Commissioning - transitioning assets into operation

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1. Introduction

1.1 Purpose
Commissioning is the process of managing all activities required to verify and document the compliance, performance, functionality and transitioning to operation of new, renewed or modified assets.

This document defines, outlines and details the commissioning process and includes inspections, testing, configuration, performance optimisation, defect management and document requirements through to operation.

1.2 General
This Commissioning specification sets out the minimum requirements for the management and implementation of commissioning services to be provided across Sydney Water Corporation (SWC) portfolio by the Contractor.

The commissioning process and responsibilities are introduced in the early sections of the document, with detailed requirements for each step then presented chronological throughout the following sections.

1.3 Applicability
This document is applicable to:
- New assets delivered via internal resources
- New assets delivered by Developers
- Renewal of existing assets
- Major overhauls of assets
- Modified or replacement of assets as part of maintenance activities
- Temporary operating arrangements required for upgrade works.

1.4 Asset types
SWC has many different water and wastewater asset types, requiring varying commissioning approaches. Table 1.4-1 presents the asset types and terminology across all asset types.

<table>
<thead>
<tr>
<th>Facility code</th>
<th>Description</th>
<th>Facility code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>Cathodic Protection</td>
<td>SS</td>
<td>Wastewater Storage Reservoir / Surge Tank</td>
</tr>
<tr>
<td>DB</td>
<td>Stormwater Bridges or Aqueducts</td>
<td>ST</td>
<td>Wastewater Treatment Plant</td>
</tr>
<tr>
<td>DP</td>
<td>Stormwater Pumping Station</td>
<td>SU</td>
<td>Wastewater Overflow Storage Facility</td>
</tr>
<tr>
<td>DR</td>
<td>Stormwater Silt / Pollutant traps</td>
<td>SV</td>
<td>Wastewater Syphons</td>
</tr>
<tr>
<td>FM</td>
<td>Facility Maintenance</td>
<td>SW</td>
<td>Wastewater Not Used</td>
</tr>
<tr>
<td>GE</td>
<td>General Not Used</td>
<td>SX</td>
<td>Wastewater Chemical Dosing Unit</td>
</tr>
<tr>
<td>GG</td>
<td>General Gauging site</td>
<td>SY</td>
<td>Wastewater Odour Control Unit</td>
</tr>
<tr>
<td>RF</td>
<td>Recycled Flow meters</td>
<td>TD</td>
<td>Corrosion Control System</td>
</tr>
<tr>
<td>RK</td>
<td>Recycled Valve Site (IICATS Monitored)</td>
<td>TP</td>
<td>Electrolysis Test Point</td>
</tr>
</tbody>
</table>
1.5 Control and monitoring system classifications

SWC sites are classified as Monitored or Unmonitored sites, defined as follows:

- **Monitored sites**: Sites that require remote monitoring for operations
- **Unmonitored sites**: Sites with no remote monitoring.

There are two distinct groups in SWC for development and application of control and monitoring systems for operating assets. Both these groups are within SWC’s Operational Technology Services (OTS) group within Digital Business.

- **Supervisory Control and Data Acquisition (SCADA)** is the monitoring and control protocol used throughout treatment facilities
• Integrated Instrumentation, Control, Automation and Telemetry System (IICATS) is a remote monitoring and control system, used on network assets, and for unmanned, remote monitoring of treatment facilities.

There are significant differences between the two systems, and as such it is critical that the Contractor understands the interface requirements and obligations relating to a specific project or asset type, and clearly articulate these in management plans. The respective responsibilities are detailed in Section 3.

1.5.1 Monitored sites (IICATS)

SWC will undertake software development, review, testing and integration for any site using IICATS. This is a specific differentiator between IICATS sites and other controlled sites using SCADA systems.

The following requirements are specific to IICATS monitored site commissioning:

- The RTU will be supplied by OTS, unless otherwise stated in the Contract. If the RTU supplied by SWC is found to be faulty the Contractor must record the nature of the failure and notify SWC. The Contractor must return the RTU to SWC. SWC will then provide a new RTU. Tests must be repeated when a replacement RTU is installed.
- SWC will carry out IICATS Telemetry and picture testing. The IICATS site-commissioning engineer will communicate with a remote IICATS workstation operator (IICATS Commissioning Technical Support Officer) during these tests. The Contractor must assist and make allowance for this time in his schedule and necessary modifications to the RTU/PLC software.
- The Contractor is required to produce a PEFD for all Water Booster Pump Stations and PRV/PCV as a result of the site-specific requirements for these asset types. For other asset types the Contractor will confirm with IICATS if a PEFD is required, or if an existing site template can be applied.

1.5.2 Monitored sites (SCADA)

The commissioning of SCADA sites may require modifications to existing plant process and hydraulics and is almost always undertaken on brownfield assets.

All SCADA control system development, testing and commissioning will be undertaken by OTS’s designated Service Provider, based on the design provided by The Contractor and under the direction and management of The Contractor. Integration of the physical assets with the appropriate control system and final commissioning requires coordination and planning by The Contractor between the relevant stakeholders, including OTS and OTS’s designated Service Provider.

1.5.3 Un-Monitored sites (No remote control)

Unmonitored sites have no control or remote monitoring requirements. These sites still require commissioning as per the process defined in Section 2, with any control or monitoring system commissioning activities omitted.

1.6 Application of commissioning to maintenance activities

Commissioning is required on any asset that is replaced, upgraded or returned to service after significant downtime, failure or Major Periodic Maintenance (MPM) works.

The extent of commissioning required will depend on the complexity of the works, process and the equipment being placed into service.

Unless otherwise stated in the Contract or other documentation, the applicable commissioning process defined in Section 2 must be followed.

When returning assets to service, consideration must be given to recommissioning and testing back to the control system of assets that were also offline for extended periods as works were undertaken (e.g. if an
entire system is offline for works on a small portion of the system). This testing should include as a minimum, confirmation of calibration of field devices against the control system.

2. Commissioning process

2.1 Commissioning methodology

The methodology for commissioning and transitioning assets into operation will be consistent with Figure 2.1-1. This process may vary or be simplified depending on the extent and complexity of the systems or assets being commissioned, and in consultation with SWC’s stakeholders.

The following sections of this document provide the detail for each of the phases.

Figure 2.1-1: General commissioning methodology

3. Roles and responsibilities

There are two primary groups responsible for commissioning SWC assets. This includes:

- The Contractor Commissioning Team
- SWC Commissioning and Acceptance (CA) Team.

The key responsibilities of the commissioning representative from each team are summarised below:

- The Contractor Commissioning Lead is responsible for coordinating all commissioning activities and overseeing delivery of commissioning (inclusive of process proving and optimisation) in accordance with the commissioning plan, and in compliance with the project scope and technical specifications.
The Commissioning and Acceptance (CA) Team representative from SWC will ensure the correct application of the commissioning process, operation of the asset is not adversely affected by the commissioning work, verify compliance to standards and specifications and will accept Network assets on behalf of SWC and recommend acceptance to Production staff for Treatment Facilities.

The Contractor must ensure that experienced and qualified personnel are present during testing, commissioning and proving. They will provide technical expertise, supervision, adjustment/optimisation, remedial work, liaison with the CA Team Representative and training. The Contractor is responsible for the coordination of all commissioning activities, and provision of a Commissioning Lead to manage and oversee the commissioning process.

The Contractor is responsible for facilitating all inspections, carrying out all required testing, commissioning (i.e. set up of process parameters), process proving and process optimisation (optimising based on field data) of the plant, including the provision of all labour, materials, testing and any specific arrangements that may be deemed by SWC to be necessary to achieve the testing required.

The CA Team reserves the right to halt the commissioning process at any time where documentation, installation or other aspects of the project do not meet the requirements of this or other specifications nominated. The Contractor will be held responsible for delays caused by incomplete works, documentation or a lack of preparedness.

### 3.1.1 Networks facilities responsibility matrix

<table>
<thead>
<tr>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (IICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Concept design phase (as applicable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Inform IICATs and Customer Delivery of Project</td>
<td>-</td>
<td>R</td>
<td>A</td>
<td>I</td>
<td>-</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>Issue Preliminary I/O List &amp; Advice Concerning I&amp;C Standards</td>
<td>I</td>
<td>I</td>
<td>A</td>
<td>-</td>
<td>I</td>
<td>R</td>
</tr>
<tr>
<td>3</td>
<td>Request Drawing Templates (as Applicable)</td>
<td>I</td>
<td>R</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>Draft Design</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>Design Review Meeting / SID Meetings</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

*Responsibility will depend on D&C or C Only, including need specification or design basis.

10 business days’ notice required for attendance at reviews. *Responsibility will depend on D&C or C Only.
## Commissioning - transitioning assets into operation

### 2.0 Detail design phase (as applicable)

<table>
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<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
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<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (IICATS)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>6</td>
<td>Provide revised I/O List (if Required)</td>
<td>I</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Review Finalised Design</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td></td>
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</table>

**Min. 10 business days required for review of documentation**

- SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design

### 3.0 Pre-construction

#### 3.1 Brownfield (existing) assets

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (IICATS)</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Provide Info for Operational Change Request (OCR)</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>10 business days' notice required for attendance at meetings</td>
</tr>
<tr>
<td>2</td>
<td>Review, Approve &amp; Issue OCR</td>
<td>I</td>
<td>-</td>
<td>I</td>
<td>R</td>
<td>C</td>
<td>I</td>
<td>Min. 7 business days required</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Once issued, SOC will manage the OCR</td>
</tr>
<tr>
<td>3</td>
<td>Finalise Bypass Plan and FIFM (As Applicable)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Follow the appropriate FIFM Process.</td>
</tr>
</tbody>
</table>
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### Specification

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**Document uncontrolled when printed**  
**Page:** 10 of 77  
**Version:** 1  
**Issue date:** 24/09/2019

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<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (IICATS)</th>
<th>Comments</th>
</tr>
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<tbody>
<tr>
<td>4</td>
<td>Inform Stakeholders of Commissioning Date</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>10 business days' notice required</td>
</tr>
<tr>
<td>5</td>
<td>Commission Bypass System</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

### 3.2 Greenfield (new) assets

| 1   | Inform Stakeholders of Commissioning Date         | R    | -      | A      | -     | I     | I   | 10 business days' notice required |

### 4.0 During construction

| 1   | Commissioning Meetings / Risk Workshops           | R    | C      | A      | C     | C     | C   | 5 business days' notice required for attendance at meetings. |
| 2   | Provide Acceptance Team list of Test, Hold and Witness Points for inclusion in Plan | I    | -      | A      | I     | R     | -   | Example provided in Appendix E |
| 3   | Update /Finalise Commissioning Plan, ITPs & ITCs | R    | -      | A      | C     | C     | C   | Finalised 20 business days prior to the start of commissioning. |
| 4   | Provide Asset Data                                | R    | -      | A      | I     | I     | I   | HOLD POINT |
| 5   | Pre-FAT on Manufactured Equipment                 | R    | C      | A      | -     | C     | I   |                               |
| 6   | FAT on Manufactured Equipment                     | R    | C      | A      | -     | C     | C   | 10 business days' notice required for attendance at meetings.  

ITPs for FAT to be provided 10 business days prior to FAT for review. |
| 7   | Prepare Technical Spec Spreadsheet and Contingency Schematic | C    | C      | A*R   | C     | C     | -   | *SWC Project Engineer |
| 8   | Issue Contingency and Facility Information files to TAR | -    | -      | A      | R     | C     | *C  | *TAR Data uploaded to IICATS (Automated nightly process) |
| 9   | Trial FIFM (As applicable)                        | R    | -      | A      | C     | I     | C   | As per approved FIFM process |
| 10  | Construction Compliance Inspection(s)             | R    | -      | A      | C     | C     | -   | May occur multiple times throughout construction. |
| 11  | Construction ITP and ITC Finalisation             | R    | -      | A      | -     | C     | -   |                               |
| 12  | Construction Defects Site Walk                    | R    | -      | A      | C     | C     | C   | 10 business days' notice required for attendance at meetings. |
| 13  | Installation Completion Report                    | R    | -      | A      | C     | C     | I   | HOLD POINT, including submission of fabrication MDRs |
| 14  | Obtain Verification Certificate (TAR)             | R    | -      | A      | -     | I     | -   | HOLD POINT |

### 5.0 Pre-commissioning (section 9)

| 1   | Successfully Complete Pre-Commissioning Tests as per ITPs, ITCs, (Unenergised) | R    | -      | A      | -     | C     | C   | SW to Witness tests as per ITP Requirements. |
| 2   | Notice of Energisation                           | R    | -      | A      | I     | C     | C   |                               |
| 3   | Load Software, Check Asset Visible on SOC        | C    | I      | A      | -     | I     | R   |                               |
## Commissioning - transitioning assets into operation

### Activity

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (ICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Successfully Complete Pre-Commissioning Tests as per ITPs, ITCa. (Energised)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>5</td>
<td>Complete Pre-Commissioning Checklist</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>-</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>6</td>
<td>Submit Training Plan Docs</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>To be submitted for review 20 business days prior to the start of training.</td>
</tr>
<tr>
<td>7</td>
<td>Submit Red Pen Marked up drawings</td>
<td>R</td>
<td>C</td>
<td>AC</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Submit Draft O&amp;M</td>
<td>R</td>
<td>C</td>
<td>AC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

### 6.0 Commissioning (Section 10)

#### 6.1 Dry-commissioning

**SYSTEM POWERED UP**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (ICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check Signals to Site Picture</td>
<td>C</td>
<td>I</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Successfully Complete Dry-Commissioning Tests as per ITPs, ITCa.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>I</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>3</td>
<td>Submit all deliverables after Dry-Commissioning</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>4</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td></td>
</tr>
</tbody>
</table>

#### 6.2 Wet-commissioning

**SYSTEM POWERED UP AND TEST FLUID AVAILABLE**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (ICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>Provide Info for Operational Change Request (OCR)</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td>*Only applies to Brownfield sites</td>
</tr>
<tr>
<td>2*</td>
<td>Review, Approve &amp; Issue OCR</td>
<td>I</td>
<td>-</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>I</td>
<td>*Only applies to Brownfield sites</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min. 7 business days’ required Once issued, SOC will manage the OCR</td>
</tr>
<tr>
<td>3</td>
<td>Successfully Complete Wet-Commissioning Tests as per ITPs, ITCa.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>4</td>
<td>Submit all deliverables after Wet-Commissioning</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>(5)</td>
<td>Water Quality Testing (Water Assets Only)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>Also recycled water assets.</td>
</tr>
<tr>
<td>6</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
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</tr>
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</table>

### 7.0 O&M training (section 17.1)

**SYSTEM POWERED UP**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (ICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
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</table>

### 8.0 Site acceptance testing (section 11)

**SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (ICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Implement Cutover Plan*</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements. *Not applicable to greenfield sites.</td>
</tr>
<tr>
<td>2</td>
<td>Successfully Complete SAT as per ITPs, ITCa.</td>
<td>R</td>
<td>-</td>
<td>C</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings. SW to Witness tests as per ITP Requirements. HOLD POINT</td>
</tr>
<tr>
<td>3</td>
<td>Operational Test Period</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Duration as stated in Project Specification</td>
</tr>
</tbody>
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### Commissioning - transitioning assets into operation

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (IICATS)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Approve Operational Test</td>
<td>-</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>9.0</td>
<td>Operationally ready (section 12)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>Defects walk and updated defects list.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days' notice required for attendance at meetings</td>
</tr>
<tr>
<td>2</td>
<td>Operational Minimum Deliverables provided (As per section 12.1).</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Place Asset into Normal Operation</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>A/R</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Site Update Status Notification (SUSN)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>I</td>
<td>A</td>
<td>R</td>
<td>After this point site will be monitored by SOC</td>
</tr>
<tr>
<td>10</td>
<td>Process proving (section 13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Process Proving Period</td>
<td>R</td>
<td>I</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Duration as stated in Project Specification</td>
</tr>
<tr>
<td>2</td>
<td>Successful Completion of Proving Period</td>
<td>-</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>3</td>
<td>Finalise FDS and Store Online</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td></td>
<td>A/R</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Project completion (section 14)</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>1</td>
<td>Submit Final Project Deliverables incl Commissioning Report (As per section 14.2)</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Final Defect Walks</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days' notice required for attendance at meetings</td>
</tr>
<tr>
<td>3</td>
<td>Defects Addressed and Closed out</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Complete Commissioning Handover Checklist/workflow</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>5</td>
<td>Asset Handover</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td></td>
<td>R</td>
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</tr>
</tbody>
</table>

#### 3.1.2 Typical production site responsibility matrix

<table>
<thead>
<tr>
<th>CA</th>
<th>Commissioning &amp; Acceptance (Customer Delivery)</th>
<th>CONT</th>
<th>Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP</td>
<td>Operations (Customer Delivery)</td>
<td>OTS</td>
<td>Operational Technology Service (IICATS or SMART/SCADA)</td>
</tr>
<tr>
<td>PMO</td>
<td>Project Management Office</td>
<td>DESIGN</td>
<td>Designer (may be SW Internal, or Contractor/Consultant)</td>
</tr>
<tr>
<td>R</td>
<td>Responsible</td>
<td>C</td>
<td>Consulted</td>
</tr>
<tr>
<td>A</td>
<td>Accountable</td>
<td>I</td>
<td>Informed</td>
</tr>
</tbody>
</table>

- **Responsible**: The party who carries out the activity and holds responsibility for completing it.
- **Consulted**: Not directly involved with carrying out the activity, but are consulted. Generally, a stakeholder or subject matter expert.
- **Accountable**: The party who is ultimately accountable for process or task being completed appropriately. Responsible party is accountable to this party.
- **Informed**: Those who receive output from the process or task or have a need to stay informed.
### Commissioning - transitioning assets into operation

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN&lt;sup&gt;1&lt;/sup&gt;</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td><strong>Concept design phase (as applicable)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Inform OTS and Customer Delivery of Project</td>
<td>R</td>
<td>A</td>
<td>I</td>
<td>-</td>
<td>I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Request Drawing Templates (as Applicable)</td>
<td>I</td>
<td>R</td>
<td>A</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Draft Design</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>4</td>
<td>Design Review Meeting / SID Meetings</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings *Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>5</td>
<td>Confirm if any “Black Box” controllers proposed for use and provide details.</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>6</td>
<td>Approve “Black Box” controllers</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>R</td>
<td>Required prior to procurement of equipment.</td>
</tr>
<tr>
<td>7</td>
<td>Implement any requirements for “Black Box” Controller</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>8</td>
<td>Review Finalised Design &amp; Issue</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td>Min. 10 business days’ required for review of documentation SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design</td>
</tr>
</tbody>
</table>

### 2.0 Detail design phase (as applicable)

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN&lt;sup&gt;1&lt;/sup&gt;</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Notify OTS and Customer Delivery of Contract Award</td>
<td>-</td>
<td>-</td>
<td>R/A</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Project Kick Off Meeting</td>
<td>C</td>
<td>C</td>
<td>R/A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings</td>
</tr>
<tr>
<td>3</td>
<td>Request Facility and Functional Location Numbers (TAR) / Distribute</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>I</td>
<td>-</td>
<td>I</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>4</td>
<td>Detailed Design</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>*Responsibility will depend on D&amp;C or C Only, including equipment schedules, draft O&amp;M</td>
</tr>
<tr>
<td>5</td>
<td>Design Review Meeting / SID Meetings</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings *Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>6</td>
<td>Critical Spares Assessment</td>
<td>C</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>*Include Supply Chain Operations</td>
</tr>
<tr>
<td>7</td>
<td>Plain English Function Description</td>
<td>C</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Min. 10 business days’ required for review of documentation</td>
</tr>
<tr>
<td>8</td>
<td>Prepare Construction Methodology</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Prepare Draft Commissioning Plan</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Min. 10 business days’ required for review of documentation</td>
</tr>
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</table>

<sup>1</sup> Design activities relevant to commissioning shown here for clarity, particularly where the designer and contractor may be different parties.
### 3.0 Pre-construction

#### 3.1 Brownfield (existing) assets

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
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<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Prepare Cut-Over Plan</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Min. 10 business days’ required for review of documentation</td>
</tr>
<tr>
<td>11</td>
<td>Review Finalised Design</td>
<td>C</td>
<td>C</td>
<td>R/A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW-PM to determine FIFM / OCR / bypass requirements during Conceptual Design</td>
</tr>
<tr>
<td>12</td>
<td>Control System Design Kick-off</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>13</td>
<td>Develop FDS</td>
<td>*</td>
<td>*</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
</tr>
<tr>
<td>14</td>
<td>FDS Workshop / CHAZOP</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SCADA/PLC Programming, Finalise FDS.</td>
<td>*</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>I</td>
<td>R</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
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<td>16</td>
<td>Draft Software Download Plan</td>
<td>*</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
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<td>17</td>
<td>E-Stop / Handstation Review Meeting</td>
<td>*</td>
<td>R</td>
<td>A</td>
<td>C</td>
<td>I</td>
<td>R</td>
<td>*Responsibility will depend on D&amp;C or C Only</td>
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#### 3.2 Greenfield (new) assets

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<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Provide Info for Production Change Management (IMS0038)</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Review, Approve Change</td>
<td>I</td>
<td>-</td>
<td>I</td>
<td>R/A</td>
<td>C</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Finalise Cut-over Plan and FIFM (As Applicable)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Follow the appropriate FIFM Process.</td>
</tr>
<tr>
<td>4</td>
<td>Inform Stakeholders of Commissioning Date</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>I</td>
<td>C</td>
<td>10 business days’ notice required</td>
</tr>
<tr>
<td>5</td>
<td>Commissioning Temporary Arrangements</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
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</table>

#### 3.4 During construction

<table>
<thead>
<tr>
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<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Commissioning Meeting / Risk Workshop</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings</td>
</tr>
<tr>
<td>2</td>
<td>Provide Acceptance Team list of Test, Hold and Witness Points for Inclusion in Commissioning Plan</td>
<td>I</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>R</td>
<td>-</td>
<td>Example provided in Appendix E</td>
</tr>
<tr>
<td>3</td>
<td>Update /Finalise Commissioning Plan, ITPs &amp; ITCs</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Finalised 20 business days prior to the start of commissioning.</td>
</tr>
<tr>
<td>4</td>
<td>Provide Asset Data</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>I</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>5</td>
<td>Pre-FAT on Manufactured Equipment</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FAT on Manufactured Equipment</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings.</td>
</tr>
</tbody>
</table>

HOLD POINT
### Commissioning - transitioning assets into operation

**5.0 Pre-commissioning (section 9)**

**PRELIMINARY ELECTRICAL & MECHANICAL**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Successfully Complete Pre-Commissioning Tests as per ITPs, ITCs. (Unenergised)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>2</td>
<td>Notice of Energisation</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Download Software, Check Signals to PLC and SCADA</td>
<td>C</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Successfully Complete Pre-Commissioning Tests as per ITPs, ITCs. (Energised)</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>5</td>
<td>Complete Pre-Commissioning Checklist</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>-</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>6</td>
<td>Submit Training Plan /Docs</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>To be submitted for review 20 business days prior to the start of training.</td>
</tr>
<tr>
<td>7</td>
<td>Submit Red Pen Marked up drawings</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Submit Draft O&amp;M</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
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<tr>
<td>9</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
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<td>I</td>
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**6.0 Commissioning (section 10)**

**SYSTEM POWERED UP**

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>CONT</th>
<th>DESIGN</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
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<tbody>
<tr>
<td>1</td>
<td>Successfully Complete Dry-Commissioning Tests as per ITPs, ITCs.</td>
<td>R</td>
<td>-</td>
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<td>C</td>
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<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
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<td>Submit all deliverables after Dry-Commissioning</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>3</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>I</td>
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## Commissioning - transitioning assets into operation

<table>
<thead>
<tr>
<th>#</th>
<th>Activity</th>
<th>Cont</th>
<th>Design</th>
<th>SW-PMO</th>
<th>SW-OP</th>
<th>SW-CA</th>
<th>SW-OTS (SCADA)</th>
<th>Comments</th>
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<tr>
<td>6.2</td>
<td><strong>Wet-Commissioning</strong></td>
<td>SYSTEM POWERED UP AND TEST FLUID AVAILABLE</td>
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<tr>
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<td>Successfully Complete Wet-Commissioning Tests as per ITPs, ITCs.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td></td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>2</td>
<td>Submit all deliverables after Wet-Commissioning</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>C</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>4</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td></td>
<td></td>
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<tr>
<td>7.0</td>
<td><strong>Software site acceptance testing</strong></td>
<td>SYSTEM POWERED UP AND TEST FLUID AVAILABLE</td>
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</tr>
<tr>
<td>1</td>
<td>Successfully Complete SSAT as per ITPs, ITCs.</td>
<td>C</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>R</td>
<td>SW to Witness tests as per ITP Requirements. HOLD POINT</td>
</tr>
<tr>
<td>8.0</td>
<td><strong>Process commissioning (section 10.3)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>8.1</td>
<td>Testing cutover(s)</td>
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</tr>
<tr>
<td>1</td>
<td>Implement Testing Cutover as per Plan</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
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<tr>
<td>8.2</td>
<td><strong>Integrated commission</strong></td>
<td>SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE</td>
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<td></td>
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<tr>
<td>1</td>
<td>Successfully Complete Integrated Commissioning Tests as per ITPs, ITCs.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>8.3</td>
<td><strong>Process optimisation</strong></td>
<td>SYSTEM POWERED UP AND PROCESS FLUID AVAILABLE</td>
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<td></td>
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</tr>
<tr>
<td>1</td>
<td>Successfully Complete Process Optimisation as per ITPs, ITCs.</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>SW to Witness tests as per ITP Requirements.</td>
</tr>
<tr>
<td>2</td>
<td>Update Defects Register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>I</td>
<td></td>
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<tr>
<td>9.0</td>
<td><strong>O&amp;M training (section 17.1)</strong></td>
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<tr>
<td>10</td>
<td><strong>Site acceptance testing (sat) (section 11)</strong></td>
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<tr>
<td>1</td>
<td>Successfully Complete SAT as per ITPs and ITCs</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings.</td>
</tr>
<tr>
<td>2</td>
<td>Operational Test Period</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>Duration as stated in Project Specification</td>
</tr>
<tr>
<td>3</td>
<td>Approve Operational Test</td>
<td>-</td>
<td>-</td>
<td>A</td>
<td>I</td>
<td>R</td>
<td>I</td>
<td>HOLD POINT</td>
</tr>
<tr>
<td>11</td>
<td><strong>Operationally ready (section 12)</strong></td>
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</tr>
<tr>
<td>1</td>
<td>Defects Walk and Updated Defects register</td>
<td>R</td>
<td>-</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>10 business days’ notice required for attendance at meetings.</td>
</tr>
<tr>
<td>2</td>
<td>Operational Minimum Deliversables provided (as per section 12.1)</td>
<td>R</td>
<td>C</td>
<td>A</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Place Asset into Normal operation</td>
<td>-</td>
<td>-</td>
<td>A</td>
<td>R</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td><strong>Process proving (section 13)</strong></td>
<td>SITE OPERATES IN AUTO. CONTRACTOR MONITORS PLANT AND RECTIFIES FAULTS AS ADVISED BY SW.</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
# Activity | CONT | DESIGN | SW-PMO | SW-OP | SW-CA | SW-OTS (SCADA) | Comments
--- | --- | --- | --- | --- | --- | --- | ---
1. Full System Test | C | - | A | C | C | R | In accordance with Treatment SCADA Standards.
2. Process Proving Period | R | C | A | C | C | C | 
3. Successful Completion of Proving Period | - | - | A | R | C | I | HOLD POINT
12. Project completion (section 14)
   1. Submit Final Project Deliverables incl Commissioning Report (as per section 14.2) | R | C | A | C | C | 
   2. SCADA Standards Compliance Checklist | C | - | A | C | C | R | In accordance with Treatment SCADA Standards.
   3. Final Defect Walks | R | - | C | C | C | I | 10 business days' notice required for attendance at meetings.
   4. Defects Addressed and Closed Out | R | - | A | C | C | 
   5. Complete commissioning Handover Checklist / Workflow | R | - | A | C | C | C | HOLD POINT
   6. Asset Handover | C | C | A | C | R | C | 

4. **General requirements**

- Tests and inspections, unless otherwise specified or accepted, must be in accordance with the latest relevant standards of the Standards Association of Australia, SWC’s standards, WSAA Codes, or in their absence, those of the British Standards Institution or ASCE standards. The Contractor must arrange and obtain the necessary permits, notification, inspections, testing and certificates required by State and Local Government regulatory authorities such as WorkCover Authority, Electrical Supply Authority and Local Council.

- SWC reserves the right to witness any and/or perform any test for the purposes of observation, result verification, obtaining technical information or operator training.

- All data taken during each stage of testing and commissioning must be recorded and used in the assessment of performance. This data must be stored in a safe place. All test measurements and recordings are to be handed to SWC at Project Completion.

- The Contractor must have available a complete set of spare parts for minor items, such as, relays, lamps, contractor coils, etc. so that the testing process is not delayed due to the failure of such items.

4.1 **Commissioning safety and risk assessment**

All commissioning activities must be carried out in accordance with the requirements of Project Management Plans that may include:

- a) Project WHS Management Plan
- b) Environmental Management Plan
- c) Incident Management Plan
- d) Any Safety in Design requirements
- e) Commissioning Risk, HIDRA workshop involving key stakeholders

A risk assessment must be undertaken with commissioning stakeholders prior to commencing commissioning; risks must be identified, assessed and managed using an appropriate risk assessment
Commissioning - transitioning assets into operation

process and task specific Safe Work Method Statements (SWMS) must be developed and reviewed by all relevant personnel.

All commissioning plans and procedures must include emergency / contingency procedures to address perceived risk including:

- Threat to human life
- Injury to personnel
- Threat to the environment
- Breach of law / licence provision
- Emergency external to site
- Equipment breakdown
- Contingencies related to biological and mechanical commissioning
- Threat to equipment / plant
- Interaction with other operations at the SWC Plant
- Exclusion zones around assets being commissioned.

4.2 Control of monitoring and measuring devices (MMD)

Monitoring and measurements are undertaken during the delivery of the project in order to:

- Check and validate conformance to specified requirements (e.g. tolerance to design requirements)
- Monitoring compliance to standards and regulations (e.g. noise measurements)
- Demonstrate conformance of products to specifications (e.g. pump & motor capacities).

Devices used for the purposes such as observation, indicator only or fault diagnosis need not be treated as MMDs.

Due consideration must be given to the level of accuracy of the MMDs to ensure valid results. The CA Team must be consulted where any clarification is required.

The Commissioning Lead must ensure that the MMDs used on the project are:

- Suitable for the purpose
- Uniquely identified
- Have valid and current calibration status
- Calibrated against recognised standards or manufacturer’s recommendations
- Calibrated by a qualified person or an accredited laboratory
- Are calibrated for reliable operation with the process fluid and in normal operating conditions.

The Commissioning Lead must ensure that the MMDs used are registered as per The Contractor’s management system.

The Commissioning Lead undertaking surveillance must ensure that MMDs are used only by qualified persons who are familiar with the controlled environment in which the MMDs are to be used (e.g. Temperature, vibration, electromagnetic interference) and competent to maintain and protect the accuracy of the MMDs.

The Commissioning Lead must check that the unique identification of the MMD is recorded on the ITP.

In the event that the accuracy of an MMD used on the project is found to be outside the permitted limits, the Commissioning Lead must review the measurements or tests done with the MMD and check the validity of the results obtained. The Commissioning Lead must ensure that additional measurements as necessary are taken to validate the results.
4.3 Non-conformance, defects and corrective actions

During commissioning non-compliances with performance requirements, specification, the Contract or other documents may be raised. These will be separated into Non-Conformances and Defects as is defined below:

- **Non-conformance (NCR)** - A failure to meet a requirement, either from the Contract, specifications and codes, process and procedures, product quality / performance, incorrect or inadequate documentation, deviation from testing and inspections.

- **Defect** - Works that does not achieve the standard required by the Contract, either due to workmanship, defective product / systems, or damage to work.

4.3.1 Non-conformance

Testing and commissioning non-conformances will be defined as Major or Minor. Guidelines for the classification of these non-conformances and the required corrective actions are identified below.

In the case of ambiguity or uncertainty as to the classification of non-conformances during the testing and commissioning process, SWC will classify the non-conformance.

A Non-Conformance Schedule must be prepared by the Contractor, identifying all non-conformances, all planned/completed corrective actions, target dates for completion and responsible personnel. This Schedule will be submitted to SWC and updated by the Contractor on a weekly basis throughout the testing and commissioning process.

1. **Non-conformance report category "A" - Major omissions/non-conformance by the Contractor**

   This category includes all safety issues, failure of individual assets or tests which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment / facility.

   All NCRs under this category must be completed and equipment / systems successfully re-tested prior to take over of the equipment/system/facility.

2. **Non-conformance report category "B" - Major omissions/ non-conformance by SWC**

   This category like Category "A" above includes all safety issues, failure of individual assets or tests which prevents successful testing of the asset/system/facility and therefore unable to prove capability of safe and normal operation of the equipment /system/ facility.

   It is expected all NCRs under this category are to be completed by SWC and the equipment /systems successfully re-tested prior to handover of the asset/system/facility.

   However, if any of the items are unable to be completed prior to completion of part or the entire project as in the Approved Project Management Plan (PMP) the issue must be brought to the attention of:

   a. Area Manager / Asset Program Manager - Customer Delivery Division
   b. Area/Regional Manager - Liveable City Solution Division

   It is the responsibility of those listed above to develop SWC’s position on each issue and advise the CA Team Representative responsible for the handover of the facility. Timely resolution is essential to avoid Contractual issues related to completion of the project.

   **The equipment / facility will not be taken over without a documented plan to resolve each outstanding issue.**

3. **Non-Conformance report category "C" - Minor omissions/non-conformance by the Contractor**

   This category includes work that has no impact on successful testing of the asset/system/facility that is essential to prove capability of safe and normal operation of the equipment / facility.
All NCRs under this category must be listed with a written confirmation from the Contractor of acceptable completion times and any agreed penalties of subsequent non-conformances.

If the facility/equipment is part of a developer activity process All NCRs must be cleared prior to SW handover of the asset/system/facility.

4. Non-conformance report category "D" - Minor omissions/non-conformance by SWC

This category includes work that has no impact on successful testing of the asset/system/facility that is essential to prove capability of safe and normal operation of the equipment/facility.

All incomplete NCRs under this category must be listed and forwarded to:

a. Area Manager / Asset Program Manager - Customer Delivery Division
b. Area/Regional Manager- Liveable City Solution Division

It is the responsibility of those listed above to develop SWC’s position on each issue and advise the CA Team Representative responsible for the handover of the facility. Timely resolution is essential to avoid Contractual issues related to completion of the project.

4.3.2 Defects

Testing and commissioning defects will be defined as Major or Minor. Guidelines for the classification of these defects and the required corrective actions are identified below.

In the case of ambiguity or uncertainty as to the classification of defects during the testing and commissioning process, SWC will classify the defects.

A defects register must be prepared by the Contractor, identifying all defects, all planned/completed corrective actions, target dates for completion and responsible personnel. This Register will be submitted to SWC and updated by the Contractor at the end of each phase of the testing and commissioning process.

1. Defect Category "A" - Major defects by The Contractor

This category includes all safety issues, failure of individual assets or tests and design or construction issues which prevents progress to the next project phase.

All defects under this category must be completed and/or equipment/systems successfully re-tested prior to proceeding with the next commissioning phase.

Examples of major defects may include:

- incorrect equipment (non-compliant to specification, or not fit for purpose).
- construction issues (poor compaction, structural failures and leaks).
- safety issues (non-complying access, unguarded equipment etc.).

2. Defect Category "B" - Minor defects by The Contractor

This category includes work that has no impact on the works progressing to the next stage but must completed prior to Project Completion.

Examples of major defects may include:

- minor coating defects (touch-up etc).
- minor wiring non-compliances (incorrect colour, labelling etc.).

5. Planning for commissioning

5.1 Commissioning plan

The Contractor must prepare a detailed Commissioning Plan to cover all aspects of the project delivery phase including civil, mechanical and electrical construction, factory acceptance testing (FAT), pre-
commissioning, dry-commissioning, wet-commissioning, process commissioning, site acceptance testing (SAT), proving and training. The Commissioning Plan is to be considered as a live document, to be updated to accommodate changes during the delivery of the project and inclusion of new information as applicable.

A draft plan is to be produced prior to completion of detailed design (or upon award if construct only), providing high level details of the commissioning process, a register of inspection and test plans (ITPs) and checksheets and preliminary program details for review by the CA Team Representative.

As a minimum the Commissioning Plan must include the following:

1. Overview of Commissioning methodology and stages as per Section 2
2. Details of risk assessments that have been undertaken to facilitate the development of the plan and methodologies stated
3. Details of the construction stage procedures inclusive of test plan for the construction stage covering all items of process, civil, mechanical, software and electrical construction
4. Details of the pre-commissioning stage procedures inclusive of test plan covering all items of plant and equipment
5. Details of the dry commissioning stage procedures inclusive of a software download plan, commissioning procedures and test methodologies for all key testing and commissioning activities
6. Details of the wet commissioning stage procedures inclusive of commissioning procedures and test methodologies for all key testing and commissioning activities
7. Details of the SAT/integrated commissioning stage procedures inclusive of cutover, test methodologies for all key testing, commissioning and O&M training activities
8. Details of the operational test / reliability period stage monitoring and testing methodologies activities
9. Details of the process proving stage monitoring and testing methodology
10. Software Download Plan, software FAT (SFAT), software SAT (SSAT) and required operational change requests for TICATS sites
11. Detailed ITPs and inspection and test check sheets (ITCs), incorporating identification, recording and verification of:
   a) all relevant asset information required for entry into the SWC technical asset register (TAR)
   b) all civil, structural, mechanical, electrical, process and control (software) checks necessary for testing, commissioning and operation of the facility
   c) all key testing and commissioning activities as identified in the prepared procedures and methodologies
   d) all performance targets and project objectives as per the requirements of the Contract
   e) all equipment supplier recommended checks and tests
   f) the corresponding acceptance criteria that the Contractor must use for establishing the conformance of the Works with the requirements of the Contract
   g) all hold, witness or surveillance points as per the requirements of the Contract, nominated by the CA Team or otherwise nominated by the Contractor.
12. A testing and commissioning program or schedule, defining:
   a) the work breakdown structure (WBS) adopted in order to detail Lot Management of the Asset(s)
   b) holdpoint dates
   c) all dates and periods for each stage of the commissioning process
   d) all required periods for notifications and submissions to SWC.
13. A roles and responsibilities matrix, identifying all personnel, stakeholders and sub-contractors who will be involved with all key testing and commissioning activities
14. Decision-making process to determine whether a system is operating satisfactorily
15. Procedure for recording, managing and rectifying any non-conformances.

5.2 Cutover plan and procedures

All cutovers must be planned and executed so as not to adversely impact the continued operation of existing systems. It is critical that any licence obligations are met throughout the Contract. Therefore, the Contractor must plan cutovers in co-operation with all relevant stakeholders. If a cutover must be delayed due to operational needs, the Contractor will be notified by SWC.

Cutover procedures must be developed for each commissioning sub-system as well as for individual equipment, systems and facilities once construction and pre-commissioning activities have progressed to a sufficient degree as to warrant the progression to Commissioning.

Cutover procedures must detail the management of activities and risks involved with the energisation and operation of new and upgraded equipment, systems and facilities in order to minimise downtime and prevent the occurrence of foreseeable issues associated with the commissioning works.

Cutover procedures must include the following:

a) Prerequisites
b) Risk and contingency plan including HIDRA
c) Communication protocols and contacts
d) Energisation and loading procedures (electrical, fluid, chemicals, etc)
e) Marked up process and instrumentation diagrams (P&IDs) and electrical drawings with lock out tag out (LOTO) requirements / blank flanges
f) Sequence of cutover and holdpoints
g) Process requirements including power, flows and volumes required
h) Temporary works and bypass requirements
i) Control System / SCADA / IICATS requirements including disabled alarms and interlocks.

5.2.1 Equipment energisation

Cutover procedures must be prepared when energisation of new equipment requires modification of existing operating arrangements. The need for emergency asset operation must be considered and be formulated to provide redundancy during the cutover or minimise downtime if the cutover process needs to be reversed. Following cutover, the impacted equipment, systems and facilities must be deemed to be energised works.

Energisation procedures must be developed to plan and detail the steps for the energisation and de-energisation of equipment, systems and facilities, inclusive of connection to permanent electrical supply and the introduction of process fluids into the systems, as applicable, and must be submitted together with a Notice of Energisation to SWC.

Access to and subsequent work activities being conducted on energised works will be controlled using Permits to Work and LOTO plans that have been developed to include the specific conditions, risks and controls associated with the energised works.

The requirements for new Permits to Work and LOTO procedures will be communicated to all project personnel by means of pre-start meetings, toolbox meetings and appropriate signage in the area of the energised works.

All personnel carrying out work activities on any works deemed as energised must only do so after signing onto a relevant Permit to Work, reviewed and authorised by a member of the Commissioning Team.

The distinction of energised works requiring new or updated Permits to Work and LOTO plans is made to ensure that:
5.3 Asset data information

The Contractor is responsible for collation and compilation of necessary information in the required format for inclusion in TAR. The Contractor is responsible for requesting location numbers, entry of asset details in TAR and advising of decommissioned assets and their location number. Details of spare parts and decommissioned assets need to be provided by the Contractor via spreadsheet specified by SWC. The Contractor must liaise with SWC before data entry is commenced to ensure that data entry standards and SWC’s requirements are fully understood. A specialist from SWC will be available for consultation on matters involving data entry.

Requirements for data capture are constantly evolving to facilitate improvements in maintenance strategy and operational decision-making.

To prevent delays to handover, it is critical that asset data be entered as early as reasonably practicable in the project development and delivery. Provision of asset data updates in TAR are a pre-requisite to pre-commissioning commencement.

5.3.1 General

For all types of facilities and assets the Contractor must refer to the Data Dictionaries, which can be obtained from SWC.

In TAR each facility or asset location is identified with a unique number, which is termed a “Location Number”. SWC is responsible for allocation of Facility Number and Location Number. The Contractor is responsible for requesting Facility Number(s) (if not already requested) and Location Number(s) for new Assets at design stage.

5.3.2 Facility number or location number

SWC will issue Facility Numbers or Location Numbers to the Contractor for all new locations to be provided under the Contract.

The Contractor must request Facility or Location numbers using standard templates which are available from SWC. The information supplied in each request spreadsheet must relate to only one Project. A contractor working on multiple projects for SWC must, where required to supply information, do so using a separate spreadsheet for each project. Contractor requests must be provided to SWC via SWC Project Manager.

Contractor requests for location numbers must be accompanied by P&IDs or relevant drawings (i.e. for electrical assets).

Upon receipt of a Facility number request form, SWC will issue Facility Numbers from TAR. SWC may seek additional information on the location of the Facility, where required. SWC will return the Facility number request spreadsheet containing the allocated Facility number to the Contractor.

Upon receipt of a Location number request form, SWC will issue Location Numbers and enter these numbers in TAR. SWC will return Location number request spreadsheet containing the allocated location numbers and relevant external reference number to the Contractor. The Contractor must then amend the P&IDs and other relevant documentation, by replacing the provisional Location Numbers with the allocated Location Numbers.

If SWC identifies from the Contractor’s P&IDs and location layout drawings that there are location(s) not included in their Location number request spreadsheet, which require Location Numbers, SWC will allocate...
these additional Location Numbers. The Contractor must include the additional Location Numbers (and their corresponding locations) in the P&IDs and other relevant documentation.

The Contractor is responsible for providing information on existing locations and assets made redundant (decommissioned) or replaced by the project, using standard templates available from SWC. The information must be provided to the SWC’s Project Manager, most appropriately at the same time the contractor is requesting new location codes.

5.4 Asset information

The Contractor must liaise with SWC before asset information submission is commenced to ensure that data entry requirements and processes are fully understood. The Contractor must collate and compile necessary data for timely inclusion in TAR. and submit for ‘Validation’ by SWC prior to the commencement of pre-commissioning. Asset information submission will require access to SWC’s TAR for data entry personnel. SWC will arrange access to TAR for the Contractor’s data entry personnel.

The Contractor must comply with the Asset Data standards when entering asset data. SWC has guides available to assist in entering asset information.

SWC will validate asset data supplied by contractor and notify the contractor via the Project Manager of any issues that need to be resolved.

Additional time may be required if the information provided by the Contractor is incomplete and requires clarification.

5.4.1 Data verification

The Contractor must request a Verification Certificate from Asset Data Management to ensure the required asset information has been provided by the project. The request must include a list of locations requested along with final P&IDs and associated drawings, a list of redundant or replaced assets.

A representative of SWC will issue a Verification Certificate after satisfactory verification of asset information provided by the project. Any issues or concerns identified during verification must to be resolved prior of issuing of the Verification Certificate. Verification Certificate is a prerequisite for the start of Pre-commissioning activities.

5.5 Commissioning meetings

Regular commissioning liaison meetings are to be conducted with SWC during the construction, testing and commissioning periods. Alternatively, Commissioning should be included in regular progress meetings. Commissioning must be planned to coordinate with the activities of other Contractors at the site and with the operational activities of SWC.

It is recommended that a Commissioning and Cutover Plan review meeting be held during the development of construction methodology, commissioning, cutover and handover documents to enable the documents to articulate any site-specific requirements and complexities.

6. Pre-factory acceptance testing (Pre-FAT)

Pre-FAT is required on critical factory built equipment or system components prior to Factory Acceptance Testing (FAT) to confirm the scope of work and minimise the amount of time required to complete the FAT by eliminating wiring, labelling, workmanship and equipment functionality problems.

Testing at the factory for materials and major items of equipment, including all electrical components supplied by the Contractor, must be carried out and include the following as a minimum:

- pumps
- blowers and diffusers
Chemical Dosing Units (CDUs)
- Odour Control Units (OCUs)
- valves and valve actuators
- electrical equipment
- instrumentation, including flow meters, etc
- computer systems and software including Human-Machine Interface (HMI) (where applicable)
- any other relevant equipment.

A Pre-FAT must be carried out when:

a) manufacturing is complete
b) the system or sub-system is fully assembled
c) the assembly is ready for transportation to site
d) calibration sheets are complete and available and
e) Manufacturer’s data report (MDR) available.

SWC will not normally witness the Pre-FAT, but has the right to do so.

Copies of Pre-FAT Test Results Record Sheets must be submitted prior to commencement of the FAT for approval. Each test must be dated and signed off by two representatives of the Contractor.

The Pre-FATs itemise and cover all tests associated with the following:

a) completeness of work
b) labelling and wiring
c) compliance with standards and specifications
d) correctness of drawing/equipment
e) equipment rating, e.g. Circuit breakers, etc
f) firmness of equipment
g) set overloads, MAS/CAS Relays, soft starter / variable speed parameters; note the Contractor must supply a full set of variable speed parameters in a spreadsheet including a listing of all those that have been left untouched and left as factory set, (for future reference, also any software and tools required to alter the Variable speed drives (VSDs)
h) functional operations of switches, circuit breakers, push buttons, drives, PLC/RTU inputs and outputs etc.

7. Factory acceptance testing (FAT)

As a minimum, all prefabricated mechanical systems, pumping units, electrical panels, cabinets and kiosks must be factory inspected and tested (FAT). Other equipment that requires factory acceptance testing along with the type of test may be specified in the contract, needs specification, design documents or other asset specifications.

SWC will nominate hold and inspection points during FAT activities. These will be provided by SWC’s Commissioning and Acceptance Team (See Appendix E).


The Contractor must submit ITPs and ITCs for FAT testing to SWC for review prior to the commencement of testing. FAT must be of enough length to allow for testing, correction of defects and retesting (this may be 2 - 3 days).
7.1 Scope of factory acceptance testing and inspection

The scope of FAT and inspection includes but not limited to:

a) inspection, examination and certification of materials of manufacture
b) inspection of welding and castings, testing for defects
c) hydrostatic pressure testing of all parts, which may be subject to internal pressure during normal or abnormal working conditions
d) performance tests of key equipment. Type tests may be acceptable on pumps, blowers and other mass-produced commodities.
e) performance tests on pumping units. Type tests are acceptable on pumps <3 kW. Specific performance tests must be carried out on equipment with drives greater than 3 kW and evidence of the testing provided to SWC. Where drives are >100 kW, replacements aren’t readily available, or for high risk facilities, SWC reserves the right to witness performance testing. Refer to 7.3.3 for more information.
f) for software orientated systems, particularly for treatment facilities, functional testing of the control system is to be conducted during the Software Factory Acceptance Test. (SFAT). Simulated I/O is acceptable during this test.
g) specific tests in other sections of the Contract.

Testing of equipment at the manufacturer’s works will not relieve the Contractor of responsibilities to conduct site testing. Performance tests must be in accordance with an Australian or International Standard or to a method approved by SWC.

7.2 Software specific requirements

7.2.1 Plain English functional description (PEFD)

The PEFD is to be developed by the responsible stakeholder as indicated in the Contract and approved by SWC during Detailed Design, prior to commencement of the Functional Design Specification (FDS).

7.2.2 Functional design specification (FDS)

The FDS is to be developed by the responsible stakeholder as indicated in The Contract, and approved by SWC during Detailed Design, with formal testing conducted as a Software FAT.

7.2.3 Software FAT (SFAT)

Under the overall responsibility of the Contractor, the software FAT is to be organised by the Contractor and conducted by OTS or OTS’s designated service provider and witnessed by SWC operations staff, to ensure the operation is in accordance with the PEFD and FDS.

7.2.4 Software download plan (SDP) (Not normally applicable to IICATS)

Under the overall responsibility of the Contractor, a Software Download Plan (SDP) is to be developed by OTS or OTS’s designated service provider, detailing the exact processes to be followed for the downloads and any risk to the operation of existing plant operation. This is a requirement for any change or modification of operational control systems (including defects rectification).

This plan must be prepared in consultation with SWC’s Operations team and the Contractor must ensure that it is approved by SWC prior to download.

Changes to operational control systems on Treatment Plants are to be undertaken in accordance with IMS0038 - Treatment Plant Operational Change Management.
7.3 Equipment specific FAT requirements

The following specific FATs are required for the equipment as noted. The tests carried out at the manufacturer’s workshop must form the basis of the FATs for assets / equipment supplied under the Contract. Test certificates and performance curves must be provided for each test.

7.3.1 Electrical equipment, instrumentation, control and switchboards

FAT testing will be in accordance with the requirements detailed in the following relevant specifications where applicable:

- Technical Specification - Electrical (Section E15 for Switchboards)
- Technical Specification - IICATS
- Technical Specification - SCADA
- SW Standard HV Specifications.

7.3.2 Rotating/moving equipment

**Bearing tests**

In conjunction with the performance tests, the Contractor must continuously record bearing housings temperatures while operating at the most adversely loading conditions. The test should be conducted for a minimum of four hours and until the temperatures have peaked and stabilised relative to the ambient temperature for a period of at least one hour. The bearing housings temperatures, after adjustment for an ambient temperature of 45°C, must not exceed the maximum bearing temperature stated by the equipment manufacturers. These tests must be repeated on site for final acceptance.

**Vibration tests**

Preliminary vibration tests are to be undertaken at the manufacturer’s works during performance tests and repeated on site for final acceptance. The vibration tests must be conducted and evaluated in accordance with Technical Specification - Mechanical.

**Noise tests**

Preliminary noise tests must also be undertaken at the manufacturer’s works during performance tests and repeated on site for final acceptance. Preliminary noise tests must identify any obvious noisy operating condition within the asset / equipment operating range. The obtained data are to be evaluated and translated to defined site noise performance conditions. The equipment must only be delivered to site if the above evaluation indicates that the specified site noise levels will be achieved.

7.3.3 Specific testing for pumps

**Hydrostatic testing of pumps**

All pump casings, after machining, must be subject to a hydrostatic test at the manufacturer’s works by the Contractor. Alternatively, the hydrostatic tests may be carried out after the pump has been assembled. The total test pressure must be 1.5 times the sum of pump maximum shut off head and maximum suction head. The use of long bolts or other similar apparatus extending through the pump casing to seal off the suction, discharge, shaft or other openings during the test must not be permitted.

The pressure must be sustained for at least two hours. During the hydrostatic test, there must be no visible leakage through the shaft seals or any other part of the casing. The exterior of the casing must remain completely dry and there must be no visible deformation or distortion of the casing or other pump components.

The Contractor must replace all casing or parts found defective or unsound in any respect under this test at no cost to SWC.
Performance testing of pumps

Pumps must be witness works performance tested with their respective motors and starters (or variable speed drives, if supplied) at the manufacturers’ works by the Contractor in accordance with AS/ISO 9906:2018 “Rotodynamic pumps - Hydraulic performance acceptance tests - Grades 1, 2 and 3”. Grade 1 tolerance factors must be adopted for pumps driven by motors 50 kW or larger and Grade 2 for pumps with motors smaller than 50 kW. The Contractor must provide all materials, equipment (including test starters if not supplied with the pumps) and labour for the works tests.

Unless stated otherwise, the performance tests must include the following:

- Pump capacity (Q)
- Head (H)
- Net positive suction head required (NPSHr)
- Overall efficiency (ƞO/A).

The overall efficiency guarantee must include pump, motor and starter or, if supplied, variable speed drives losses. Acceptance of NPSHr tests must be based on satisfying the stated NPSHr at 3% head drop, i.e. “NPSH3”, at the pump minimum head / maximum flow duty point. The NPSHr tests will include a minimum of three tests, i.e. one at this duty point and one on either side of it, to confirm the trending of the NPSHr curve.

Valves, pipes and fittings

All valves, pipes and fittings must be subject to hydrostatic and leakage acceptance tests and all other production and batch release tests as specified in the relevant standards at the manufacturer’s works. The valves must also be supplied with Type Test Certificates. The tests must be carried out in accordance with relevant Australian Standards.

System components for specific applications, such as chemical dosing, are subject to stringent requirements in regard to material selection, fabrication, installation and training of personnel. The requirements are specifically outlined in the relevant SWC specifications for those asset types.

7.4 FAT and inspection report

The Contractor must submit a FAT and Inspection Report to SWC. SWC will may witness the FAT. Any defects or non-conformances identified during the test are to be identified, documented and dealt with in accordance with 4.3.

The Contractor must not deliver or install any part of the system until such approval has been granted by SWC in writing.

Tests and inspections performed by suppliers/manufacturers at their factory or on site must be recorded and reviewed as part of the pre-commissioning verification process.

Testing of major items must include, but not be limited to:

- Material tests
- Manufacturing tests
- Electro-mechanical and mechanical equipment tests
- Electrical equipment tests
- Control and monitoring equipment tests
- All ITPs, ITCs, material certificates, Original Equipment Manufacturer (OEM) test and certificates, performance curves and all other relevant documentation must be included in the FATs and Inspection Report.
8. Construction completion

Construction Completion is required prior to commencement of Pre-Commissioning.

The following activities will be captured within the Construction Verification Checklists. Construction Verification will include, but not be limited to:

a) confirmation that plant hardware is installed in accordance with the P&IDs and relevant drawings and meets the Specification
b) hydrostatic pressure testing of piping and tank systems including certificate of compliance for any plumbing or drainage works
c) valves checked for “clean” travel and correct sealing when closed
d) lubrication of pumps and assemblies
e) electrical test certification including certificate of compliance
f) checking tanks and pipelines have been installed and cleaned to ensure that all construction debris has been removed
g) compaction tests
h) concrete testing
i) CCTV inspections
j) inspections on buried pipeline or components prior to backfilling
k) delivery of construction mechanical and electrical ITPs, PEFD, FDS and SFAT documentation to WAC status
l) delivery of vendor manuals
m) check electrical integrity, including point to point testing, electrical tests for insulation, earth leakage, resistance to high voltage (HV)

n) instrument configuration in accordance with the IO list, units, ranges etc
o) valve, actuator and limit switch configuration
p) leak and pressure test water retaining structures
q) undertaking all pre-start-up activities as recommended in O&M manuals.

The above activities will be captured on construction ITPs and will be signed off by the SWC prior to commissioning activities commencing.

It is the responsibility of the Contractor to engage CA Team Representative at the relevant stage of the construction programme.

The Contractor must not pre-commission any part of the system until a punch list/defects walk has been completed and approval has been granted by the CA Team Representative in writing.

9. Pre-commissioning

Pre-commissioning is the checking/verification of individual components of sub-systems for correct installation, configuration and operation. Pre-Commissioning is performed on all new plant components once their basic construction or installation is complete.

The Contractor will undertake the pre-commissioning activities in conjunction with the commissioning team and vendors where applicable. These activities will be captured within the pre-commissioning ITPs and ITCs.

Pre-commissioning completion is required prior to commencement of commissioning.

Pre-Commissioning may include the following activities:

- Notice of Energisation (NOE)
9.1 Prerequisites for pre-commissioning

The Contractor must ensure the following are prepared and submitted to SWC in advance of pre-commissioning. The requirements may vary depending on asset type and complexity of the project. Some of these items may form part of the Commissioning Plan submitted at the first stage of commissioning:

a) a completed Pre-commissioning Checklist
b) FAT and Inspection Report(s)
c) where applicable, approved SFAT
d) ITPs and procedures for the pre-commissioning stage covering all items of plant and equipment
e) Installation Completion Reports accepted and endorsed by SWC’s subject matter experts (SMEs)
f) calibration certificates for equipment or instruments used for testing
g) all regulatory certificates and approvals required for the installation and the equipment obtained by the Contractor on SWC’s behalf
h) where applicable, MDRs for pre-fabricated equipment
i) all drawings including P&IDs marked-up to a Work As Constructed (WAC) condition
j) NOE (as applicable)
k) where applicable, issued for construction (IFC) copies of the FDS and PEFD
l) data loaded into TAR
m) completion of any required preliminary training programs (vendor training, for example)

n) where applicable, the asset Hazardous Area Dossier needs to be completed/updated as applicable to EEHA requirements and submitted for review before power can be applied to any electrical equipment or cables in a hazardous area
o) Construction completion documentation must be completed and submitted to SWC for approval
p) Commissioning and Cutover Plan Review meeting held
q) Updated Defects Register.

9.2 Pre-commissioning activities

9.2.1 Electro-mechanical and mechanical equipment

Electro-mechanical and mechanical equipment checks and testing will include the following, where applicable:

- Electrical energisation of motor control centres (MCCs) and field instrumentation
- Air compressor configuration - Setting of Load/Unload setpoints
- Valves checked for “clean” travel and correct sealing when closed
- Initial configuration and calibration of Field Instrumentation
- Motor Rotation Checks in Field mode
- Delivery of mechanical, electrical ITPs, FDS and SFAT documentation to IFC status
- Delivery of vendor manuals
- Instrument configuration in accordance with the IO list, units, ranges etc
- Valve, actuator and limit switch configuration
- Leak and pressure test water retaining structures
- Setting of pressure control/pressure sustaining and pulsation dampers
- Pump configuration
- Motor starter configuration and tuning.
a) Verify that equipment has not been damaged by transport or installation
b) Flushing of water retaining structures
c) Service pressure test pipework and valves for leaks
d) All delivery blocks and oils have been removed and equipment is ready for commissioning
e) Runs of rotating equipment, rotating direction, and performance of electric motors
f) Functional tests of equipment
g) Testing and adjustment of safety devices
h) Recording of key test / set points in TAR, (specifically PRVs and pressure vessels)
i) Check that equipment is correctly lubricated and lubrication reservoirs charged with suitable lubricant
j) Correct functionality of all site connected items on each motor drive, including Local Control Station (LCS), Latch/Emergency Stop push button, thermistor, motor anti-condensation heaters, etc.
k) Clearance, end play and operation of major bearings
l) Alignment of drive systems (by dial, feeler gauges and stainless shims or equivalent laser alignment), tightness of couplings, mounting of bolts, vibration, etc
m) Correct installation of guards, trip wires and other personnel safety equipment
n) Measure and record kW and current draw of each motor at no load
o) Measure and record the power factor at various loads, where possible
p) Level control of pumps
q) Valve positions and operation
r) Ensure the system has been cleaned and flushed
s) Ensure equipment storage plugs, locks etc. are removed
t) Check of lifting facilities
u) Registration of key equipment, (pressure vessels, bulk chemical storage tanks etc.), or update of existing details with WorkSafe NSW.

9.2.2 Electrical equipment

Electrical equipment checks and testing will include the following, where applicable:

a) Voltage tests
b) Trip tests
c) Functional tests
d) Electrical integrity tests, including electrical tests for insulation, earth leakage
e) Resistance to high voltage
f) Testing and adjustment of safety devices
g) Check of ranges/settings of equipment
h) Instrument power up, configuration, including unit and range setting.

NOTE: Instrument setup and parameterisations details to be extracted from instruments and provided as part of O&M Manuals.

i) Electrical continuity and electrical earthing tests
j) Check maintained emergency and exit lights
k) Check two way switching operation
l) Check operation of photo-electric cell and override switch
m) Check type, number and locations of light switches and GPOs
n) Correct operation of all field connected items
Commissioning - transitioning assets into operation

- o) Electrical point to point checks
- p) Installation diagrams for installed instruments
- q) Visual inspection of labelling and terminations of electrical wiring
- r) Visual inspection of cable pits
- s) Visual inspection of electrical wiring on cable trays
- t) Visual inspection of electrical wiring in conduits
- u) Set up and programming of VSDs and soft starters
- v) Profibus network testing
- w) Fibre Optic testing (OTDR)
- x) Network redundancy testing
- y) Power redundancy testing.

NOTE: The setup is limited to motor nameplate details, motor protection settings and other parameters to enable “bump” testing of the motors.

Records of parameters are to be recorded and supplied prior to testing of any motors.

9.2.3 HV Electrical works

Electrical equipment checks and testing will include the following, where applicable:

- a) Insulation resistance tests
- b) Voltage withstand tests
- c) Ductor tests
- d) Phase rotation tests
- e) Polarity checks
- f) Primary injection testing of CTs
- g) Secondary injection testing of protection relays.

9.3 Pre-commissioning completion requirements

When pre-commissioning is completed the Contractor must ensure the following requirements are fulfilled before commissioning commences:

- a) Asset Isolation Plans - if required
- b) Copies of WAC drawings available including P&IDs (redline mark-ups are permissible.) and stored on site. A current copy of electrical drawings must be kept in the switchroom or kiosk at all times once switchboards are live
- c) manufacturer’s trial run records/ test certificates of equipment available including performance tests
- d) Decommissioned and disposed assets list
- e) Supplier/vendor Instrument calibration records
- f) Updated Commissioning Plan
- g) Project Safety Plan covering the commissioning work including the required SWMS for the commissioning tasks
- h) Environmental Management Plan (EMP) covering the commissioning work of the project
- i) where applicable, draft Plant Operations Manuals for the asset (treatment facilities)
- j) where applicable, draft Process Equipment Asset Specifications for the asset (treatment facilities)
Commissioning - transitioning assets into operation

l) where applicable, up to date FDS and PEFD
m) where applicable, a completed SFAT has been conducted for the Asset(s)
n) commissioning team and other critical personnel have sufficient training to enable asset to be commissioned
o) if the Works change the hydraulics of the asset and network or impact flow monitoring equipment, then notify Hydrographic Services to recalibrate flow instrumentation
p) where applicable, Software SAT (SSAT) scripts are available
q) updated Project Risk Register
r) proof of compliance with statutory and regulatory requirements
s) defects/punchlist walk with key stakeholders completed
t) updated defects register
u) no category ‘A’ defects
v) a completed Pre-commissioning ITP

The Contractor must pre-commission all Components, together with their ancillaries, and rectify any non-conformances in accordance with the Contractor’s Quality Plan.

On Water assets, the asset must be appropriately washed / cleaned / disinfected and followed up with appropriate sampling to demonstrate cleanliness before proceeding to wet commissioning.

10. Commissioning

Commissioning will be performed on components and sub-systems, once pre-commissioning is complete. The Commissioning Team will also undertake testing activities in conjunction with suppliers or vendors where applicable.

Commissioning will be conducted in 3 stages as follows:

a) **Dry Commissioning** includes dry tests on equipment and systems to confirm initial configurations, fail safes and operation

b) **Wet-Commissioning** is the process used to determine the control system operates in accordance with the FDS and involves the initial setting of control loops. This process should determine that all process controls and safety interlocks are fully operational.

c) **Process Commissioning** *(Only required on assets with a process component)* relates to the demonstration that the upgraded asset and all associated components integrate and operate as intended. The plant must be brought on-line with product and all the systems necessary to operate the asset must be fully tested and commissioned.

10.1 Dry-commissioning

This phase will typically consist of testing dry running equipment, in particular electrical power, component testing and “end to end” testing of the RTU/PLC, SCADA/IICATS interface and mechanical equipment as applicable. These activities will be captured on dry-commissioning ITPs and ITCs and will be signed off prior to Wet-Commissioning by the relevant Commissioning Representative.

Example testing requirements for Water and Sewer pumping stations are detailed in a series of standardised testing sheets (PSATs), which are included in Appendix H & I.

Dry-Commissioning will include, but it is not limited to:

a) initial configuration of Operator set points and alarm values
b) initial configuration of PRVs, PCVs and associated hardware
c) confirmation of ‘Fail Safe’ mechanisms
d) network communications verification
e) checking the electrical instrumentation and control systems input and output signals in conjunction with the RTU/PLC and SCADA/IICATS system
f) SCADA/IICATS picture testing and screen navigation
g) checking equipment operation and remote lockout from LCS
h) rotation checks (bump test) of all pumps and motors
i) dry-run functional tests, where possible
j) calibrate and test all instruments and analysers
k) simulate fault condition tests
l) check interlocks, RTU/PLC and SCADA/IICATS logic
m) alarm handling, including local and SOC Alarms
n) dry tests for the asset including but not limited to all mechanical and electrical equipment, instrumentation, control and SCADA systems, alarm annunciators, set points.

10.1.1 Prerequisites for dry-commissioning

The Contractor must ensure the following are prepared and submitted to SWC in advance of dry-commissioning any component, system or sub-system. The requirements may vary depending on asset type and complexity of the project. Some of these items may form part of the Commissioning Plan submitted at the first stage of commissioning:

a) where applicable, Asset Isolation Plans and Permit to Work
b) where applicable, completed Software FAT (SFAT) (SCADA sites)
c) where applicable, approved Software Download Plan (SDP) (SCADA sites)
d) for existing IICATS sites, an Operational Change Request (OCR) may be required by Network Operations. The OCR will be submitted by Network Operations to SOC
e) where applicable, SOC notified Dry-Commissioning is in progress (IICATS sites)
f) approved RTU/PLC and SCADA/IICATS software downloaded
g) temporary bypass systems in place (if applicable)
h) ITPs and procedures for the dry-commissioning stage covering all items of plant and equipment
i) calibration certificates for equipment or instruments used for testing
j) all drawings including P&IDs marked-up to a WAC condition
k) IFC copies of the SSAT, FDS and PEFD
l) pre-Commissioning ITP completed.

10.1.2 Dry-commissioning completion requirements

a) WAC drawings available including P&IDs (redline mark-ups are permissible)
c) draft WAC FDS and PEFD detailing any amendments made as a result of dry-commissioning tests
d) functional “End to End” testing of devices completed
e) IICATS program(s) are normally downloaded to the site RTU via the mobile network
f) device mode of operation verified. (Field, Manual & Automatic)
g) device Interlocks and alarms tested
h) instrument and control device parameters recorded. This includes motor starter setup information. Configuration to be backed up from device.
i) motor rotation and range of operation confirmed
j) Local and Remote alarms verified
10.2 Wet-commissioning

Wet-commissioning will be performed on plant components and sub-systems, once dry-commissioning is completed. Where available wet-commissioning will be carried out using potable/recycled water.

Wet-Commissioning is the process used to determine the control system operates in accordance with the FDS and involves the initial setting of control loops. This process should determine that all process controls and safety interlocks are fully operational.

Facilities may be broken down into sub-systems composed of interrelated equipment and other components for which functional testing has been completed. Each system will then be tested to demonstrate that it operates in the manner designed. Individual commissioning ITP’s will be developed for each sub-system that is to be tested and signed off.

For Water and Sewer pumping stations, example testing requirements are detailed in a series of standardised testing sheets (PSATs), which are included in Appendix H & I.

Wet-Commissioning will include, but it is not limited to:

a) any Statutory approvals have been obtained before wet testing (e.g. approval to discharge)
b) initial priming of pumps and process pipework
c) initial setting and confirmation of process control loops
d) initial calibration of process instruments
e) vibration and Noise testing of mechanical equipment identified in Technical Specification - Mechanical
f) all instruments have been calibrated and test/calibration sheets have been completed. These must include any internal setting/set points and a hard copy output detailing the parameters set (particularly applicable to drives or instruments with internal ranges and parameters)
g) check performance of equipment to the requirements of the Contract
h) check integration of controls systems particularly with off-site equipment
i) wet-run performance tests with one of the scenarios on the most critical operating condition
j) submission of power factor correction report as applicable
k) submission of harmonic analysis and correction report as applicable

Not all equipment or controls may be able to be tested before wastewater or process fluid is introduced. The Commissioning Plan must clearly state if this is so and must include steps to manage the associated risk.

The Contractor must carry out all the necessary adjustments until the Components are ready and suitable for starting and running under all operating conditions. Tests must be carried out to verify that the Components will meet operational requirements of the Contract under conditions replicating the operational range as much as possible. The scope must include any specific tests nominated in this Contract for particular items of plant and equipment. The Contractor is required to simulate the conditions necessary for the proper operation of all Components including stoppages due to simulated power failure.

During the wet tests, the Contractor must ensure the following work has been completed:

a) any Statutory approvals have been obtained before wet testing (e.g. approval to discharge)
b) all instruments have been calibrated and test/calibration sheets have been completed. These must include any internal setting/set points and a hard copy output detailing the parameters set (particularly applicable to drives or instruments with internal ranges and parameters)

c) check completeness of entire installation paying particular attention to integration of sub-systems

d) check performance of equipment to the requirements of the contract

e) check integration of controls systems particularly with off-site equipment

f) wet-run performance tests based on various operating scenarios including worst case conditions and other conditions as required for reliable operation (i.e. high, low flow, emergency PLC settings and so on)

g) submission of power factor correction report as applicable

h) submission of harmonic analysis and correction report

i) operations and maintenance training completed, prior to cutover and TOM, as applicable.

j) software Pre-SAT (PSAT) including functional testing of all phases of operation in accordance with the FDS.

k) software Site Acceptance Testing (SSAT) - NB: Timing of Software SAT can be project dependent. On sites where testing on water is not possible, this will be undertaken concurrently with the overall asset SAT.

l) updated defects register

m) where progressive systems commissioning is required, provision of warranty period preventative maintenance job plans to TAR.

n) no category ‘A’ defects

o) a completed wet-commissioning ITP (with details of requirements (a) to (m) above.

The Contractor must update all data in the TAR on a weekly basis during the wet testing period of the asset(s) until completion of the works.

Wet testing must be completed before process fluid is admitted to the Component.

10.3 Process commissioning

The Process Commissioning phase relates to the demonstration that the upgraded asset and all associated components integrate and operate as intended. The plant must be brought on-line with process fluid/product and all the systems necessary to operate the asset must be fully tested and commissioned. The process commissioning may happen altogether or by sub-system, according to the natural flow of the asset’s processes.

The Contractor must prepare and submit a Cutover plan to detail the implementation of these operations safely and effectively. A draft of the Cutover Plan should be included with the commissioning plan and updated prior to its execution as necessary. For treatment facilities, the cutover plan should be developed in accordance with IMS0038 ‘Treatment Plant Operational Change Management’.

a) final tuning of process control loops

b) final calibration of process instruments

c) confirmation of process flows

d) confirmation of effluent quality

e) update of all project documentation to WAC status

f) delivery of Commissioning ITPs.

Process commissioning must include the following:

a) Integrated Asset Commissioning is the phase in which all newly commissioned and existing systems are integrated together to be tested and operated in their final process arrangement.
b) Process Optimisation is the period of operation with process fluids immediately following cut-over or seeding in which equipment and control setting are adjusted and tests conducted for a period to ensure the Components operate as intended.

The Contractor must commission all Components with process fluid to prove the components operate reliably in actual flow conditions with fully automatic operation including correct start up, shutdown and emergency shutdown sequences, and stoppages due to simulated power failure.

Each component must be tested over its full range of operating conditions which can be reasonably simulated / achieved at the time of the tests. The tests must be designed to demonstrate the component’s compliance with design hydraulic, mechanical, electrical control and occupational noise criteria.

10.3.1 Integrated asset commissioning

After successful commissioning of all assets, the Contractor must commission the integrated asset/plant, comprising new and existing Works.

The Integrated Asset must be operated continuously over its full range of operating conditions, which can be reasonably simulated/ achieved during a process proving period.

10.3.2 Process optimisation

During this time the Contractor must conduct various relevant tests, carry out all necessary adjustments, and optimise the Component until it performs reliably and as intended under a range of service conditions in automatic mode to demonstrate performance compliance. It is likely process optimisation will be ongoing from Process commissioning through to the end of the proving period.

Any process control modifications are to be recorded within the FDS.

11. Site acceptance testing (SAT)

Site Acceptance Testing is formalised testing prior to final cutover and putting assets into ongoing operation. There are three key stages to SAT.

a) **Pre-SAT** is an internal SAT conducted by the Contractor to ensure all systems are performing as intended prior to the formal SAT

b) **SAT** is the formal test conducted prior to the introduction of process fluids and will be witnessed by the CA Team

c) **Operational Test** is the period of a number of continuous days, as specified (refer to Project Specification) during which the assets must operate reliably in the intended manner. For operational test, the asset must be selected in automatic sequence mode (all modes should be tested as applicable) and in automatic equipment control mode at the SCADA interface. Plant Operations Manuals must be adjusted as applicable based on actual asset operation.

11.1 Pre-site acceptance testing (PRE-SAT)

The Contractor is to conduct a Pre-SAT on all process or sub-systems prior to the formal SAT, to eliminate any wiring, software or equipment functionality issues.

A Pre-SAT must be carried out once:

- the system or sub-system has been dry and wet commissioned
- the system or sub-system post FAT software has been downloaded.

SWC will not normally witness the Pre-SAT but must have the right to do so.

The signed copies of the Pre-SAT ITP must be available for review on the day of the SAT.

The Pre-SATs must itemise and cover all tests associated with the relevant section of the FDS.
11.2 Site acceptance test (SAT)

SATs will include, but are not limited to:

- Functional Testing of all phases of operation
- PLC/SCADA system operation and Alarm Handling
- All alarms and control functions are operable (electrical simulation not acceptable)
- Functional check on interlocks and control systems for the entire plant
- Integration of the asset with existing operations
- Local, Remote testing of devices
- Duty/Standby/Assist testing of process units
- Functional testing of components and sub-systems
- Initial PID Loop tuning
- Flow, temperature and pressure control
- Other process performance testing and monitoring as required by the specification.

During FAT or SAT, if equipment is subjected to considerable wear and tear, it must be replaced by the same specification of new equipment at the Contractor’s expense.

11.3 Operational test

Operational Tests must be carried out by the Contractor to prove compliance with the hydraulic, mechanical, electrical control and occupational noise requirements set out in the Project Specification and other parts of this Contract. During the Operational Test, Components or part thereof must be tested under the worst operating hydraulic and/or all loading conditions for a sufficient period of time to validate the performance of the Component.

All documentation including SOPs, O&M manuals, WAC drawings and Asset Management Maintenance Systems Data must be adjusted as required to reflect any modifications and the actual operation following Operational Testing.

The acceptance criteria for the Operational Test is that the Component must operate continuously for a specified period of days, 24 hours a day (unless agreed otherwise by SWC) meeting all hydraulic, mechanical, electrical control and occupational noise requirements as stated in the Contract and other parts of this Contract, under automatic mode of operation without any category ‘A’ defects.

12. Operationally ready

After successful commissioning, SAT and Operational Test, activities may commence to transition the asset into ongoing operation.

Once an asset is accepted as being Operationally Ready, from that point forward it will be operating for its intended purpose, monitored by SWC. At this stage the assets will be cutover to for ongoing monitoring, with defined contacts for the Contractor for failures and call outs. On IICATS sites an OCR will be required to define where SOC directs contact in the event of a failure.

Making an asset and associated system(s) operational will generally require the following to take place:

(a) Minimum Operation Deliverables are to be submitted to and accepted by SWC

(b) Interim Operating Modes occur when discrete systems or part of a system may be in an operational state, however SWC will commence and continue to operate the system in conjunction with the existing equipment, systems and facilities to maintain asset capacity and performance
12.1 Minimum operation deliverables

To enable assets to be placed into ongoing operations, specific activities and documentation must be completed. The items below are the minimum requirements; and must be met. Other site-specific requirements to accelerate transitioning assets to ongoing operation are to be agreed with SWC as required. Additional requirements for specific works will be specified in the Contract:

a) All assets labelled (temporary labelling)
b) All relevant assets in TAR (and verified)
c) Clear operational instructions, call out contacts etc.
d) Alarm help information available (IICATS)
e) Draft Contingency Plans, uploaded to TAR
f) Red Line markups of WAC Drawings
g) Completed Site Acceptance Tests (SATs), including automation and control test results
h) Asset Inspection and Defects walk conducted
i) Defects Register (e.g. non-conformances, defects) updated, including any items identified during Pre-Commissioning and Commissioning
j) No “A” Category defects
k) Draft O&M manuals
l) Draft Plant Operations Manuals and Process Equipment Asset Specifications
m) HIDRA updated to reflect upgrades (for Linear Assets e.g. Rising Mains)
n) Draft maintenance plans
o) Site must be safe for ongoing operation and maintenance activities

12.2 Interim operating modes

Interim Operating Modes may be required for operational reasons or due to complicated constructability issues or for staged cutover of assets. The use of interim operating modes is subject to agreement by all operations, maintenance and commissioning stakeholders.

After successful Commissioning of discrete systems (Commissioning Work Lots), SWC will commence and continue to operate the System in conjunction with the existing equipment, systems and facilities to maintain asset capacity and performance. Systems may be required to operate in an Interim Operating Mode, either in an Automatic or a clearly defined Manual control sequence, under the instructions of the CA Team in consultation with operations.

The Contractor must remain fully responsible for the performance of the Works. Systems will not be able to be operated in Interim Operating Modes unless the requirements of section 12.1 have been achieved. SWC will maintain the works in accordance with preventative maintenance plans from TAR, or as agreed by SWC prior to accepting assets for interim operation.

Operations personnel and the Commissioning Team must co-ordinate and work together to monitor all new plant SCADA alarms as part of on the job training for the upgraded asset operation. SWC will advise The Contractor of any system failure of breakdowns for the purpose of defects liability periods.

In Network Facilities, Temporary Operating Modes, (TOM), are known as Interim Operating Procedures, (IOP).
12.3 Final cutover
Following successful SATs the Contractor must cutover and allow process fluids to enter the component. All activities and tests that were performed during the wet testing stage must be re-tested following the cut-over to ensure that there is no abnormal operational performance difference following the introduction of process fluids. The Contractor must install the control system works or modifications for the relevant component and have them fully functional and ready for use by the operators before the cutover is implemented.

The Contractor must be responsible for the dewatering, sludge and debris removal and cleaning of existing or new structures/equipment to a condition necessary to facilitate each cutover.

13. Process proving
The process proving period is the nominated duration that the asset must demonstrate that it meets or exceeds the performance requirements, specified in the Contract. During the process proving period the asset must operate as a complete unit and all new equipment will run under conditions as close as practicable to specified load conditions. The asset will be operated in accordance with the process manuals as applicable and consistent with specified automation.

Process proving will be conducted as soon as practicable following the integrated commissioning and/or SAT of the asset.

At treatment plants and manned assets, SWC operators must be fully trained prior to the commencement of the process proving period and will operate the plant during the process proving period under the technical control and instruction of the Contractor.

Where assets under test operate outside of normal working hours, the Contractor must put into place a suitable system of notification with SWC to enable SWC Operations to advise the Contractor of urgent issues.

Any modifications to the plant, control systems, set-points, circuitry, and the like must be carefully recorded, communicated to operations staff and all relevant documents updated.

During the process proving period, the collected data will be compared to the performance requirements, which are specified in the Contract. The process proving must continue until such a time that the specified performance requirements are met continuously for the nominated period. If, during the process proving period, the plant fails to meet the specified performance requirements, then the provisions of Section 4.3 must apply. The process proving must continue until there is an uninterrupted specified period meeting all the specified performance requirements.

During the process proving period, the Contractor will provide weekly test reports (in Microsoft Excel or Microsoft Word) to SWC. The weekly test reports must include test results, a log of alarms and any equipment failures and details of any operator attendance at the plant outside the normal attendance times. If any results which do not meet the requirements or operators are required to attend the plant outside normal attendance hours, the Contractor must notify SWC immediately.

The Commissioning Report will be revised at the end of the process proving and provided to SWC for review.

13.1 Process proving tests
Where required, Process proving tests must be carried out by the Contractor to prove compliance or otherwise with the specified performance requirement using sampling and test methods specified in Section 0. The Contractor must take into account the turnaround time for sampling and testing. The recording, sampling and analyses parameters and frequency will be in accordance with specific performance requirements in the Contract.
During the process proving, assets or part thereof will be tested under the worst operating hydraulic and/or all loading conditions for a sufficient period of time to validate the performance of the asset.

The Contractor must monitor and record the consumption of all consumables such as power and chemicals during the process proving period. The levels in chemical storage tanks will be recorded at the start of the process proving period, at the completion and before and after any delivery. Here instruments monitor the levels, the level will be verified by physical measurement.

SWC may elect to take samples for analysis and to record an independent set of test results for evaluation.

13.2 Staffing during process proving

SWC will provide to the Contractor, normal operating staff for operating the plant under the technical control and instruction of the Contractor during the process proving period.

The Contractor must make allowance for suitable 24-hour on-call support during the performance testing and proving period. Depending on the nature of the project this will include but not be limited to the following:

a) Engineering Support - Commissioning and Control System Integration
b) Mechanical Support - Fitters etc
c) Electrical Support - Electricians and instrumentation specialists.

This support must be able to respond to site within 1-hour of the call out made by the relevant SWC staff.

13.3 Quality testing

Where applicable, the Contractor must prepare an interim report for each week during which sampling is carried out. The weekly report must include an analysis of data for that week plus that from the preceding week(s). Both reports must be issued within 24-hours of all analyses being completed and must be transmitted by email to SWC. SWC may require the frequency of reporting to be increased depending on the nature of the results.

The Contractor must ensure no results are missing in the weekly reports. Duplicate samples suitably preserved for analysis must be retained, should SWC require substantiation of the results or results do not meet the quality assurance requirements.

The Contractor must analyse duplicates on any samples, which do not conform to the limits specified in this Contract. The repeat analyses must be carried out at the Contractor’s expense. Should the result remain outside the limits, SWC must be notified immediately during working hours, or the next working day if analyses are performed out of hours or on a weekend or public holiday. SWC will approve the format and content of the reports.

14. Project completion

Project completion will normally occur after commissioning is complete, and all final documentation has been accepted by SWC. Site works remain the responsibility of the Contractor until the Completion of Contract.

14.1 Prerequisites to project completion

The conditions for project completion include but are not limited to the following:

a) successful completion of Pre-FAT, FAT, Pre-SAT and SAT and approval of all test sheets
b) successful completion of commissioning, including reviewed and approved Commissioning Report
c) all NCRs resulting from FAT and SAT have been rectified and signed off by SWC
d) removal of redundant equipment and restoration of the site
e) all redundant cables be removed. Where it can be demonstrated as impractical, cost prohibitive or unsafe to remove all or a part of the cable, the cable needs to be made safe in accordance with Technical Specification - Electrical
f) closure of all items in omissions and major defects list
g) Preventative Maintenance Schedules completed
h) Signed off Commissioning Handover checklist (or completion of document submission workflow on SWC’s project management system).

14.2 Document submissions

Typical document submissions for acceptance are presented in Table 14.2-1 below, for specific project requirements refer to the project Scope of Works document.

Table 14.2-1: Document Submissions

<table>
<thead>
<tr>
<th>Document descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction ITPs &amp; ITCs</td>
</tr>
<tr>
<td>Commissioning ITPs &amp; ITCs</td>
</tr>
<tr>
<td>Test &amp; Calibration Certificates</td>
</tr>
<tr>
<td>FAT, SAT Test Records</td>
</tr>
<tr>
<td>WAC Drawings</td>
</tr>
<tr>
<td>WAC Needs Specification (where applicable)</td>
</tr>
<tr>
<td>WAC Design Report (where applicable)</td>
</tr>
<tr>
<td>WAC FMECA and Reliability Block Diagram for the assets</td>
</tr>
<tr>
<td>Verification Certificate issued by SWC advising Asset Information is complete</td>
</tr>
<tr>
<td>WAC Approved Operations and Maintenance Manuals</td>
</tr>
<tr>
<td>HYDRA data sheets (where applicable)</td>
</tr>
<tr>
<td>Environmental Records</td>
</tr>
<tr>
<td>Community Relations Records</td>
</tr>
<tr>
<td>Software Programs</td>
</tr>
<tr>
<td>WAC FDS, PEFD</td>
</tr>
<tr>
<td>Updated Plant Operations Manuals and Process Equipment Asset Specifications</td>
</tr>
<tr>
<td>Warranties transferred to SWC</td>
</tr>
<tr>
<td>Operation and Maintenance Training Records and Training Material</td>
</tr>
<tr>
<td>Recommended List of Critical Spares (Based on Critical Spares Assessment)</td>
</tr>
<tr>
<td>Decommissioned Assets Register</td>
</tr>
<tr>
<td>Other handover docs as required in I&amp;C and SCADA standards</td>
</tr>
</tbody>
</table>

14.2.1 Work as constructed drawing submissions

WAC drawings require a review and approval process with SWC prior to acceptance. All drawings will be submitted via SWC’s Engineering Drawing Management System (EDMS). This process needs to be completed prior to handover, and timeframes for review and approval should be considered when submitting.
14.2.2 Operation and maintenance manual submissions

O&M manuals require a single hard copy submission (in addition to electronic submission), provided as detailed in section 17.6, and to be kept at the facility.

14.3 Handover of documents

All documents are to be submitted in electronic format to SWC via USB, File Transfer or other agreed method to enable SWC to upload the files to SWC’s controlled electronic filing system (currently SWIM).

All documents supplied in electronic formats must conform to the following:

- each document must be supplied as a single file. Where documents are made of several files, they are to be made into a single consolidated file.
- documents must not contain links to other documents. References to other documents are permitted.
- all electronic files provided to SWC must not be password protected, locked or read only
- electronic copies of all documents must be supplied in their native formats as well as in PDF format.

14.3.1 File naming convention

File names must consist of the following components:

- Facility Number - Asset Number File Name - date as per following example
- SP1234PMP02 Operation & Maintenance Manual 04-05-09.

Where there are documents common to several assets, only one document is required and including all identified asset numbers associated followed by an electronic file names must be kept to a minimum character length (maximum of 128 characters).

14.4 Critical spares and special tools

The Contractor must consult with Supply Chain Operations to conduct a spares assessment on all OEM and non-OEM spare part and rotatable equipment requirements. This is to ensure SWC maintains the right and adequate spare parts into inventory within the SWC Supply Chain network, which supports forward maintenance activities once assets are operational.

The following clauses are applicable to all new installations:

- The Contractor must complete a critical spares assessment in consultation with Supply Chain Operations
- The Contractor will recommend a list of spare parts and stock levels inclusive of description, part numbers, supplier details, price, recommended minimum stock level and re-order level
- Following consultation with SWC, the initial stock of spares must be procured by the Contractor and must be delivered to SWC prior to handover
- The Contractor must provide a recommended list of special tools and software for maintenance purposes (e.g. program loader and proprietary software etc.). All recommended special tools should be supplied prior to hand-over.

14.5 Warranties

The Contractor must obtain warranties as specified in the Contract and must ensure that SWC will have the benefit of the warranties. The Contractor must ensure that SWC will have the benefit of any warranties specified in the Contract that are obtained by subcontractors.

14.6 Maintenance plans and maintenance handover

Preventive maintenance “Job Plans” need to be produced by the Contractor against each asset number and provided to the asset data management team for inclusion into TAR prior to handover. The Contractor must
allow for a meeting with the Responsible Engineer (Treatment) or Operations Representative (Networks) to discuss if standard SWC Job Plans are applicable or if new Job Plans need to be created. The Contractor should also consider if normal ongoing Job Plans are sufficient or if there are specific warranty or defect liability period Job Plans required.

15. Decommissioning and disposal of assets

Any assets that are redundant, being decommissioned or replaced as part of the works, or as specified in the Contract must be either disposed of or made safe, decommissioned correctly and associated site documentation updated to reflect its state.

The following key considerations must be made when decommissioning assets:

a) List of decommissioned assets to be provided  
b) TAR must be updated with all decommissioned asset details  
c) Redundant cabling removed back to the switchboard  
d) Cells in switchboards decommissioned, blanked off etc as necessary  
e) Consult with SWC to confirm items that may be maintained for spares and returned to the warehouse for storage. This includes consultation with OTS for Instrument and Control related equipment.  
f) Update and revision of site labelling, including labelling of spare conduits to identify location and status  
g) Revision of current site drawings to reflect all decommissioned or redundant components and superseding of redundant drawings.

15.1 Decommissioning of redundant mains

Where linear assets are being left in ground they are to be grout filled using a product complying with SWC standard EPS504 or approved equivalent.

15.2 Update of spares inventory for decommissioned items

The Contractor will consult with Supply Chain Operations to assist with revising spares inventory for decommissioned equipment.

16. Asset specific requirements

SWC has many different assets, requiring varying commissioning approaches. This section details the general methodology and terminology to the different stages of commissioning, applicable across all asset types.

16.1 Linear assets

16.1.1 Water main specific

The following requirements are specific to water linear assets:

a) Testing will be in accordance with SWC’s Technical Specification - Civil, section C4.22  
b) The Contractor will ensure that all installation, cleaning, inspection, testing and commissioning activities comply with the relevant pipe manufacture’s technical guidelines  
c) The Contractor must allow for all necessary equipment and labour to carry out all filling, testing and disinfection works and to allow for planning and coordination with SWC and SWC’s nominated departments and personnel  
d) All drinking water mains must be disinfected in accordance with SWC’s latest procedure for disinfecting new water mains available ((SOP) WPIMS 5027 - Disinfecting New Water Mains)
e) The Contractor will submit a filling, testing and chlorination program to SWC to enable SWC to coordinate resources, schedule timing of works with SWC’s assets, and ensure sufficient supply of testing water (where appropriate). The Contractor must make all due allowances to accommodate SWC’s resourcing and timing for the supply of testing water.

f) If the results of any inspection or testing as specified above fail to meet the requirement of the Contract, the Contractor must carry out all necessary remedial works to satisfy SWC that the finished pipeline complies with all requirements. SWC may, at their discretion, request additional inspections or testing as necessary to demonstrate that the remedial works are satisfactory.

16.1.2 Pressure mains
The Contractor must test the pressure main in accordance with WSA04 and must ensure that all closing joints (i.e. PE to DICL or PE to PE) are tested to ensure these joints are adequate.

16.1.3 Relining works - testing and acceptance
The Contractor will conduct hydrostatic tests on SWC’s sewers and maintenance holes/access chambers, and house/property service lines as specified in this document and/or by SWC’s Authorised Person. The intent of such test is to:

either

identify leakage and establish leakage rates in SWC’s sewers HSLs and maintenance holes/access chambers prior to rehabilitation,

or

assess seal achieved through rehabilitation.

Testing method(s), alternative to those specified here will be given consideration provided the Contractor at tendering stage negotiates for such alternative(s), after providing specifications, advantages and cost of alternatives.

The Contractor is to demonstrate the quality of work through hydrostatically testing a minimum sample of sealed sewer assets (SWC’s sewers, maintenance holes, house service lines, etc) plus additional samples if excessive failures occur.

Extent/coverage of each test
Following are the extent or physical coverage of each test, to be performed independent of each other.

For SWC’s sewers, maintenance hole to maintenance hole will be considered as one complete testing. SWC’s Authorised Person however, may allow the test to be carried out in parts to satisfy other criteria e.g. hydrostatic head requirement, over-pressurisation of old pipes, water escaping through branch lines/HSLs, etc.

For HSLs the test must be carried out from the junction at SWC’s sewer (including the junction) up to the top of vertical at the boundary trap. Junction test must cover lengths on up and down stream of the junction opening, up to but excluding the joints, in the main sewer; and including the length of lateral up to and including the first joint.

The maintenance hole test must exclude any conduit length but must include the first joint between conduit and maintenance hole. Full height of maintenance hole must be included in the test unless the rehabilitation was specifically restricted to lesser height or the height is prohibitive endangering the structure. In such cases SWC’s Authorised Person will provide guidance.
Equipment

The Contractor will have all equipment(s) required for conducting hydrostatic tests. The equipment must include such items by which a line between two maintenance holes can be sectionalized into at least three sections and hydrostatically tested. The equipment and arrangement should be such that length and hydrostatic head (pressure gauges) at both ends of each section under test (especially middle section) can be precisely measured from ground level. Mechanical or pneumatic plugs can be used.

For testing of junctions up to first joint in the laterals will require lateral packers.

To conduct tests quickly and save water, the Contractor may have to use mobile water tankers with attached pump sets.

Test procedures for sewers

In both SWC’s sewers and HSLs, junctions and connections in the line may have to be isolated to restrict hydrostatic tests within intended segments only.

The hydrostatic head requirement for the tests must be as follows:

a) The hydrostatic head for testing HSLs will be up to ground level at the vertical pipe. The pipe connection to vertical pipe, leading towards the building/lowest gully, must be plugged during this test.

b) The hydrostatic head for testing SWC sewers must be 1,000 mm above soffit of the pipe at the highest point and must not exceed 2000 mm at the lowest point.

c) Hydrostatic tests must be carried out after appropriate flow control and diversion measure. This includes notification to the residents regarding their use of water during the duration of tests.

d) The test must be started by first filling up the pipe line segment (or its section, as appropriate) under test with water up to the desired level and allow 10 minutes. Refill line up to the specified level and start the clock. Replenishing water continuously, if necessary, for next 5 minutes and maintain the hydrostatic head at the same level. Note: Volume of water added in the 5-minute period. This is referred to as replenishment volume.

e) Repeat the exercise one more time, by topping-up, and replenishing water for 5 minutes. Therefore, each test would yield two 5-minute replenishment volumes.

In case a pipe cannot be filled up to the desired level, despite consuming water three (3) times the volume that is being filled, then SWC’s Authorised Person may decide to abandon the test and declare the seal to be defective.

The leakage rate from each test will be calculated by the following formula:

\[
lps \text{ post grouting} = \frac{(Second \text{ Replenishment Volume \text{ in mL}})}{(Pipe \text{ diameter \text{ in mm} \times length \text{ in m})} \times 12
\]

The Contractor must measure test lengths of sewers for calculating the above rate.

Test procedures for junctions up to first joint

The hydrostatic test must be carried out by using lateral packers. The packer lengths must be such that it will be able to isolate the junction and first joint from rest of the main or lateral connection.

The test must be carried at a pressure of 5 PSI and held for 60 seconds.

Test procedures for maintenance holes

The procedure for hydrostatic testing must be as follows:

a) Plug all pipe connections at the maintenance hole, arrange flow control and diversion
Commissioning - transitioning assets into operation

b) Fill maintenance hole to rim with water
c) Wait 10 minutes
d) Refill with water
e) Measure water loss at the end of 10 minutes

The Leakage rate must be calculated by the following formula:

\[
\text{Elm Post Grouting} = \frac{(\text{Second Replenishment Volume in Litres})}{(\text{Diameter of Pipe in mm} \times \text{Length of Pipe in m})} \times 100
\]

Test procedures for grouted liner end sealing

The procedure for hydrostatic testing must be as follows:

a) Plug all pipe connections at the maintenance hole with plug at least one meter from the outlet/inlet(s), arrange flow control and diversion
b) Fill maintenance hole to a minimum of 1-meter head above pipe soffit
c) Wait 10 minutes
d) Measure refill volume with water to initial test level mark

Acceptance testing of rehabilitated works

Acceptance test for leakage seal must be carried out on the following rehabilitated items:

- Maintenance hole
- House service line (grouted)
- Main line (grouted)
- Main line (grouted/lined) to junction seal
- Main line liner to end seal.

SWC’s Authorised Person will nominate batches of items for testing approximately one month after completion of rehabilitation of the sewer asset.

The minimum number of compliance tests for each item of work is set out in the following table.

<table>
<thead>
<tr>
<th>Sewer asset item</th>
<th>Contractor testing</th>
<th>Independent auditor testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance hole</td>
<td>10%</td>
<td>Variable</td>
</tr>
<tr>
<td>House service line (grouted)</td>
<td>10%</td>
<td>Variable</td>
</tr>
<tr>
<td>Main line (grouted)</td>
<td>10%</td>
<td>Variable</td>
</tr>
<tr>
<td>Main line (grouted) to Junction Seal</td>
<td>10%</td>
<td>Variable</td>
</tr>
<tr>
<td>Main line liner to junction seal</td>
<td>10%</td>
<td>Variable</td>
</tr>
<tr>
<td>Main line liner to end seal</td>
<td>10%</td>
<td>Variable</td>
</tr>
</tbody>
</table>

The Contractor will undertake hydrostatic testing on each batch within three weeks of advice from SWC’s Authorised Person. The first round of each batch test must be completed within two weeks.
The round testing of each batch must be at least 10 samples or multiples of 10. If more than one out of 10 tested from any batch fails against the acceptance criteria, then an additional round of testing of equivalent sample size must be undertaken.

Failure of any round of testing will lead to further rounds being tested up to the total number of samples within that batch.

If at any stage of the testing, the total pass rate (i.e. sum of the individual pass tests (excluding re-tests for reworked items) / total number of tests carried out (excluding re-tests for reworked items)) is less than 80% then the Contractor has to demonstrate the quality of remaining completed work. Individual Acceptance Testing as referred to in the following Acceptance Testing Flowchart must be carried out.

There are two stages in the progress of work when reconciliation of the overall acceptable pass rate to actual performance is made. One at approximately 80% of the item’s progress completion and another at total completion of the work. In both cases, if the pass rate is less than 90% then the Contractor will carry out Individual Acceptance Testing to demonstrate quality of the remaining untested items and to raise the overall pass rate to 90% or above.

The Contractor will advise SWC’s Authorised Person of the time and location of testing to enable the witnessing of the tests if desired.

The Contractor will undertake approved testing method is required to demonstrate the quality of work for each item of work being tested. If un-rehabilitated HSLs cannot be isolated from main lines, then segmented or joint to joint testing method must be used.

The Contractor may propose alternative but proven methods of hydrostatic or vacuum testing that achieves the same objective as specified methods. SWC’s Authorised Person may accept or reject the proposed alternatives.

The Contractor will undertake the rectification work on items that fail the acceptance criteria and demonstrate sealing as per the criteria by subsequent hydrostatic testing. The Contractor will meet all costs for rectification work and re-testing.

Acceptance criteria for rehabilitated works

Acceptance of rehabilitation work will be at three levels:

a) Acceptance of individual work items tested:
   If any work item tested fails to meet the acceptable criteria, then it is considered to be defective and must be reworked and re-tested at the Contractor’s expense.

b) Acceptance of a batch:
   If more than 10% of the sample items tested within the batch fail, an additional batch of equivalent size must be tested. Failure of additional batches will lead to further batches being tested up to the total amount of work being undertaken under the contract.

c) Acceptance of the project (completion or at any stage of the work):
   If the progressive total failure rate of items during any stage of the work exceeds 20%, or if the progressive total failure rate of items at the reconciliation stage (approximately 80% of the work progress or when nominated by SWC’s Authorised Person) and at project completion exceeds 10%, individual tests on remaining untested items must take place until the total failure rate is 10% or less.
Table 16.1.3-2: Acceptable leakage of individual sealed items

<table>
<thead>
<tr>
<th>Item</th>
<th>Max allowable leakage</th>
<th>or</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full line hydrostatic test of grouted main line</td>
<td>5 mL/mm dia/m length/hr</td>
<td>10 L/test</td>
</tr>
<tr>
<td>Segmental hydrostatic test of grouted main line</td>
<td>5 mL/mm dia/m length/hr</td>
<td></td>
</tr>
<tr>
<td>Joint test of grouted main line (using packers)</td>
<td>1 joint/line (i.e. All other joints in the main line should be fully sealed)</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic test of grouted HSL</td>
<td>5 mL/mm/m/hr</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic test of grouted maintenance hole</td>
<td>.5% of theoretical volume/10 mins</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic test of grouted end seal</td>
<td>7 L/10 mins</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic lateral packer test of junction seal</td>
<td>No pressure loss over 60 seconds</td>
<td>10 L/10 mins</td>
</tr>
</tbody>
</table>

Note: For sewers in water charged ground:
MH leakage estimated from volume in invert after 10 minutes prior to HT test
Grouted lines and junction leakage - none visible from CCTV examination.
Maintenance hole theoretical volume of conical MH \( \pi \times 0.225 \times \text{depth}. \)
Acceptable leakage of multiple tested sealed items:
When SWC’s Authorised Person has nominated a batch of items for testing, the Contractor may propose changes to facilitate testing of multiple items in a single test, e.g. one or more liner end seals per maintenance hole, or a full line test with one or more rehabilitated HSLs.
The maximum allowable leakage must be the maximum allowable leakage of any individual item.

16.2 Reservoirs

16.2.1 General requirements
- Reservoir filling and operational tests must be programmed and executed so as not to adversely impact the continued operation of SWC’s assets.
- The Contractor must design and undertake tests to demonstrate the performance of each reservoir bypass, scour and overflow systems against the requirements of the specification.
- The Contractor must undertake the test in a manner that minimises the volume of water discharged to the environment. Water from the scour and overflow test must be discharged in accordance with SWC’s discharge protocols for water supply assets.
- A reservoir will only be emptied when absolutely necessary (i.e. especially during times of drought). A reservoir will not be emptied without the prior written approval of SWC.
- All sampling and testing will be undertaken in accordance with Section 0.

16.2.2 Reservoir filling
During the filling of each reservoir, the Contractor must:
  a) Demonstrate the air expulsion performance of the drinking water inlet main
  b) Test the rechlorination dosing system
Filling of reservoirs will be undertaken as follows:

a) Each reservoir must be filled in increments of 20% of its total depth until each reservoir is full. Determination and application of suitable and appropriate rates for filling and emptying of the reservoirs must be the responsibility of the Contractor.

b) At each depth increment, the level will be maintained for a minimum of 24 hours.

c) Following each 24-hour period, the Contractor must measure and record the level of each of the control survey marks on the ring beam of each reservoir to identify any settlement that may have occurred during that period and must inspect each reservoir for any evidence of leaks including visible wet patches, or defects which may cause leakage.

d) Each record of survey and inspection must be reviewed and certified by a structural engineer and submitted to SWC prior to commencing the next increment of reservoir filling. The Contractor must not proceed with filling if the survey identifies that any settlement at any control location has occurred or if there is any evidence of leaks. The Contractor must notify SWC of any settlement immediately along with advice from the Contractor's structural and/or geotechnical engineer of the cause of the settlement, the likelihood of further settlement and the possible consequences on the reservoirs or connecting pipework. Any leaks including visible wet patches, or defects which may cause leakage, must be rectified prior to continuing the filling procedure.

16.2.3 Sampling and testing

Specific sampling and testing requirements in the commissioning of reservoirs.

Should any sample fail to meet the acceptance criteria defined in the Contract, the Contractor must resample and test for each of the failed parameters. If the sample fails again, the Contractor must investigate the cause of the failed test and submit a recommendation of its proposed corrective action to SWC for approval. In the event that the Contractor's corrective action is unacceptable to SWC, SWC may instruct the Contractor of a more appropriate action or actions. The Contractor must implement the agreed corrective action and repeat sampling and testing for the failed parameter or as otherwise directed by SWC.

The Contractor must submit the test results, along with any data collated to SWC. SWC will review the data and the Delivery recommendation and advise the Contractor in writing of its acceptance or otherwise of the test results, the Contractor’s recommendation or any other information submitted with the test results. SWC shall advise the Contractor whether the reservoirs can be put into service or whether further sampling, testing or other action is necessary. The Contractor must be responsible for all additional sampling, testing, consumables or works necessary to achieve water quality acceptance and allow the reservoirs to be put into service.

Testing and sampling will include but not be limited to:

a) With each reservoir at maximum level, the Contractor must record the chlorine residual. Boost chlorine to 3 mg/L (free). Let water stand for 24 hours. The Contractor must investigate if chlorine is lost rapidly in each reservoir by developing a depth profile of chlorine residual over the full depth of the reservoir.

b) Metals scan using method number TM64TML. The results of the metals scan must be within the range level typically expected as provided in Table 13 Australian Drinking Water Guidelines (ADWG).

c) An organics scan using method number TC015. Due to the vast number of organic compounds that could be found within the drinking water supply and the limited information that can be available on acceptable levels in drinking water supplies, each organic compound with a positive result will have to be considered individually together with its toxicity level.

In the event of a positive result for organics, for each positive result the Contractor must:

i. Check any results for blanks and / or controls if applicable

ii. Identify if the compound is listed in the ADWG and if so at what acceptable levels
iii. Identify if there is any information in the ADWG Fact Sheets on the compound
iv. Identify if there is any information in the ChemWatch database or Safety Data Sheets (SDS) on the compound
v. Identify any other credible source of information regarding the compound and its likely impact on drinking water supplies
vi. Record toxicity levels if available
vii. Collate and review all the above available data and formulate a recommendation.

16.2.4 Reservoir operational test

Each Reservoir should be placed into service and commence the operational test when chlorine residual has reached target residual and all tests (including odour/taste) are satisfactory. If chlorine levels fall below 0.5 mg/L (total) prior to a reservoir being put into service, boost levels to 3 mg/L (free) for 24 hours, prior to putting into service.

The reservoirs must commence operational testing no later than one week after the completion and passing of all relevant tests. If for any reason this does not happen, the water quality testing must be repeated prior to commencement of the Operational Test.

17. Commissioning documentation

17.1 Training plan and training requirements

17.1.1 Training plan

The Contractor must train SWC’s nominated staff in the operation and maintenance of the works. The purpose of training is to teach SWC’s Operation and Maintenance personnel all aspects of operating and maintaining the works, ensuring reliable, safe and effective operation and maintenance under all conditions without supervision, direction or assistance of the Contractor. This will include operation of any HMI's, SCADA and software configurations for the various operational modes of the asset (auto, manual, field) as applicable.

The training must be conducted in a series of programmed half-day sessions attended by up to 10 persons per session, and include a mix of hands on and presentation based training. A training plan must be submitted and agreed with SWC prior to the commencement of training, unless agreed otherwise. The plan must include:

- Detailed agenda for the training session(s)
- Details of any supporting materials to be used to assist the session (e.g. O&M manuals, Plant Operations Manuals, Process Equipment Asset Specifications)
- Proposed date and times for the training.

The Contractor will issue to each of the nominated attendees a set of training handouts containing information that the Contractor considers as necessary to properly train SWC personnel. For treatment facilities, at least one training session must be recorded (video and/or sound) to facilitate future training of staff.

On manned sites, the Contractor must be prepared to vary the hours of training and run multiple sessions to fit in with the availability of staff and rolling roster operations. Unless noted otherwise, a minimum of one training session per operations/shift team is to be allowed for on treatment assets.

The Contractor will be responsible to confirm, in writing, the attendees of the training and evidence that the attendees have demonstrated the required degree of competence.
17.1.2 Training requirements

Training must cover all aspects of operation and maintenance of new equipment. This must include but not be limited to the following (these may not be all applicable to networks assets):

- **Overview** of the upgraded assets and processes, boundaries of the upgraded equipment and respective impacts on the existing equipment or process
- **Process Equipment Asset Specification Training** including process theory, operation principles, limitations and target performance criteria
- **Plant Operations Manual Training** to walk through updates that have been developed, demonstrate their application (including hands on training) and review the manual in the operating environment
- **Software/Operation Training** to be delivered by the Contractor and software integrator or their nominated representative who is knowledgeable of the FDS and control system. This training will explain detailed operation and background of the control system.
- **Maintenance Training** with asset maintainers to demonstrate key maintenance items, review lifting and access issued etc
- **Site Walk** of the upgraded equipment, to show physically the arrangements for operations and maintenance
- **Troubleshooting** information to assist O&M with ongoing issues that may arise with the new assets. This should focus on:
  - What do I need to look at?
  - What are the parameters it should be within?
  - What is the action if it is outside these parameters?
- **Supplier Training** for key equipment, covering maintenance and operations of the equipment. This may include hands-on maintenance training for replacement of maintainable items.

The personnel to be trained will have a range of backgrounds including plant operator, electrical trade, instrumentation trade, mechanical trade and professional engineer. The training may include one or more specialist sessions which provide more detail on those areas specific to a particular work discipline of the individual trainees.

17.2 Commissioning ITP register

The Commissioning ITP Register is a high-level document breaking down and identifying individual work elements within the overall commissioning works.

The Commissioning ITP Register will identify the commissioning work lots to be developed and their associated Commissioning ITPs and ITCs.

17.3 Commissioning ITPs

Specific Commissioning ITP’s will be prepared for each commissioning sub-system on a sequential basis. ITPs define system elements that are to be tested, inspection and test routines that will be employed, acceptance criteria, and verification records to be produced or provided.

Hold and witness points will be defined in the ITP to satisfy the requirements in the specifications.

Once all specified test routines have been successfully completed and documentary evidence approved, then the associated commissioning activity can be approved by the Commissioning Manager.

A guideline and checklist for ITP development is available from SWC (refer to Section 21).
17.4 Commissioning inspection and test checklists (ITCs)

ITC checklists are produced which define specific inspection and test routines and which are used to record test results for each commissioning procedure.

Each asset must be accompanied by ITCs which define set points, checks and other verification records as required to ensure reliable operation. Relevant ITCs will be referenced from the ITP.

17.5 Commissioning /process proving report

The Contractor must submit a Commissioning Report prior to an asset being deemed Operationally Ready. The report and its appendices are to be issued to SWC in native file format including any data on Microsoft Excel. The report will include but not be limited to:

- completed ITPs, check sheets and test sheets for all commissioning stages
- summary of asset performance clearly showing required performance and actual performance
- check sheets
- test sheets
- flows, pollution loads, chemical and power consumption
- noise and vibration testing as applicable
- all recorded data taken
- a history of all testing and proving periods - i.e. chronological diary of findings and incidents including:
  - Contractor's workmanship
  - logs of alarms and operator attendance
  - plant operating peculiarities and observations
  - any measurement and checks that may be required by operating and maintenance personnel
  - results of any statutory testing and inspection
- modifications to the process operation
- list of control and instrument set points and alarm signal settings which have been determined during the successful operation of the plant and include these in the O&M Manuals
- records of any modifications to the plant, control systems, set-points, circuitry and the like
- other information as applicable
- completed SAT documentation
- WAC SSAT documentation
- WAC FDS and PEFD
- a completed Handover Checklist - with details of requirements (a) to (n) above.

Comments should be included on any observed deficiencies in plant equipment design and performance. Any observations that would be helpful to operating and maintenance staff can be summarised at the end of the report.

Where commissioning is staged, a commissioning report must be provided for the completion of each stage (or a single report that is revised for each stage).

A Draft report must be submitted to SWC for review. The Contractor will incorporate final comments in the final report.

17.6 O&M manuals

The requirements for the Production Facilities are different from that of the network facilities like pumping stations and reservoirs. Detailed requirements are specified in Sections 17.6.1 & 17.6.2 below.
17.6.1 Type of O&M manuals

O&M Manuals can be prepared at Process Level, Area Level or Equipment / Asset Level. Depending on the Contract, the Contractor must discuss and agree with SWC on the type/s of O&M Manuals required. Each manual must have a content page indicating the chapters and corresponding page numbers.

O&M Manuals (Applicable to WWTPs, WFPs & WRPs only)

These PDF documents will then be consolidated into one PDF file, with PDF bookmarks (destination set) for each section and headings in the content page to create one O&M Manual.

The typing must be prepared using MS Word. The collection of documents that make up the manual must be converted to PDF format.

a) The Manuals must contain sufficient information on the specification, installation and maintenance of the equipment supplied, installed, or modified under the Contract. The Manuals must be supplied to SWC prior to handover of the assets. Delivery of the assets under the Contract will not be considered complete until all Manuals and required copies are supplied by the Contractor and accepted by SWC.

b) Each copy of the Manual must be adequately bound or contained in a three-ring, hard cover binder, with the equipment and plant identification permanently marked on the outside cover. Each page must be numbered. The page format must be A4 (or A3/A4 for drawings as approved by SWC) and printed in a clear typeface with a 35 mm margin for binding. Alternative methods of binding and page size format may be submitted, but acceptance of these will be subject to the approval of SWC.

c) The contents must be presented as follows (alternative compilation will be subject to approval):

Title Sheet - containing:
   i. Name of the Plant
   ii. Contract Details
   iii. Name of Supplier
   iv. Address and Telephone Numbers for Service Calls

d) The information to be supplied in each Chapter must be as follows (where applicable):

Contents

Chapter 1: Description - A full description of the equipment type (engineering description for example centrifugal pump), with a tabulation of dimensions and performance ratings.

Chapter 2: Technical Data - A copy of the Technical Data Sheet including make, model, size & serial number supplied by the manufacturer; reliability data (MTBF, MTTR, Reliability Block Diagram and MTBR - for replaceable assets) must be provided for each equipment type supplied by the Contractor. Attach a copy of FMECA if carried out by the Contractor.

Chapter 3: Principles of Operation - A basic working description, including novel features and any automatic control including print screens of SCADA, IICATs and HMI as applicable.

Chapter 4: Operating Instructions - A step-by-step procedure organised into sections entitled including photos for each step as applicable:
   1) Checks before Starting
   2) Starting
   3) Continuous Operation
   4) Stopping
   5) Emergency Stopping
6) Abnormal Operation as applicable

Chapter 5: Installation and Commissioning Instructions - Details of standards and procedures for mounting or erecting, wiring and lubricating the equipment. The commissioning instructions must include step-by-step procedures for checks before the first start, first start, after starting and operational tests. They should be co-ordinated with Chapters 3 and 8 and may refer to both.

Chapter 6: Maintenance Plans (Preventive Maintenance) Step-by-step procedure for preventative maintenance work to be carried out at various intervals, supported by FMECA, if available (e.g. two weeks, four weeks, six weeks etc) Procedure should also clearly indicate replacements of consumables where necessary and the labour-hours required for each activity. These will be the basis of the preventative maintenance schedules which are to be developed by the Contractor in consultation with SWC.

Chapter 7: Maintenance Plans (Overhaul / MPM) Step-by-step procedures for fault finding and correction and for overhauling (major periodic maintenance) involving parts other than consumables. A list of necessary special tools should be included. Indicate Design Life.

Chapter 8: Test Data, Inspection Results (e.g. Test Sheets, FAT, SAT etc) and Troubleshooting - Instructions to qualified tradesman for assessing the operational performance of the equipment and system.

Chapter 9: Parts List and Recommended Spares - Illustrations and schedules for identification and specifications for all items in the equipment. Exploded diagrams are required, if available. The recommended spare parts stock must be indicated.

Appendices (Including; complete vendor manual, software documentation (if software required to configure equipment)

Notes:

The information in Chapters 1 to 5 must be included for each item supplied, while the extent of information in Chapters 6 to 9 may vary with the complexity of the equipment. The text must be in English and easily understood by plant operators and fitters. Information irrelevant to the equipment supplied in the Contract must not be included in the Manual.

The PDF Version of the manual must have bookmarks for each chapter with major headings. The bookmark must include the reference number and description. Documents that are locked and cannot be included into a single PDF document must be scanned at 250dpi, saved as jpeg with maximum compression. This document must then be included into the single PDF document. When converting documents to PDF use the print command and select the PDF printer. This will automatically create the "Bookmarks" while converting other formatted documents to PDF. When collating various documents into a single PDF document use the Acrobat “Combine Files into PDF Command”.

Advertising brochures and catalogues are not acceptable. Remove all pages not associated with the equipment installed.

All electronic files should be in “Vector” format (not scanned) if possible. Some signed documents will need to be in “Raster”. Documents in “Raster” that are available in “vector” format are not locked for collating and will be rejected.

Equipment such as cable connectors, lamp holders, non-repairable equipment or items that are readily available at the local electrical equipment supplier, are not required in the O&M Manual.

17.6.2 O&M Manuals for unmanned sites (applicable to all facilities other than WWTPs, WFPs & WRPs)

When a combination of different software is used or where there are several components / pages of PDF documents forming one O&M Manual, the document must be consolidated into one PDF file, with
Commissioning - transitioning assets into operation

bookmarks for each section in the content page. PDF Version of the manual must have bookmarks for each chapter and each major heading. The bookmark must include the reference number and description. All electronic files should be in "Vector" format (not scanned) if possible. O&M instructions that are of a general nature are not acceptable.

Documents that are locked and cannot be included into a single PDF document must be scanned at 250dpi, saved as jpeg with maximum compression. This document must then be included into the single PDF document.

Advertising brochures and catalogues are not acceptable. All pages not associated with the equipment installed will be removed.

O&M information for each of the following asset types must be included in the O&M Manual. O&M Manuals must also be supplied for any additional asset, if it is specified.

- Operation and maintenance of the pumping station
- Pump and motor
- Control equipment
- Specialised equipment
- Odour Control Unit
- Chemical Dosing Unit
- Power Generating Equipment
- Cranes and Hoists
- Ventilation systems
- Reservoirs
- Valve stations.

Ensure that the O&M Manual specifies the assets that are installed and used within the facility ONLY, do not include manufactures specifications for all equipment’s with the company’s product list as this will be rejected by SWC.

Chemical Dosing and Odour Control units must be treated as standalone and the O&M manual for them will be separate to the one supplied for the pumping station.

The contents of the O&M Manual must be in accordance with Section 17.6.1 a), b) and c) above.

17.6.3 Manufacturer’s instructions manuals

The Contractor must supply manufacturer’s instruction manuals if available for each asset installed or key component of an asset. Examples of key components include PLCs, motors, gearboxes etc. Items such as connectors, lamp holders and contactors are not regarded as key assets or key components.

The manufacturer’s instruction manuals must be included as appendices to the relevant O&M manual.

17.7 Plant operations manual, process specification, asset specification, UPGs, SOPs and work instructions

Where modifications or changes are being made to a facility process or a change in operational methodology is required, new or updates to UPGs, SOPs, Plant Operations Manual, Plant Process Specification and Plant Asset Specifications may be required. The development of new documents is to incorporate information from existing documents available for the asset in consultation with the operations team and utilise standard templates.
17.7.1 Plant operations manual

Plant Operations Manuals are being developed for each production facility to consolidate existing SOPs and Work Instructions. These documents define the steps for operating the production facilities process-by-process in Automatic, Manual and Field modes.

The Contractor is to request the active manual from the relevant production hub, and update with changes relevant to upgrades. This is to be carried out in accordance with the IMS0038 Production Change Management Process.

17.7.2 Process equipment asset specifications

Process Equipment Asset Specification and common UPGs are being developed by Customer Delivery Process Engineers to consolidate existing plant based UPGs. Any updates to these documents are to be handled through the nominated Process Engineer for the relevant Production Hub.

17.7.3 Unit process guidelines

The purpose of a UPG is to provide a process management framework for the operations staff to manage the unit process effectively.

Each UPG will have several Standard Operating Procedures (SOPs) to support the operation of the unit process.

In general, a UPG will:

a) define the objectives and functions of the process unit, and its relationship with other process units
b) describe the components/equipment of the process unit
c) describe the theoretical basis for the operation of the process unit
d) describe the validation criteria and process limiting factors of the process unit
e) describe the process control strategy and how it can be used by the operations staff to achieve the desired objectives
f) provide a trouble-shooting guide for the process unit.

The format of the UPG will typically be as shown below:

<table>
<thead>
<tr>
<th>Heading of section</th>
<th>Content requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Introduction</td>
<td>Identify the Process Unit</td>
</tr>
<tr>
<td>1.1 Structure of UPG</td>
<td>Describe the structure/format of the UPG preferably with a summary of the sections in the Unit Process Guidelines.</td>
</tr>
<tr>
<td>1.2 Responsibilities</td>
<td>Define responsibilities of the operating staff in relation to approval, implementation and validation of the UPG.</td>
</tr>
<tr>
<td>2.0 Process Description</td>
<td>Plant Specific Description of the Process Unit</td>
</tr>
<tr>
<td>2.1 Process Flow Diagram</td>
<td>Schematic description of the process unit covering the main process streams, side streams and recycled streams. Identify sub-units of the process unit. Attach P&amp;ID.</td>
</tr>
<tr>
<td>2.2 Process Sub-Unit</td>
<td>Describe each process sub-unit.</td>
</tr>
<tr>
<td>2.2.1 Function of Sub-Unit</td>
<td>Describe the function of the process sub-unit.</td>
</tr>
<tr>
<td>2.2.2 Components of Sub-Unit</td>
<td>Describe major components/equipment of the sub-unit. The description should include configuration and SWC dimensions of physical structure, capacity, pump size (kW), motor rpm, type, etc, related to its function. Refer to relevant drawings of the plant.</td>
</tr>
<tr>
<td>Heading of section</td>
<td>Content requirement</td>
</tr>
<tr>
<td>--------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>2.3 Instrumentation and Control</td>
<td>Describe the overall instrumentation and control system for the process units. Describe the control logic. Refer to relevant process and instrumentation diagrams. The information used here must normally be extracted from the FDS.</td>
</tr>
<tr>
<td>3.0 Process Theory</td>
<td>Describe the theoretical basis of the process design and operation of the process unit.</td>
</tr>
<tr>
<td>4.0 Process Monitoring</td>
<td>Describe the process monitoring requirements.</td>
</tr>
<tr>
<td>4.1 Process Validation Criteria</td>
<td>Identify criteria to be used for assessing and validating the performance of the process unit. Define each criterion. Provide formula for converting monitoring data into values to be assessed against the criterion. Provide the relevant mean, low and high values for each criterion.</td>
</tr>
<tr>
<td>4.2 Process Limiting Factors (PLF)</td>
<td>Identify the factors that can limit or inhibit the performance of the process unit. Identify the suitable location for monitoring these factors. Provide the mean (target value), low and high values for each limiting factor. Explain how the process can be brought under control if the PLFs are above or below the target values.</td>
</tr>
<tr>
<td>4.3 Other monitoring requirements</td>
<td>Identify the monitoring data related to the validation criteria or process limiting factors that are used to monitor.</td>
</tr>
<tr>
<td>5.0 Process Control Strategy</td>
<td>Describe the process control strategy to ensure the performance of the process unit.</td>
</tr>
<tr>
<td>5.1 Ranking of Process Limiting Factors</td>
<td>Rank the priority for control of the process limiting factors.</td>
</tr>
<tr>
<td>5.2 Key Process Control Actions</td>
<td>Describe actions that production officers can perform directly to control the process limiting factors.</td>
</tr>
<tr>
<td>6.0 Process Run and Control Charts</td>
<td>Describe the type of run and control charts to be used to monitor and assess trends of relevant process parameters. Provide the relevant mean, low and high limits on these charts. Simple tools for the preparation of these charts such as forms, templates, calculation sheets etc should be included as appendix to the UPG. More complex tools should be developed into Standards Operating Procedures (SOPs).</td>
</tr>
<tr>
<td>7.0 Process Trouble Shooting Guide</td>
<td>Identify the potential problems and provide guides to overcome the problems and bring the process back under control. This section uses four column format with the following headings: Observation: Visible sign of the process problem Probable Cause: Probable cause of the process problem Necessary Check: Check to be carried out to validate/check the process problem Corrective Action: Action to be taken overcome the process problem.</td>
</tr>
<tr>
<td>8.0 References</td>
<td>List of reference documents used for the preparation of the UPG and/or those that should be referred to for the optimisation and improvements of the process performance.</td>
</tr>
</tbody>
</table>
### 9.0 Appendices

Provide additional information, tools, etc, referred to in the UPG

**a) Preparation of UPGs**

Where the process provided is in common use, SWC will provide generic UPGs for each of the unit processes supplied under this Contract. The Contractor will customise the generic UPGs by adjusting, modifying and developing them to accommodate any specific site requirements. The customising must be carried out in consultation with the SWC's operation and other expert staff.

Where the process is not in common use, the Contractor must develop the UPGs in consultation with the SWC's operation and other expert staff.

#### 17.7.4 Standard operating procedures

The Contractor must prepare Standard Operating Procedures (SOPs) for each unit process covered by this Contract.

The purpose of the SOPs is to provide step-by-step instructions to the operations staff to operate the associated process unit process effectively and safely, for the plant to achieve its required outcomes.

The SOPs will be organised into four groups, namely:

- **a) Sampling SOPs:** Procedures for taking samples at various locations of the process unit.
- **b) Analysis SOPs:** Procedures for the type of analysis to be carried out on the samples collected for assessing the performance of the process unit.
- **c) Monitoring SOPs:** Procedures for gathering process information required for making process decisions.
- **d) Equipment SOPs:** Procedures for operating the process equipment including start-up and shut down in automatic and manual modes.

In general, a SOP will:

- **a) state why the procedure is required**
- **b) define the scope of the procedure**
- **c) define the responsibilities of operations staff**
- **d) specify conditions and standards to be applied to the procedures**
- **e) specify the tasks to be carried out to complete the procedure**
- **f) identify the hazards associated with the procedure and the control measures to be taken**
- **g) contain a routine risk assessment.**

The format of a SOP will be as follows:

<table>
<thead>
<tr>
<th>Heading of section</th>
<th>Content required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.0</strong> Introduction</td>
<td>Describe the purpose of the SOP. Outline briefly the tasks of the SOP and its importance to the plant production.</td>
</tr>
<tr>
<td><strong>2.0</strong> Responsibility</td>
<td>Define who is responsible for performing the SOP, who is responsible for evaluating the performance and evaluation frequency.</td>
</tr>
<tr>
<td><strong>3.0</strong> Conditions</td>
<td>Define the factors that must be present or satisfied to carry out the SOP safely and correctly.</td>
</tr>
<tr>
<td><strong>4.0</strong> Standards</td>
<td>Define the accuracy/precision required of the SOP.</td>
</tr>
<tr>
<td><strong>5.0</strong> Safety</td>
<td>State the hazards and the safety measures to be taken.</td>
</tr>
<tr>
<td>Heading of section</td>
<td>Content required</td>
</tr>
<tr>
<td>--------------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| **6.0** Environment | Describe the environmental impacts of not following or inappropriately following the Procedure.  
State the environmental safeguards to be put in place. |
| **7.0** Procedure | Describe the procedure in a three-column format with the following headings:  
**Location:** Identify the physical location where a specific task is performed.  
**Task:** Describe what is to be done.  
**Step:** List activities in the sequence to be completed to perform the task. |
| **8.0** Troubleshooting guide | This section is applicable on a need basis only. This section uses a four-column format with the following headings:  
**Observation:** Visible sign of the problem related to the SOP  
**Probable Cause:** Probable cause of the problem.  
**Necessary Check:** Action to be carried out to validate/confirm the problem.  
**Corrective Action:** Action to overcome the problem. |
| **9.0** References | List of other SOPs that refer to this SOP or are referred to by this SOP. |
18. Signage, labelling and identification

18.1 General requirements
The Contractor must supply and install labels to identify locations in accordance with the location numbers issued by SWC.

Labels are used to provide a description of the assets as well as to display the unique identification linking to TAR.

The Contractor must supply a full list of labels and signage for endorsement prior to the 90% detailed design milestone.

Signage for SWC sites is detailed in SDIMS0026 Customer Delivery Facility Safety Signage Specification. Proofs of signage to be provided to SWC for review prior to manufacture.

In cases where there are two contractors working within one facility, e.g.: Vacuum systems or CDUs the Contractor working inside the building for all electrical and mechanical assets must provide SWC approved labelling. The Contractor working outside the building including civil, mechanical and site within the facility grounds must provide all SWC approved labelling.

18.2 Label descriptions
The description of the asset on labels is to be succinct and needs to describe the asset’s function, for example:

Valve – Pump 1 Inlet Isolation ✓ Inlet Gate Valve ❌

Appendix G includes a list of common descriptions for SPS and WPS.

18.3 Label dimensions
The size of the label must be determined by the number of letters, size of letters, space available to install the label and the text must be understood without ambiguity. The location number must remain on a single line.

18.4 Label materials
Materials will be as follows:

- Internal Labels (Low Impact Areas or Switchboards) - Traffolyte or similar material with black lettering engraved on a white background, unless specifically nominated otherwise. Edges of labels must be bevelled on all sides. Shutdown system labels (example emergency stop buttons) and warning labels will be white lettering engraved on a red background.

- Exposed Labels (e.g. installed on outdoor enclosures such as kiosks, cubicles, buildings etc., or high wear locations) - are to be 1.2 mm thick, 316 Stainless Steel, 0.75 mm engraved and in-filled with black paint. Labels in chemical contact process areas must be treated similarly. Edges of labels must be bevelled on all sides and corners rounded to prevent injury. Etched labels will not be accepted.

- Corrosive Environments (wet wells maintenance holes) - stainless steel and fixed with a minimum of two stainless steel screws.

Labels identifying physical assets i.e. wet wells, motors, instruments must be visible without the removal of a cover or access lid. The manufacturer’s nameplate, attached to the assets installed under the Contract, must be in addition to the Location Number label described above and must be visible from the access position.
Commissioning - transitioning assets into operation

If Contractor is in doubt, communication between SWC and the Contractor must take place for confirmation on label details including installation location

18.5 Label font sizes

All label lettering must be in “CAPITAL” and “ARIAL” font. The wording on the labels must be horizontal. Unless otherwise stated elsewhere in the Contract documents, the following font sizes are applicable.

a) Facility Numbers such as SP1140 on kiosks or equipment enclosures should be 12 mm and on superstructures (e.g. SP1139) 100 mm high.

b) Where permissible (except for physically small assets) font size 10 mm must be used for location labels. For very small assets, the font size may be reduced to fit. The exceptions to this rule are listed below.

c) Location number labels for electrical components must be 4 mm.

d) In certain facilities such as SPSs, and WPSs, a pump unit number may be specified in the drawings. In such cases, the Pump Unit Number label must have a font size of 50 mm.

e) The labels that describe operating procedures must have headings of 6 mm and the content must be of 4 mm.

18.6 Installation of labels

All stainless-steel labels must be secured using stainless steel fixtures.

The Traffolyte labels on front panels of switchgear and control assemblies must be secured using stainless steel fixtures. Gluing is not acceptable.

Self-adhesive Traffolyte labels, where the adhesive covers the complete back plane of the labels, are acceptable for use inside enclosures, buildings and switchgear and control assemblies only.

To prevent re-doing the labels after maintenance/replacement of the equipment, the location labels must not be directly secured to replaceable components. For such assets, the labels must be installed on a permanent structure as close as possible to the equipment. For example, the valve label must not be fixed to the valve body but could be mounted on a suitable bracket on the valve flange or valve-supporting plinth, except in the case of small valves where a hanging label fixed with stainless steel wire is acceptable. The stainless-steel wire and fixings must be installed so that there are no sharp objects that may injure personnel during operation or maintenance.

When labels are fitted close to access covers, they must visible with the cover in both open and closed positions.

The labels for electrical equipment within cubicles must be on the mounting plate. Attaching labels to cable trays and other removable parts is not acceptable.

All inscriptions on the labels must be visible from the ground or a level platform.

If Contractor is in doubt on location of an asset label, communication between SWC and the Contractor must take place for a confirmation on exact location before printing.

18.7 Examples of labelling

Figure 18.7-1 provides an example of a typical asset label, including dimensions.
18.8 Exemptions to labelling rules

a) Where labelling requirements are specifically stated in SWC approved drawing/s, Contractor must comply with such instructions instead of the labelling requirements under this clause.

b) Under special circumstances, for example, where locations belonging to two facilities are physically in close proximity to each other or where a location is remote from the parent facility, SWC may request the Contractor to include the facility number in the labels e.g. SP1139PEN01 instead of PEN01.

c) For specific assets including High Voltage (HV) assets, sewer gauges and vacuum sewage systems, reference to these rules will be referred to the Asset Data Dictionaries.

d) Small, non-maintainable assets (DN15 valves, camlocks, minsups etc.) do not require labels.

e) If the Contractor is uncertain of labelling requirements, clarifications should be sought from SWC.

18.9 Survey datum marks

During construction of wet wells one Survey Datum reference marks with labels must be installed. Labels identifying RL in m AHD must be provided on the wet well roof slab, on the top of the inlet maintenance hole, on top of emergency storage tank and wherever else level measuring instruments and/or switches are installed.

Sitting of survey reference marks and labels must be as close as possible to the instruments as follow:

- Wet Well - on the roof slab adjacent to the instrument access hatch
- IMH - on the rim of the MH above the instruments
- Storage Chambers - on the roof slab adjacent to the instrument access hatch
- The reference mark label must clearly indicate the reduced level and datum e.g. RL 123.45m AHD.

19. Testing, sampling & analysis

Where sampling and testing is required, it will be undertaken in accordance with this section. Project specific sampling requirements will be detailed in the Contract.

Prior to commencing any sampling, a Sampling Plan should be provided by the Contractor.

19.1 Sampling

The Contractor must use refrigerated automatic samplers for sampling raw wastewater, intermediate and final effluent. All sampling for chemical analysis will be flow weighted composite unless otherwise specified.
The automatic samplers will be programmed to collect maximum volume over the sampling day, i.e. 9.5 litres.

A duplicate sample will be collected for all samples, which are to be analysed for Faecal Coliforms. Where the Contractor intends to use preservatives for certain analyses, the types of preservatives must conform to:

AS 2031.1 - Chemical
AS 2031.2 - Microbiological

The Contractor must supply a list of the analyses, which will be performed immediately upon receipt at the laboratory. For those that cannot be, the type of preservation techniques which will be used should be provided.

Sample containers for microbiological tests must be suitably prepared to AS 2031.2.

Sampling for process unit cleanouts must be in accordance with SWC Process Unit cleanout guidelines.

19.1.1 Sampling failure

The samplers are required to function correctly and collect the correct amount of sample in the correct manner throughout the testing period. Failure of the sampling renders the results invalid and is a Major non-conformance requiring the testing to be restarted after the sampling failure is rectified.

If a sample has not been collected in the correct manner then the following must be undertaken:

Sampler failure

Where there are eight or more hours remaining in the sampling day, and a replacement sampler can be in place before 1500 hours, then the Contractor will replace the sampler and reset the replacement to sample a uniform frequency and volume such that the necessary sample volume is acquired during the remainder of the sampling day.

Where there are less than eight hours remaining in the sampling day or it will be later than 1500 hrs on that day before the sampler can be replaced (or sample failure is only discovered when the supplier arrives to collect the samples) then that day's sampling will be aborted and reason noted in the weekly report.

Insufficient sample in sample bottles

If the Contractor, when collecting the samples, discovers that insufficient volume has been collected by the sampler then:

For minor shortfalls of volume (less than 15% of the programmed volume) a grab sample at the time of pickup will be used to top up the volume only if this is required to perform the necessary analysis. This must be noted on the weekly report.

For large shortfalls of volume (greater than 15% of programmed volume) the composite will be rejected if there is insufficient volume to perform the analysis and that day's sampling will be aborted and the reason noted on the weekly report.

19.1.2 Collection, transportation and receipt of samples

The Contractor must complete a chain of custody form for all samples taken, at the time of carrying out the work. Sample containers must be suitably labelled to identify the time, date etc. They should be easily paired with their respective chain of custody form.

Samples will be transported in a manner such that a temperature between 1°C and 6°C is maintained always. The Contractor will provide details of proposed transportation methods, which will minimise the possibility of sample breakage in transit, and guarantee sample temperature remains between 1°C and 6°C.
Except as provided otherwise herein, the Contractor must ensure that each particular sample will be at the Contractor’s laboratory within eight hours of the completion of sampling. Should the sampling end between midnight and 7 am, the Contractor must ensure that the samples are at the Contractor’s laboratory by 11 am after each sampling event. This is to ensure that for those analyses requiring immediate analyses, that the analyses can be commenced and preservation of the others can be undertaken.

Enough samples will be sub sampled on receipt so that a duplicate can be preserved and kept at the Contractor’s laboratory until the results have been reported and have been demonstrated to meet the Quality Assurance requirements.

The requirements of this clause will apply to samples taken or collected on a weekend or public holiday.

19.2 Analysis

19.2.1 General

The analytical work must comply with the procedures specified in “Standard Methods for the Examination of Water and Wastewater” (APHA/AWWA/WEF). The analytical technique to be used for the measurement of faecal coliform levels will be the membrane filtration method.

Upon arrival of the sample at the Contractor’s laboratory, the following analyses must be commenced immediately: BOD$_5$, Faecal Coliform and other analyses that SWC considers necessary to ensure the integrity of the sample is not compromised. Samples for other analyses must be preserved until the next working day, if not analysed in the same working day.

It is expected that the maximum turnaround time for any one sample will not exceed ten working days, except for BOD$_5$ duplicates.

a) Laboratory analysis

The Contractor must ensure that a NATA approved laboratory (approved by SWC and paid for by the Contractor) performs all sampling and testing. The sampling and analysis will be executed as specified in:

- “Standard Methods for the Examination of Water and Wastewater” (APHA/AWWA/WEF)
- The requirements stipulated in separate sections of the Contract

b) Laboratory quality manual

The Contractor must supply, as part of the Test Plan & Procedures, an uncontrolled copy of the Quality Manual prepared by the Laboratory that will conduct sampling and analysis for the Contract and other relevant manuals.

19.2.2 Sampling

Provide a flow chart for procedures that detail how sample results are received, checked and accepted, including quality control checks.

Provide sub-sampling procedures that guarantee no contamination.

Provide chain of custody forms to be used.

For each analysis group provide preparation and cleaning procedures for the acceptable sample containers, indicate the type of container suitable.

Maintenance schedule program for auto samplers. This should include, but not be limited to, a description of the cleaning procedure for the sampler, pump tubing, sampling lines etc.

Communication protocols for broken or missed samples etc.

Collection, transportation and receipt

Sample collection.
Sample transportation and receipt, including details of the proposed transportation methods, which will minimise the possibility of sample breakage in transit, and guarantee samples are stored between 1 and 6°C.

Sub-sampling for analysis and duplicates (with any preservatives).

19.2.3 Analyses

Supply a list of the analyses to be performed immediately upon receipt at the laboratory. For those which cannot be performed immediately, the type of preservation techniques to be used must be documented.

A schedule of Methods, Quality Control & Limits, including for each analysis, the method and matrix, standard or modified method, accreditation, volume to be used (in the case of BOD, minimum number of dilutions which will be used per sample), limit of quantitation, method detection limit, method range, quality control to be used, acceptance limits for each quality control procedure, turn-around time.

Details of the Quality Control (QC) Procedures for analyses must include but not necessarily be limited to:

- minimum of one replicate every 10 samples (can be a replicate on <10)
- blanks
- spikes
- standards
- surrogates
- use of validated Internal Reference Material
- use of Certified Reference Material
- sampling Blanks
- provide the acceptance criteria for the QC items outlined above.

A list of personnel who will perform each analysis together with each person's qualifications and experience must be submitted to SWC. SWC reserves the right to reject personnel considered not suitably qualified or experienced. The list should include the names of backup personnel who will perform the analysis.

19.2.4 Reporting

Provide the laboratory's statistical procedures for rounding and interpretation of limiting values (i.e. AS 2706). Be sure to address situations when one of the results from a duplicate is a 'less than' (<) result.

The three day geometric mean must be calculated using the formula: \( \sqrt[3]{a_1 \times a_2 \times a_3} \), where \( a_1, a_2, a_3 \) are the results for each day, over any three consecutive days.

Provide suggested reporting and database formats.

19.3 Screenings samples

There is no "Standard Method" for measurement of the BOD content of washed and dewatered screenings.

The following test method will be used to measure the BOD content of washed and dewatered screenings.

The BOD content in the washed and dewatered screenings will be measured by the BOD\(_5\) and expressed as a cleanliness factor or concentration, as described below.

The cleanliness of the washed and dewatered screenings will be measured to give either:

1. A cleanliness factor determined by the equation below:

\[
\text{Cleanliness Factor} = \frac{\text{BOD}_5 \text{ (g/ litre)}}{\text{Density (tones/m}^3\text{)} \times \text{Dry Solids Fraction}}.
\]

The Contractor will guarantee that 8 out of 10 samples must have a cleanliness factor of less than 50. The cleanliness factor will be obtained by measuring leachate BOD\(_5\), the density and dry solids content of the screenings and inserting the figures obtained in the formula above.
The BOD<sub>5</sub> must be analysed in accordance to Standard Method - 5 day biochemical oxygen demand (BOD<sub>5</sub>).

Or

2. The maximum BOD<sub>5</sub> of the washed and dewatered screenings must be not more than 50 mg/g of dry solids.

The method for determining the BOD<sub>5</sub> will be:

A 2 to 3 kg sample of the discharged screenings (free of any external source of moisture) will be taken and stored in a sealed plastic bag for transport to the laboratory. Analysis will be taken as soon as possible. The sample bag is opened in the laboratory and the contents quickly shredded without loss of water or other sample material. The whole sample is then well mixed. Sub-samples of 150 to 200 g are then taken, one for dry solids determination, the other for washing with five successive litres of clean water. Between each wash the sample is drained through a 30 micron mesh sieve. The combined washings are analysed for total BOD<sub>5</sub>, according to the Standard Method for 5 day biochemical oxygen demand (BOD<sub>5</sub>).

19.4 Grit samples

The moisture content and the organic content of the washed and dewatered grit will be measured in accordance with “Standard Methods for the Examination of Water and Wastewater” (standardmethods.org).

19.5 Noise

Occupational noise measurement

The Contractor must carry out detailed noise analysis on the following new and modified equipment:

- all new pumps greater than 5 kW that are not submerged
- aeration blowers and pipework
- air compressors (including filter air scour blowers)
- centrifuges
- pneumatic valves located in enclosed areas
- any mechanical equipment with a motor size greater than 15k W (unless submerged).

The noise analysis carried out on equipment will be as follows:

Preliminary noise tests will also be undertaken at the manufacturer’s works during performance tests and repeated on site for final acceptance. The preliminary noise tests will identify any obvious noisy operating condition within the asset / equipment operating range. The obtained data are to be evaluated and translated to defined site noise performance conditions. The equipment can only be delivered to site if the above evaluation indicates that the specified site noise levels will be achieved.

The Contractor must conduct noise tests on all individual equipment installed and the complete plant carried out under full operational load. The noise tests will be conducted under the noisiest loading conditions within the defined operating range. The sound pressure level will be measured with a precision sound level meter conforming to AS IEC 61672. All measurements to be carried out and certified by trained personnel with currently NATA calibrated equipment and must conform to the requirements of the Contract. The measured data will be supplied in Sound Pressure Levels (SPL) and Sound Power Levels (SWL) - refer to table below - Noise Analysis Data sheet.

The Contractor must supply full details of the test procedure, conditions and standards used.

The Contractor must enter the results of the above tests in a “NOISE ANALYSIS, Data Sheet” which must be included in the commissioning records.

Noise analysis - data sheet
The test results will be used to verify compliance with both WHS and environmental noise regulations. Assets / equipment tested to meet the environmental noise requirements should have an allowance for noise increase with age and wear. This means the maximum acceptable noise level must be at least 2 dBA below the legal limit.

Assets will not be accepted unless they meet the specified noise levels. When assets fail to meet the required noise levels, the Contractor must take necessary actions to remedy the problems to the satisfaction of SWC, at no extra cost to SWC.

Noise measurements must be in accordance with the methods prescribed by the NSW EPA in the Industrial Noise Management "Industrial Noise Policy" (2000) document. Noise measurements on property boundaries to the site must be at the location on that boundary which will record the highest sound level.

Noise measurements must be at a time when conditions relating to meteorology and operation of the works will yield the highest sound level.

Noise measurements must be aborted if wind is in excess of 18 km/h or if rain occurs.

19.6 Odour assessment

19.6.1 General

The Contractor will carry out odour assessment during the following conditions:

- Dry weather
- When the sewer flows are not influenced by rainfall
- In the months January through April.

The Contractor will sample each odour source at least twice on different days and at a time of day where worst case conditions are most probable. Samples must not be collected within 5 days of any significant rain event in the catchment of the wastewater system.

19.6.2 Sampling for odour testing

The Contractor will collect the odorous air samples in accordance with the Technical Notes: Assessment and Management of Odour from Stationary Sources In NSW November 2006 (epa.nsw.gov.au/air/odour.htm). The Contractor will submit a duplicate set of samples to SWC for independent testing if necessary. The Contractor will provide a minimum of 2 days’ notice to SWC prior to sampling so that SWC may witness the collection of samples.
19.6.3 Testing for odour concentration

The analysis of the collected odorous air samples will be performed in accordance with the Australian and New Zealand Standard: Air Quality Determination of Odour Concentration by Dynamic Olfactometry’ (AS/NZS 4323.3:2001 (R2014)).

19.6.4 Modelling of odour impacts

The odour impact will be assessed by use of the most recent version of the AUSPLUME gaussian plume dispersion modelling software and is to be performed over the nose response time of 1 second (Assessment and Management of Odour from Stationary Sources In NSW November 2006 (epa.nsw.gov.au/air/odour.htm) for 99% of the modelled time.

The largest available site specific, or if not available site representative, meteorological data file is to be used for these assessments. The meteorological data file noted previously and a local terrain file are to be used as inputs to this process. The outcome of this modelling must produce a situation which conforms to the NSW EPA requirements.

19.7 Hydraulic testing

19.7.1 Structures

No work can be backfilled, covered or concealed until it has been inspected and tested. Testing must be in accordance with - SW Technical Specification - Civil.

19.7.2 Pipework hydrostatic tests

No work can be backfilled, covered or concealed until it has been inspected and tested. Pipe joints and structures must be exposed to enable observation during hydrostatic tests.

Pipelines must be tested for leakage and defects in the pipes, joints, fittings, valves and thrust blocks. The test must be carried out in sections as soon as practicable after each section has been laid, jointed and cleaned and not earlier than seven days after the last concrete thrust block in the section has been cast unless suitable strutting and bracing is installed to take the thrust. Solvent cement joints must be cured for at least 24 hours before testing.

In order to achieve stable testing conditions, the pipe section to be tested must be filled slowly with water, ensuring all air is expelled and allowing for absorption. The section must be kept full of water for 24 hours prior to the commencement of the pressure testing. During pressure testing of a pipeline each isolation valve must sustain the full pressure on one side of the valve with no pressure on the other side.

The Contractor must ensure that all pipe components under test (including thrust blocks) have rated pressure or manufacturers recommended maximum test pressure above the hydrostatic test pressure. The test report must be supplied to SWC.

Pipework must be tested in accordance with relevant Australian Standards. The test pressure for all pipework must be the design pressure plus 25%. The design pressure for pumping station discharge pipework and pressure mains must be the larger of the pump shut-off head plus the maximum head at pump suction and the maximum pressure determined by water hammer analysis. For all other pipework the design pressure must be the larger of the maximum head and the maximum pressure determined by water hammer analysis.

The pipe work must be deemed tested when the test pressure has been maintained for two hours without topping up and there is no visible leakage or sweating or pressure drop. Test certificates are to be supplied by the Contractor.

When conducting hydrostatic testing, all tests will be measured using a minimum of two calibrated pressure gauges, and the relevant calibration certificates and numbers included with relevant quality documentation.
19.7.3 SPS pipework hydrostatic tests

For Sewage Pump Stations, testing requirements will be as follows:

- For submersible SPSs, minimum test pressure must be 1200 kPa at the lowest point of pipework under test. For dry mounted sewage pumps, minimum test pressure must be 850 kPa.
- For axially split case pumps the minimum test pressure must be 1200 kPa.
- For multi-stage vertical booster pumps, the minimum test pressure must be 850 kPa.
- For emergency bypass pipework including all appurtenances in sewage pumping stations, the minimum test pressure must be 1200 kPa.

Notwithstanding the above, the Contractor must consult the pump supplier to confirm if their equipment is rated for the minimum test pressures mentioned in this clause.

19.7.4 Hydraulic capacity

The Contractor will carry out all tests necessary to determine compliance with the Contract for the hydraulic capacity of process units and systems including flow splitting and bypasses, under simulation of the most severe loading conditions. The Contractor will provide, calibrate and maintain all flow measuring devices, which are necessary for these tests. The flow measuring devices must be installed in a manner to ensure accurate measurement. Flow splitting between process units and overflow weir settings will be within ± 5% of that required by the design inclusive of the accuracy of the flow measuring devices.

If peak instantaneous hydraulic conditions are not achievable during commissioning, the Contractor will test hydraulic capacity at the maximum flows achievable, as agreed with SWC, and submit calculations, which predict the performance at the maximum design flows by calibration of the design calculations and/or extrapolation of the results obtained for the flows used in the hydraulic capacity tests to the peak instantaneous hydraulic conditions.

19.8 Other specific testing

19.8.1 Crane and lifting equipment testing

Cranes must be tested and commissioned in accordance with AS 1418.3. Prior to the testing, the crane must be inspected in accordance with AS 1418.1. Following testing a Work Cover Certificate will have to be obtained for the lifting device and provided to SWC.
## 20. Definitions

The following terms are defined as they are applicable to SWC:

<table>
<thead>
<tr>
<th>Term / Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility</td>
<td>A system of infrastructure components designed to work together and controlled as a single entity. Facilities generally have all components located on the same site.</td>
</tr>
<tr>
<td>Enterprise Asset Management System (EAMS)</td>
<td>SWC's current enterprise asset management system</td>
</tr>
<tr>
<td>CA Team</td>
<td>Commissioning and Acceptance Team (SWC Customer Delivery)</td>
</tr>
</tbody>
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### 20.1 Acronyms

The following terms are used throughout this document.

<table>
<thead>
<tr>
<th>Term / Acronym</th>
<th>Meaning as used in this Document</th>
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</thead>
<tbody>
<tr>
<td>ADWG</td>
<td>Australian Drinking Water Guidelines</td>
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<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>CA</td>
<td>Commissioning &amp; Acceptance</td>
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<tr>
<td>CCTV</td>
<td>Closed Circuit TV</td>
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<tr>
<td>CDU</td>
<td>Chemical Dosing Unit</td>
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<tr>
<td>CT</td>
<td>Current Transformer</td>
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<tr>
<td>dB</td>
<td>Decibel</td>
</tr>
<tr>
<td>dB(A)</td>
<td>Decibel A-weighted</td>
</tr>
<tr>
<td>DICL</td>
<td>Ductile Iron Cement Lined</td>
</tr>
<tr>
<td>DN</td>
<td>Nominal Diameter of a pipe</td>
</tr>
<tr>
<td>dpi</td>
<td>Dots per square inch</td>
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<tr>
<td>EDMS</td>
<td>Engineering Drawing Management System</td>
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<tr>
<td>EEHA</td>
<td>Electrical Equipment in Hazardous Areas</td>
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<tr>
<td>FAT</td>
<td>Factory Acceptance Test</td>
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<tr>
<td>FDS</td>
<td>Functional Design Specification</td>
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<td>FIFM</td>
<td>Flow Isolation and / or Flow Management</td>
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<tr>
<td>FMECA</td>
<td>Failure Mode, Effects, and Criticality Analysis</td>
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<tr>
<td>Term / Acronym</td>
<td>Meaning as used in this Document</td>
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<tr>
<td>FST</td>
<td>Final System Test</td>
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<td>GPO</td>
<td>General Power Outlet</td>
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<td>HIDRA</td>
<td>Hazard Identification and Risk Assessment</td>
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<td>HMI</td>
<td>Human Machine Interface</td>
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<td>HSL</td>
<td>House Service Line</td>
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<td>HT</td>
<td>Hydrostatic Testing</td>
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<td>HV</td>
<td>High Voltage</td>
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<td>Hz</td>
<td>Hertz</td>
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<tr>
<td>IICATS</td>
<td>Integrated Instrumentation Control Automation &amp; Telemetry System</td>
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<tr>
<td>I/O</td>
<td>Control Signal Inputs and Outputs</td>
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<tr>
<td>IFC</td>
<td>Issued For Construction</td>
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<td>IFR</td>
<td>Issued For Review</td>
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<td>ITC</td>
<td>Inspection and Test Checklist</td>
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<td>IOP</td>
<td>Interim Operating Procedures</td>
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<td>ITP</td>
<td>Installation and Test Plan</td>
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<tr>
<td>LOTO</td>
<td>Lock Out Tag Out</td>
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<tr>
<td>MCC</td>
<td>Motor Control Cubicle or Cabinet</td>
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<tr>
<td>MDF</td>
<td>Main Distribution Frame</td>
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<td>MDR</td>
<td>Manufacturer data report</td>
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<td>MMD</td>
<td>Monitoring and Measuring Devices</td>
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<tr>
<td>MPM</td>
<td>Major Periodic Maintenance</td>
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<tr>
<td>MTBF</td>
<td>Mean Time Between Failure</td>
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<td>MTBR</td>
<td>Mean Time Between Repair</td>
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<td>MTTR</td>
<td>Mean Time To Recovery</td>
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<td>NCR</td>
<td>Non-Conformance</td>
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<td>NOE</td>
<td>Notice of Energisation</td>
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<tr>
<td>OCR</td>
<td>Operational Change Request</td>
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<tr>
<td>Term / Acronym</td>
<td>Meaning as used in this Document</td>
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<td>---------------</td>
<td>----------------------------------</td>
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<tr>
<td>OCU</td>
<td>Odour Control Units</td>
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Commissioning - transitioning assets into operation

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22. Appendices

The following appendices are guidance material only. They may be continuously revised or improved and are provided to assist in the development of project specific commissioning documentation.

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