes actions, roles and responsibilities, the commissioning programme and risk mitigation measures.

The commissioning plan is a live document that requires updating as the site conditions evolve during the installation. These changes may affect the commissioning procedures.

The content of this document should include:

- Commissioning scope
- Confirmation of standard testing requirements from Watercare construction standards
- Commissioning objectives and performance requirements set by the designer and/or contract
- Operational protocols and procedures
- Integration procedures to integrate new system with the existing system to minimise impact
- Risk assessment and mitigation strategies
- Site health and safety requirements such as exit plans, environmental controls and emergency contact
- Identify specific skill requirements, resources or temporary plant
- Provide logical sequencing of work that considers interfaces and constraints
- Effects on adjoining processes
- Identify the level of testing at the various stages of commissioning

3.2 Commissioning pre-requisites

The prerequisites that are required before the specific plant commissioning can take place may include, but are not limited to:

- Construction QA and QC certificates
- Load test certificates
- Calibration certificates
- Building certificate of compliance
- Producer statements
- ERMA certificate
- Vessel certificates
- Electrical Certificate of Compliance
- MCC, switchboard and DCS cabinet FAT test and inspection report
- Any equipment off site test reports and certificates
- Manufacturers factory test certificates and / or third party witness test certificates for components
- Maintenance schedules
- Resource consents in place

4. Risk management

Risk shall be reviewed on a suitable frequency and the register updated accordingly.

4.1 Risk assessment

Risk assessment shall be completed before commissioning work starts. The risk assessment needs to document commissioning risks and mitigation measures based on the commissioning plan and the proposed work methodologies. Any changes to the risk assessment or methodologies must be updated.

4.2 Change to System Risk Profile (CSRP)

Work affecting any existing plant, process or piping systems must be identified and a CSRP completed. The CSRP must be approved by Watercare before the work is started.

5. Roles and responsibilities

The roles and responsibilities of persons forming the commissioning team needs to be detailed at an individual level for each commissioning stage.

Each task shall have an owner, a description of the task with a step-by-step schedule, the desired outcome or measurement and the schedule by which the task must start and end.

Persons selected for a task shall be suitably qualified and experienced to complete the task.

5.1 Watercare and commissioning team responsibilities

The following sections list possible team members. The members of the team may be included as necessary for the complexity of the commissioning work. This assessment must be made with Watercare based on:

- Contractor team experience
- Consultant team experience
- Risk to existing Watercare infrastructure

5.1.1 Watercare project delivery lead

The Watercare project delivery lead has overall responsibility for the delivery of the project and liaises with the Service Delivery area manager on progress of the project and the Watercare commissioning engineer on implementation of the commissioning plan.

5.1.2 Watercare Service Delivery area manager

The Watercare service delivery area manager has overall responsibility for the plant and provides approval for the work to proceed and final acceptance once commissioning is complete.

5.1.3 Watercare commissioning engineer

The Watercare commissioning engineer leads the Watercare commissioning team. The commissioning engineer is responsible for the commissioning process and provides an interface between the contractor, consultant, discipline leads and Watercare Service Delivery. The commissioning engineer has the following responsibilities:

- Review and approval of the commissioning plan
- Liaison with the contractor, suppliers, the discipline leads and the Watercare Service Delivery staff
- Review of commissioning methodologies
- Sign off of inspected items and associated forms
- Run risk assessments on the contractor's commissioning plan and the commissioning methodologies with relevant personnel

- Arrange for review of any operational work plans associated with the commissioning activities by the operations controller
- Coordination and direction of discipline leads for witness testing and document reviews
- Coordination with software lead
- Participation in control system FAT
- Witness control system SAT
- Ensure up to date red-line mark-up documentation is available to Service Delivery staff throughout works
- Review training and training manuals in advance of a new or upgrade system coming into operation
- Assist with the implementation of isolations
- On call support for the newly operational plant and equipment
- Approval of process commissioning report.

5.1.4 Watercare site engineer

The Watercare site engineer works with the Watercare commissioning engineer throughout the commissioning process to ensure that construction related activities are prioritised to facilitate commissioning. The site engineer will also provide an additional interface between the contractor and Watercare Service Delivery with the following responsibilities:

- Liaison with the contractor, suppliers, the discipline leads and the Watercare Service Delivery staff
- Prioritisation of snag lists and ensuring priority items are completed
- Review of commissioning methodologies
- Sign off of inspected items and associated forms
- Participation in risk assessments
- Assist with the implementation of isolations
- Development of the defects list during commissioning
- Review the training documentation
- On call support for the newly operational plant and equipment
- Assist Watercare commissioning engineer.

5.1.5 Watercare operations controller

The Watercare operations controller liaises with the Watercare commissioning engineer to ensure operation of existing systems are not compromised by the commissioning activities. The operations controller is also responsible for carrying out isolations, or in the case of electrical works making sure that isolations are understood and applied in a timely manner. The responsibilities of the operations controller include:

- Participation in control system FAT
- Review of commissioning methodologies
- Review of operational work plans
- Participation in risk assessments
- Development of shutdown plans
- Implementation of isolations.

5.1.6 Watercare site Service Delivery team

The site Service Delivery team shall be informed during all stages of commissioning. The site service delivery team will be involved in a number of commissioning related activities that includes:

- Review and implementation of operational work plans to support commissioning activities
- Input into commissioning methodologies

- Participation in commissioning activity risk assessments
- Support and implementation of isolations required for commissioning

5.1.7 Watercare discipline leads

The discipline leads i.e. electrical and control, works in support of the Watercare commissioning engineer to ensure the work plans are completed and the inspection and test plan is completed. The responsibilities of the discipline leads include:

- Review of contractor work plans including inspection and test plans and check-sheets
- Participation in risk assessments for work plan and commissioning activities
- Inspection of the works prior to testing and compilation of snag lists
- Witnessing appropriate parts of the contractors testing and accepting the successful result on Watercare's behalf
- Recommending sign-off of areas to proceed to hot commissioning to the Watercare commissioning engineer.

5.1.8 Software team

The software team is responsible for the production of:

- Level 2 FD,
- Developing the software,
- Software FAT and associated documentation
- CAR form
- Software SAT
- Software commissioning documentation
- As-built of the level 1 FD.

5.1.9 Contractor

The contractor is responsible for preparing the work plans covering the inspection, testing and commissioning of all the civil, mechanical and electrical work but excluding software FAT and software SAT and software commissioning activities.

Loop testing and I/O commissioning is the responsibility of the contractor but requires interface with the software team. A protocol for these tests needs to be agreed between the contractor and Watercare with regards to timing, responsibilities and scope of this testing. The steps involved are listed below:

- Mechanical/electrical installation complete as far as possible, valves, cells exercised locally etc.
- Point to point testing completed and I/O terminated at DCS card
- Span of instruments setup, calibrated etc. where possible (i.e. with local display)
- Commissioning documentation completed as far as possible (E.g. schedules red-line mark ups)
- I/O enabled at the card by the Software Team
- Blocks of equipment shall be ready to be tested as a set
- Discrete loops - all components of the loop are exercised and checked (hardware/wiring/DCS) by operating equipment from the DCS where it is safe to do so (in conjunction with Watercare)
- Analogue loops - Injection testing to be performed, span match at instrument and DCS level confirmed
- Loop is checked and if functional signed off
- For issues that cannot be resolved quickly on the spot, the I/O shall be disabled and troubleshooting shall take place separately either in the DCS or in the field

- If it is a quick change i.e. adjusting a proximity switch or adjusting a software reference this will be done at the same time to complete the overall loop check
- Submit completed work plan and pre commissioning documentation

5.1.10 Consultants

The consultant commissioning representative reports to the Watercare commissioning engineer and Watercare site engineer. The consultant must ensure that commissioning, work plans, inspections and test plans are completed to meet the design performance requirements. The responsibilities of the consultant commissioning representative include:

- Review of contractor work plans including inspection and test plans and check sheets
- Inspection of the works prior and during testing
- Review commissioning methodologies and confirm performance testing plan for use in the commissioning report
- Provide technical support during all commissioning stages
- Collect documentation and data from all parties for the development of the commissioning report
- Complete the commissioning report

5.1.11 Specialist suppliers

Specialist product suppliers must be identified and are responsible for supervising the installation, orientation, testing and commissioning of their equipment. The supplier representative will liaise with the Watercare commissioning engineer on all commissioning matters.

The supplier must provide training for personnel as part of the commissioning process.

6. Inspections and audits

Inspection and audits should comprise of the following check items for commissioning:

- Confirmation of correct make, model, etc. of the equipment specified
- Confirmation installation location and detail requirements as per the design
- Ensure safe operability
- Performance outcome as desired and correct functionality

Watercare's general construction standard lists a number of minimum quality control checks and tests during construction. These quality checks must be completed prior to commissioning.

7. Factory acceptance testing

Factory acceptance testing (FAT) is typically required where the automation or process software is complex or has redundancy measures build into the logic.

Test cases shall be based on the design functional description. The FAT checks as far as possible that:

- Equipment and components are in accordance with the specification
- Input and output connections are in accordance with the drawings
- Equipment is calibrated
- Trip points, alarms and diagnostic outputs are responsive
- Behaviour and actions are as expected from input and outputs

- Operator functions, bypass and manual overrides operate as required

Any changes or modifications shall be subject to safety analysis and impact assessment. Re-testing of the equipment or programmed behaviour needs to be completed for the impacted functionalities.

The test results are reported to identify which objectives had been met or not. Any discovered problems during the test shall be recorded and the actions taken to correct the failures documented.

8. Site installation

The equipment is installed on site in accordance with the general and specific requirements prior to commissioning. The quality assurance programme is followed with the necessary quality control points signed-off.

9. Site acceptance testing

The entire new installation is tested on site to demonstrate that the logical integrity and physical reactions complies with the design requirements. Site acceptance testing may include both cold testing and hot testing, but should at a minimum be conducted as a hot test. Any deficiencies are resolved and retested.

Training for the operators on the actual equipment shall be provided during the site acceptance phase in preparation for the site integration testing and operation handover.

Site acceptance testing should include completion of:

- Finishing visual checks
- Input and output signals tested
- Equipment calibration verified
- Trip points and alarms set
- Behaviour and actions verified
- Operator functions, bypass and manual overrides verified

9.1 Visual check guidelines

The following checks serves as guidelines only, but may be used to populate the installation specific visual checks. Also refer to the Watercare civil and mechanical construction standards for the minimum quality assurance and control check sheets.

Pipework, valves and piping instruments	
Installation complete and undamaged	
Installation conform to the piping and instrumentation diagram	
Correct material type used	
Pressure rating as required on all components	
Correct diameter	
All joints fitted with gaskets/O-rings/seals	
All joints must be tight with all bolts fitted	
All the required supports are in place and the appropriate restraints applied	

Pipework, valves and piping instruments	
Confirmation of any expansion joints fitted correctly and in the designated location	
Couplings are restrained as required	
Confirm correct orientation of components	
All components are clearly identified and labelled	
Coatings finished to specification	
Paperwork in order i.e. certificates of conformity, FAT, etc.	

Mechanical equipment	
Equipment is complete and to specification	
Confirm equipment appears undamaged	
All transit packaging is removed	
Baseplates and fixings are secure	
Fastenings are correct and tight	
Restraints are in place	
All gaskets/O-rings/seals are in place	
Confirm correct orientation of components and direction of movement	
Moving parts are free to operate	
Alignment complete	
Vents and valves clear for operation	
Any oil reservoirs are to the correct level	
Mechanical interlocks free to operate and in place	
Guards are in place and secure	
Any special tools (where required) are available	
All components are clearly identified and labelled	
Coatings finished to specification	
Paperwork in order i.e. certificates of conformity, FAT, etc.	

Instrumentation	
Model make and features are to specification – suitable for are operation i.e. Hazardous areas	
All transit packaging is removed	
Confirm installation is correct to the piping and instrumentation diagram; location is as specified	
Confirm instruments appears undamaged	
Fastenings are correct and tight	
Accessible to view, maintain and replaceable	
All gaskets/O-rings/seals are in place with correct IP rating	

Instrumentation	
Confirm correct state, orientation of components and direction	
Instrument clear to operate i.e. ultrasonic view or free motion of level switch, etc.	
All components are clearly identified and labelled	
Coatings finished to specification	
Paperwork in order i.e. certificates of conformity, FAT, etc.	

Electrical	
Cable trays and cables are secure	
Complete random cable isolation tests	
Earthing installed as specified	
Cable glands are installed on all cables	
Cables are identified and labelled	
Conduits are secure and cable entries sealed	
Bending radius not exceeded	
Suitable separation between electrical and control cabling	
Control boxes and distribution boards are secure and correctly fixed	
Control boxes and distribution board enclosures are undamaged	
Enclosures are condensation free	
IP ratings are as specified	
Terminals checked for tightness	
Shrouds barriers and blanks fitted	
Installation is neat and tidy	
Enclosures, switches lights, etc. are labelled	
Switchgear oil level checked	
Mechanical operation of all switches , lockouts, position locks etc. operate freely	
Paperwork in order i.e. certificates of conformity, FAT, ESC, etc.	

9.2 Cold testing

The cold test is conducted with the installation complete but without fluid or media. This test may limit some applications where instrumentation or plant cannot be run dry.

9.3 Hot testing

The hot test is conducted with the installation complete but not connected or interacting with existing processes and often with a safe substitute fluid replacement such as air or water. Where an installation may be expected to receive or provide signal outputs these are to be verified off-line.

9.4 Training

Training shall be conducted in a planned manner identifying specific operator tasks and fault finding procedures. A training register shall be used to confirm that the persons responsible for operating the plant has been assessed as competent for safe operation once the system is handed over to Watercare.

Documentation required for training will include the necessary operating manuals of the equipment and standard operating procedures. It is expected that these may require updating as the installation is fine-tuned during the testing procedures.

10. Start-up

The system is placed into full operation and taken over for owner operation

10.1 Site integration testing

The site integration testing occurs over an agreed timeframe. During this timeframe the installation is monitored against the expected performance and to ensure that the process integrity is sustainable. Typical checks and actions include:

- Validate interaction of test points with exiting systems that could not be physically connected during site acceptance testing
- Monitoring performance as environmental conditions change
- Evaluate responses as operational conditions fluctuate
- Monitor trends and data feedback integrity
- Monitor operational interaction
- Close out problems and defects

11. Hold points

Hold points are the critical sign-off points required from Watercare before the commissioning process can continue onto the next phase.

The minimum hold points should include:

- Acceptance of the commissioning plan
- Factory acceptance testing of all componentry and software prior to site installation
- Before integrating into any existing live systems and on completion of the site acceptance testing

12. Audit and reporting

Reporting shall identify the tests that have been performed, a summary of the reaction and any actions taken to correct incorrect outcomes. Each correction shall confirm if the defect has been successfully resolved. The typical reports during the commissioning phases are:

- On completion of the FAT to document the successful completion of the testing
- On completion of the SAT to document the successful completion of the testing
- On completion of the SIT to document the completion of the commissioning work

The audit path is illustrated below:

Commissioning Plan				
Phase checks		A	B	C
1	Resources			
2	Temporary plant			
3	Constraints			
4	Risk assessment			
5	Protocols and procedures			
6	Acceptance criteria			
7	FAT			
8	Cold test			
9	Hot test			
10	Training			
11	SAT			
12	Handover			
Status			**Date**	**Rev**
Phase A – Planning				
Phase B – Installation				
Phase C - Start-up				

O&M Manual				
Section		Phase A	Phase B	Phase C
1	Operations			
2	Hazards and controls			
3	Maintenance			
4	Equipment lists			
5	Control system			
6	Testing and commissioning records			
7	Equipment data			
8	Consents			
9	Drawings			

Standard operating procedures (SoP)			
Section / Area		Draft	Final
1			
2			
3			

Training				
Section / Area		Plan	Attendance Register	Operator Assessed
1				
2				
3				

Plant in operation	
1	Draft O&M
2	Draft SoP
3	Training complete
4	Defects under correction
5	FAT complete
6	SAT hot test

Defects list			
		Version	Closeout
1	Phase A		
2	Phase B		
3	Phase C		

Risk assessment									
Risk title		Commissioning Phase	Probability	Cause	Consequence	Risk treatment / Control actions	Contingencies	Risk owner	
1									
2									

Test documentation			
		Due	End
1	Test tasks and logs		
2	Test certificates		
3	Change logs		

Test detail requirements			
Details for:		Draft	Final
1	Factory tests of equipment		
2	Process tests		
3	Cold testing		
4	Hot testing		
5	Performance testing		

Programme			
		Due	End
1	Outline strategy		
2	Test specifications		
3	Test schedules		
4	Risk mitigation		
5	Training		

Reports			
		Due	End
1	Factory acceptance report		
2	Site acceptance report		
3	Site integration report		

Handover	
1	Training complete
	Final O&M
	Final SoP
	Final As-builts
	All defects closed out
	Sign-off

13. Decommissioning of equipment

Decommissioning of redundant equipment will generally be undertaken at the end of the project except where the space is required for the newly upgraded plant.

The items to be decommissioned need to be identified prior to starting any work. The process for decommissioning shall be as follows:

- Identify and clearly mark equipment to be decommissioned in the field
- Isolate equipment mechanically and process-wise in the field
- Up-date I/O schedules to show the signals to be removed
- Decommission the I/O one at a time
- When all I/O are removed, isolate equipment electrically in the field
- Remove redundant software and confirm there are no unresolved references
- Physical removal of the equipment and ensure the site is safe

14. Templates

The following templates can be used or modified and expanded to suit the installation requirements:

Template	***No.***
• Commissioning plan	
• Test plan	
• Test schedule	S-01
• Test specification	
• Commissioning log	
• Defects list	
• Training register	
• Control system end of day checklist	S-02
• Test certificates - configuration:	
○ Pipework	C-01
○ Valves, penstocks and actuators	C-02
○ General electrical	C-03
○ Calibration – flow/speed/mass	C-04
○ Level	C-05
○ Instrument installation	C-06
○ Instrument setup	C-07
○ Instrument loop calibration	C-08
○ PLC I/O tests	C-09
○ PLC Analogue test	C-10
○ Variable speed drives	C-11
• Test certificates - functionality:	
○ Leakage test	F-01
○ Valves, penstocks and actuators	F-02
○ Pumps and blowers	F-03
○ Chemical dosing control	F-04
○ Process control set values	F-05
○ PLC variables	F-06

- SCADA Analogue test F-07
- Interface test F-08

Commissioning Plan (Template)

1. Introduction

[Description of the project]

2. Commissioning objectives

[Describe the commissioning philosophy, purpose and output requirements. Include any decommissioning requirements and identify how the staging and interaction will happen]

3. Commissioning scope/Systems to be commissioned

[List of systems to be commissioned and the inter system connectivity]

4. Commissioning team

[Tabulate team members, their roles, title and contact details]

Role	Company	Name	Title	Contact number		Email address
				Working hours	After hours	
[Project delivery lead, etc.]	[Watercare, etc.]	[Joe Blogs]	[Project manager, etc.]	[0211234567]	[1234567]	[j.blogs@email.nz]

4.1 Roles and responsibilities

[Describe the responsibilities of the roles listed. See section 5.1 for typical expectation]

4.2 Special resources

[Create a list/table of other additional resources that may be required]

Resource description	Used for	Commissioning activity	Responsibility	Schedule number
[exmpl. 12 tonne crane]	[exmpl. Lifting chamber cover]	[exmpl. Valve actuators in inlet structure]	[exmpl. Contractor X]	[exmpl. #8]

4.3 Communications plan

[Identify daily communications such as end-of day handover or shift-change procedures, meeting frequency, notification processes and the like]

5. Health and Safety and Environmental planning

[Identify site specific management of activities that impact on the environment, such as flushing of chlorinated lines. Identify the specific PPE requirements, procedures such as confined spaces entry and actions such emergencies or measures of handling]

6. Activity plan

6.1 Isolation plan

[Identify isolations that are required and the process to be followed to allow the isolations to be made]

6.2 Factory acceptance testing

[Identify factory acceptance tests that must be complete before cold and hot testing may commence]

6.3 Cold testing

[Activities: what, why, when and how]

6.4 Hot testing

[Activities: what, why, when and how]

6.5 Commissioning schedule

[Schedule produced in MS project]

7. Quality management

[Description of how the quality of the commissioning work will be managed on site]

8. Watercare site specific requirements

8.1 General

[Describe the site conditions, access requirements and processes that may be relevant]

8.2 Existing plant/processes

[Ongoing operations that may be impacted on by the commissioning (must also be considered as part of the risk management process)]

9. Risk management

9.1 Risk register

[Tabulated risks register with risk score, resolution and responsibilities]

9.2 Time for corrections and escalation process

[Identify the agreed period for correcting snags or defects during commissioning and how this will be accommodated in the commissioning schedule. Describe the escalation process to be followed when snags are not resolved on time]

10. Commissioning documentation

Appendix A – Schedules and logs

Appendix B – Configuration tests

Appendix C – Functionality tests

Project Name					Project No.			Test Plan	
Test No.	Test Description	Test Location	Test Supervisor	Test Specification Reference No.	Test Certificate No.	Test date dd-mm-yyyy	Date passed dd-mm-yyyy	Sign-off	Comments

							Test Certificate No.	**S-01**
Project Name				**Project No.**			**Test Schedule**	
Description of system/area:				Plant section:				
Test no.	Test Description	Test date dd-mm-yyyy	Test start time	Test end time	Repeat test	Date passed dd-mm-yyyy	Test responsibility by	Comments

		Test Specification No.	

Test Specification			
Project name		Project No.	
Section of plant			
Equipment under test			
Tag no.			
			Notes
Test Objectives			
Test conditions			
Test sequence and instructions			
Acceptance criteria			

References:	Test specification approval	
Documents:		
	Commissioning Engineer	Site Engineer
Drawings:		
	Date	Date

Commissioning log

Project Name		**Project No.**	
Discipline: *I = Instrumentation M = Mechanical / Process* *E = Electrical S = Software*		**Date:** dd-mm-yyyy	

Log:

Action required (Y/N)		*If yes, append commissioning snag list*	**For action by:**		**Date required** dd-mm-yyyy
Action detail:					

Reference *(List and attach to log)*

Project Name					**Project No.**			**Defects List**	
Description of system/area:					Plant section:				
No.	Sub-area	Description	Date raised dd-mm-yyyy	Responsibility	Due completion dd-mm-yyyy.	Priority	Re-test required Y/N	Test No.	Comments

Training file No.	

Training register

Project name		Project No.	
Equipment / Plant/ section covered by training			

Attendance register

Name	Signature	Name	Signature

Training references material	Training completed	
	Commissioning Engineer	Site Engineer
	Date	Date

		Test Certification No.	S-02

Control System: End-of-day checklist

Project name		Project No.	
Section of plant		Time check completed:	
Description			

	Completed or N/A	Comments
General for all sites		
As-built mark-up and on site		
Software copies on site		
Brief on-call staff on current status and any potential issues		
Migrated tags and status spreadsheet emailed		
Central Control Room phoned: • No alarms showing • Check alarm operation		
DCS or Delta V site specific		
DCS cold start memory downloaded		
Download setup data to propagate graphics changes		
Alarm areas assigned to workstations and remote client session		
RTU/ SCADA site specific		
Central Control Room phoned: • SCADA to RTU communication and alarming is working (test with door open/ intruder) • Correct equipment status is being shown and trended on CCR SCADA • For all un-commissioned equipment and active alarms signals an explanation note has been added on the SCADA		
Current controller software / radio /config copies in QVCS source control and email to cservicedesk@water.co.nz		

Remarks / instructions:	End-of-day sign-off	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-01**
Test specification No.	

Pipework

Project name		Project No.	
Line function description			
Line No.			
Material type and pressure rating			

No.	Assessment	Checked or N/A	Comments
1	Installation complete		
2	Pipework conforming to P&ID		
3	Joints complete, all bolts installed and tightened		
4	Mechanical and instrumentation correctly installed		
5	Materials comply with specification		
6	Pipe and joint restraints suitably installed		
7	Pipe coating without defects		
8	Correct labels and markers in place		

Drawing references	Configuration test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-02**
Test specification No.	

Valves / Penstocks / Actuators

Project name		Project No.	
Function description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

Setup

No.	Assessment	Checked or N/A	Comments
1	Installation complete as per P&ID and labelled		
2	Confirm correct valve size, rating and type		
3	End of travel switches set correctly		
4	Valve rotation on closing		☐Clockwise ☐Anti-clockwise
5	Valve rotation indicated and correct		
6	Joints complete, all bolts installed and tightened		
7	Coating without defects		
8	Supports in place		
9	Spindle greased		
10	Rinsing spindle protection in place		
11	Valve fully open and close freely		
12	Safe to operate		
Penstock specific			
13	Penstock square without distortion		
14	Correct orientation		
15	Grouting completed		
Actuator specific			
16	Unused cable entries blanked with correct IP rated plug		
17	Earth bonding complete		

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-03**
Test specification No.	

General electrical installation

Project name		Project No.	
Equipment location Tag no.	From:	To:	
Cable or equipment function description			
Line No. / Tag no.		Manufacturer	
Model no.		Manufacturer Serial No	

No.	Assessment	Checked or N/A	Comments
1	Materials comply with specification: Correct size Correct type Glands installed, correct fit and type Cable armouring earthed at both ends Correct phasing Adequate separation from other cables	 ☐ ☐ ☐ ☐ ☐ ☐	
2	Equipment certified, calibration in date		☐Pre-test OK ☐Post –test OK
3	Continuity: Core numbers _____		
4	Insulation resistance: _____ (MΩ)		Voltage: _____ Duration: _____ sec
5	Fault loop impedance:_____ Ω		

Drawing references	Configuration test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-04**
Test specification No.	

Calibration – Flow / Mass / Speed

Project name		Project No.	
Function / equipment description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	
Operating range			
Test medium			
Operating medium details	Product		
	Strength		
	Active component		
	Density (Mass/volume)		

Test / Ref	Speed / volume		Stroke %	Current (amps)	Discharge		Measured rate		Dose		Error %
	Setting	Unit			Pressure	Unit	Value	Unit	Value	Unit	

1. Multiply the active component strength by the flowrate
2. The resultant dose in mass/time is used to convert to actual dose when process flow is taken into consideration
3. Dose (mass/time) = Pump delivery X product strength (active component)
4. Actual dose rate (mg/l) = (Dose (g/l) / Plant flow (l/s))/ 1000

Drawing references	Configuration test completed:	
Attachments: Pump curves and other references	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-05**
Test specification No.	

Level

Project name		Project No.	
Equipment			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

Ref	Set point		Description	Control function	Check
	Value	Unit			

Inputs				Outputs			
Ref	Description	State	Check	Ref	Description	State	Check

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-06**
Test specification No.	

Instrument installation

Project name		Project No.	
Function description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

Setup

No.	Assessment	Checked or N/A	Comments
1	Installation complete as per P&ID and labelled		
2	Confirm correct size, rating and type		
3	Coating without defects		
4	Supports in place		
5	Location safe to view, operate freely and replaceable		
6	Cabling installed and earthed		
7	All transit packaging is removed		
8	Instrument appears undamaged		
9	Fastenings are correct and tight		
10	All gaskets/O-rings/seals are in place. – Correct IP rating		
11	Confirm correct state, orientation of components and direction		
12	Correctly identified and labelled		
13	Calibration certification current		

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-07**
Test specification No.	

Instrument Setup

Project name		Project No.	
Equipment			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	
Calibration requirements			

Ref	Setting		Description	Ref	Setting		Description
	Value	Unit			Value	Unit	

Inputs				Outputs			
Ref	Description	State	Check	Ref	Description	State	Check

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-08**
Test specification No.	

Instrument Loop Calibration

Project name		Project No.	
Equipment			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	
Calibration No.		Calibration date	

Measurement

Transmitter input	Transmitter output	Local instrument reading	Panel instrument reading	Notes

Control

Controller output	Transducer output	Valve position output	Control valve positioner	Notes

Load devices

Load device / location	Type	Manufacturer	Load	Check

Inputs				Outputs			
Ref	Description	State	Check	Ref	Description	State	Check

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-09**
Test specification No.	

PLC Input / Output test

Project name		Project No.	
Equipment			
PLC No.		Manufacturer	
Model No.		Manufacturer Serial No	

Tag No.	Description	I/O type	Module	Ch	Rack	Slot	I/O Enabled	I/O to Module	Module to I/O	Module to screen	View I/O channel correct	View Graphics correct	Field devices Action – Graphic status		Notes
													OFF/ 4mA	ON/ 20mA	

Attachments: Others (specify)	Configuration test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-10**
Test specification No.	

PLC Analogue

Project name		Project No.	
Equipment			
PLC No.		Manufacturer	
Model No.		Manufacturer Serial No	

Analogue inputs

Tag No.	Description	Terminals	Range	Rack	Slot	Signal checks			Notes
						0%	50%	100%	
Analogue outputs									

Attachments: Others (specify)	Configuration test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**C-11**
Test specification No.	

Variable Speed Drive

Project name		Project No.	
Function description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

Ref	Parameter	Units	Factory setting	Site setting	Notes
1	Minimum frequency				
2	Maximum frequency				
3	Acceleration time				
4	Deceleration time				
5	Current limit				
6	Analogue output minimum				
7	Frequency for min. analogue output				
8	Frequency for max. analogue output				
9	Analogue input minimum				
10	Frequency for min. analogue input				
11	Frequency for max. analogue input				
12	Current supervision limit				
13	Frequency supervision limit				
14	Reference signal supervision limit				
15	High temperature trip setting				

Inputs

Ref	Description	State	Check

Outputs

Ref	Description	State	Check

Drawing references	Configuration test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**F-01**
Test specification No.	

Leakage test

Project name		Project No.	
Pipe or structure description			
Line No. / Tag No. / Equipment Id			
Material type and maximum pressure rating			

Ref	Assessment	Pass / Fail	Comments
	Refer Watercare General Civil and Mechanical Construction standards for leakage testing of pipe and structures, or as otherwise specified by design for the specific structure being tested		

Layout and description of structure or pipe being tested:

Test medium and pressure:

Test start time:		Test end time:	

Make-up volume during test:

Make-up allowed as per testing standard:

Drawing references for structure or pipe under test	Function test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**F-02**
Test specification No.	

Valves / Penstocks / Actuators

Project name		Project No.	
Function description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

Setup

No.	Assessment	Checked or N/A	Comments
1	Set to **Open** on: ☐Limit ☐Torque _____value		
2	Set to **Close** on: ☐Limit ☐Torque _____value		
3	End of travel switches set correctly		
4	Valve rotation on closing		☐Clockwise ☐Anti-clockwise
5	Valve/actuator location indicator, correct indication		
6	Valve operated using hand-wheel, fully open and close		
7	Manual /Auto selection operates correctly		
8	Remote manual operates correctly		Operating time _____min.
9	Open / close signals operating		

Auto remote setup

		PLC		SCADA						MCC			
		On	Off	Open	Close	Auto	Manual	Failed	Reset	Avail.	open	Close	Failed
10	Auto –open												
11	Auto – close												
12	Manual select at SCADA - open												
13	Manual select at SCADA - close												
14	Manual select at MCC - open												
15	Manual select at MCC - close												
16	SCADA local reset initiated												
17	Remote reset initiated												

Drawing references	Function test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**F-03**
Test specification No.	

Pump sets / Blowers

Project name		Project No.	
Function description			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

No.	Assessment	Checked or N/A	Comments
1	Mechanical installation complete incl. relief valves etc.		
2	Electrical installation complete and certified to operate		
3	Alignment completed – couplings and bases		
4	Limitations of start-up i.e. not dry run		
5	Motor run direction correct		☐Clockwise ☐Anti-clockwise
6	Emergency stop operates correctly		
7	Safety interlocks operate correctly		
8	Lubrication systems operate, no leaks		
9	Bearing temperature		Run duration _____hrs/min.
10	Full load current of motor within specification		_____Amps
11	Pressure during run		Inlet: _____kPa Discharge: _____kPa
12	Flow rate		Theoretical: _____l/m Actual: _____l/m
13	Vibration measurement within limits		
14	Record noise measurement, within limits		
15	Thermal cable terminal testing under load		1 hr:____2 hrs:____5 days:____

Inputs				Outputs			
Ref	Description	State	Check	Ref	Description	State	Check

Drawing references	Function test completed:	
Attachments: Supplier information	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**F-04**
Test specification No.	

Chemical dosing control

Project name		Project No.	
Equipment description			
Tag No.			
Control loop type			

Controlled parameter	

Controlling analysers

Control set point	

Controller settings

Test results

Attachments: Others (specify)	Function test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	F-05
Test specification No.	

Process control set values

Project name		Project No.	
Section			
Interface.			

No.	Description	Equipment	Set value	Tested value	Units	Comments

Drawing references	Functional test completed:	
Attachments: Others (specify)	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	F-06
Test specification No.	

PLC variables

Project name		Project No.	
Equipment			
Tag No.		Manufacturer	
Model No.		Manufacturer Serial No	

No.	Description	Set point			Control function	Tested value	Comments
		PLC	Value	Units			

Attachments: Others (specify)	Functional test completed:	
	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	**F-07**
Test specification No.	

SCADA Analogue

Project name		Project No.	
Section			
Equipment		Manufacturer	
Model No.		Manufacturer Serial No	

Tag No.	Analogue	Range	Units	Reading			
				Instrument	Graphic	Table	Trend

Drawing references	Functional test completed:	
Attachments: Others (specify)	Commissioning Engineer	Site Engineer
	Date	Date

Test certification No.	F-08
Test specification No.	

Interface

Project name		Project No.	
Section			

Tag No.	Description	Value	Units	Reading				
				Instrument	SCADA	PLC	Local HMI	Remote CCR

Drawing references	Functional test completed:	
Attachments: Others (specify)	Commissioning Engineer	Site Engineer
	Date	Date