

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Quality Management Plan

Story: SCIRT Management Plans

Theme: The SCIRT Model

A plan which aims to ensure the SCIRT programme complies with set specifications, design and industry quality standards.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz



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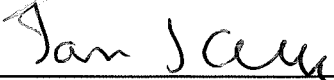
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Quality Management Plan

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ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Term	Definition
CCC	Christchurch City Council
CERA	Canterbury Earthquake Recovery Authority
CSS	Construction Standard Specification
DT	Delivery Team
ECI	Early Contractor Involvement
EGM	Executive General Manager
GIS	Geographic Information System
IDS	Infrastructure Design Standard
ITP	Inspection and Test Plan
IRTSG	Infrastructure Recovery Technical Standards and Guidelines
IST	Integrated Services Team
KPI	Key Performance Indicator
KRA	Key Result Area
LDO	Lead Design Organisation
NCR	Non-conformance Report
NZTA	New Zealand Transport Agency
NOP	Non Owner Participant
QMP	Quality Management Plan
RFI	Request for Information
SCIRT	Stronger Christchurch Infrastructure Rebuild Team
SQE	Safety, Quality and Environment

1 INTRODUCTION

1.1 PURPOSE

The Quality Management Plan (QMP) aims to ensure the overall Stronger Christchurch Infrastructure Rebuild Team (SCIRT) programme complies with set specifications, design and industry quality standards.

The QMP provides the framework for monitoring and measuring the compliance and performance of each project within the SCIRT programme. The QMP addresses how quality is delivered through the development of projects, construction delivery and hand-over to the respective asset owners.

Primary responsibility for quality is with the Non Owner Participant (NOP) Delivery Teams and Design Teams using their own quality management systems. This QMP provides a framework to set expectations and for alignment of the different Delivery Teams quality management systems to improve quality performance throughout the course of the SCIRT programme of works.

1.2 OBJECTIVES

The objective of this plan is to ensure quality is integrated into the SCIRT processes, systems and delivery mechanisms, and to give confidence in quality product. SCIRT is committed to delivering quality outcomes for all work undertaken.

1.3 REQUIREMENTS

This plan sets out the how Design and Delivery Teams integrate to take a consistent approach in delivering the required quality standards throughout the programme.

The core focus on delivering quality includes:

- Design Quality Management
- Risk Management
- Early Contractor Involvement (ECI)
- Construction Management Plan development and implementation
- Inspection Test Plan development and implementation
- Subcontractor management
- Auditing and review process
- Defects Surveys and Performance Testing
- Quality Reporting
- Non Conformance Report (NCR) Management
- Quality Assurance processes
- Construction Completion Process

1.4 SCIRT QUALITY MANAGEMENT SYSTEM STRUCTURE

The SCIRT Quality Management System relies on utilising the existing individual ISO accredited Quality Management Systems in place for each Lead Design and Delivery Team home organisations working within SCIRT.

The ISO 9001 Quality Management system comprises of various inputs which are managed through continual improvement processes to ensure customer requirements are met and customer satisfaction achieved.

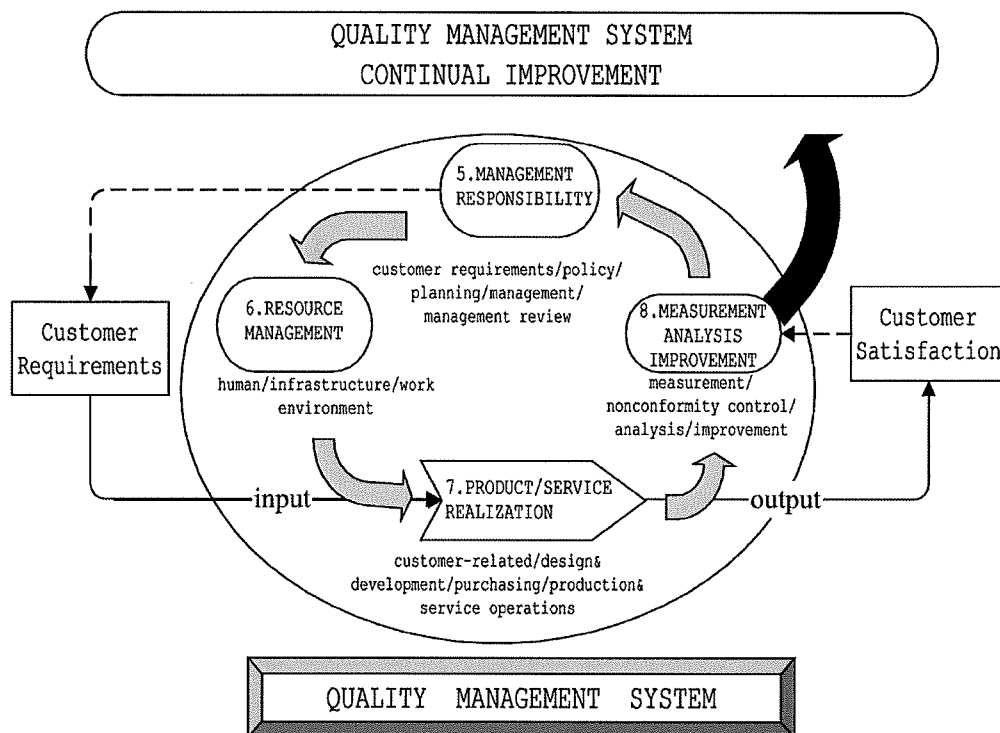
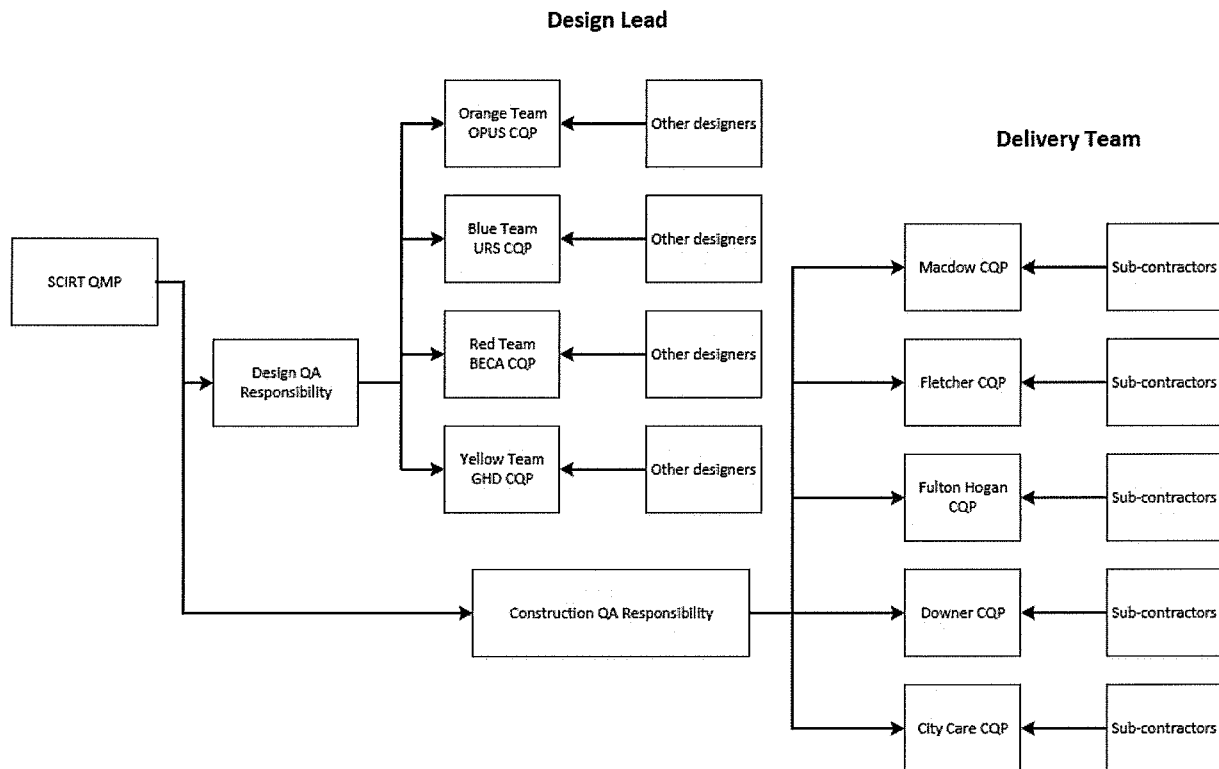


Figure 1: Model of the Quality Management System

The QA procedures for a project design will be undertaken by the Design Lead organisation. The QA procedures for construction delivery will be undertaken by the Delivery Team. This can be seen below:



The aim is to have all stakeholders involved in a proactive and accountable manner to ensure that the programme quality objectives are met for each project in a consistent manner. To do this, each organisation has written a supplementary SCIRT Contract Quality Plan (CQP) that fits within their company standard QA procedures.

1.5 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This plan is not a standalone document and it interfaces with all other SCIRT management plans, in particular, the Construction, Design, Value and Risk Management Plans.

2 PERFORMANCE MEASUREMENT AND MONITORING

2.1 VALUE KRA

Quality performance is measured under a Key Performance Indicator (KPI) within the Value KRA. This measure is the Project Quality of Construction Audit (also known as the Construction Verification Audit, KPI 5.2).

Details of how this KPI is measured can be found in the KRA Management Plan.

2.2 PROGRAMME QUALITY PERFORMANCE

Performance information on NCR rates, rework costs, key outcomes and upcoming priorities are reported to the SCIRT Board on a monthly basis through the operational report.

3 ROLES AND RESPONSIBILITIES

3.1 DESIGN AND DELIVERY TEAM

Specific responsibilities within the Design and Delivery Team Organisations for quality management, including subcontractor quality management responsibilities, are outlined in their CQP for SCIRT related work.

3.2 EXECUTIVE GENERAL MANAGER (EGM)

Promotes quality culture at senior level, leads by example and reports directly to the Board on quality performance.

3.3 SQE MANAGER

Provides strategic direction for quality for delivery of projects within specifications and design. Promotes quality culture at the programme and systems level, leads by example and reports quality trends to the EGM.

3.4 DESIGN MANAGER

The Design Manager is responsible for the delivery of QA for all project design, and for ensuring appropriate audits of design QA are carried out.

3.5 DELIVERY MANAGERS

The Delivery Managers are responsible for ensuring the construction quality specification and therefore asset integrity requirements are met, and for the delivery of all QA documentation.

3.6 QUALITY MANAGER AND ADVISOR

Provides support to the Design and Delivery Team Quality Managers and ensures that the SCIRT audit verification and reporting processes are met. Promote strong collaboration with all stakeholders across the SCIRT delivery program.

3.7 PROJECT COORDINATORS

The SCIRT Project Coordinators are responsible for supporting the Delivery Teams both through the ECI process and the construction phase for the development and implementation of the Construction Schedule and ITP documents. They are also responsible for conducting the Project Quality of Construction Audit (KPI 2.2) and informing the Delivery Managers and Quality Manager of conformance trends and opportunities.

3.8 DELIVERY TEAM QUALITY MANAGERS

Delivery Team Quality Managers are responsible for overseeing quality management within the Delivery Team, facilitating adherence to the Delivery Team's ISO accredited quality management system, interfacing with IST, ensuring SCIRT programme quality requirements are met and reporting on Delivery Team quality performance.

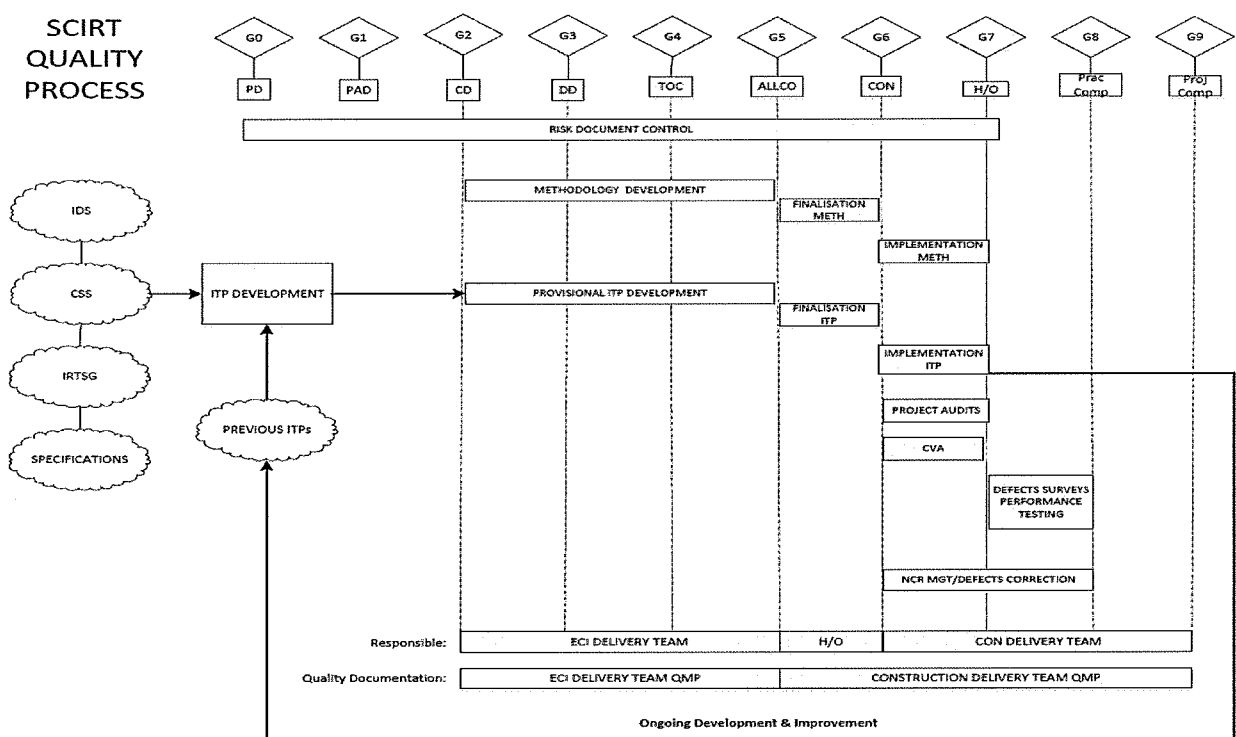
3.9 QUALITY LEADERSHIP GROUP (QLG)

The QLG purpose is to provide quality assurance, by continual improvement of the quality system and processes. The QLG meetings occur fortnightly and involve Delivery Team Quality Managers, IST SQE Manager and Quality Manager.

4 PROJECT SYSTEMS

The inter-relationship between the SCIRT business process and the quality process can be seen below. The process is reliant on a staged development of integrated quality documentation, systems and processes through the design and construction stages.

Close interaction between the Design Team, ECI Delivery Team, Quality Managers and Construction Delivery team is required throughout the process.



5 DESIGN QUALITY

The Design Team consists of engineers from a number of Consultants working in the IST. There were originally four Lead Design Organisations (LDOs) within the Design Team. Each LDO was responsible for the design, quality assurance, and documentation of each project assigned to them. Since the start of 2015, the number of designers reduced (due to reduction in workload) such that the four teams were merged into one Design Team, with the Design Team Lead reporting to the Professional Services and Design Manager.

5.1 DESIGN PACKAGES

Designs will be specific for each project as per programme schedule. Design packages shall cover the scope, resourcing, construction cost estimate, programme, interfaces with other design packages, inputs, references, output details and a verification plan.

Designs will be compliant with the Christchurch City Council Infrastructure Design Standard (IDS) and subsequent NTC's that may be issued, and the Infrastructure Rebuild Technical Standards and Guidelines. Departures will be approved by the Scope and Standards Committee. Designs for projects will be approved before issued for construction.

5.2 QUALITY PLANS

Each of the four Lead Design Organisations (LDOs) within the Design Team developed a SCIRT specific Quality Plan. These are based on the Lead Organisations ISO9001 accredited Quality Systems and the requirements of SCIRT. Even though the four teams have merged into one, the QA requirements for each project remain based on the LDO's plan for which the project was originally assigned.

The plans provide the procedures for conducting quality reviews and well as documentation requirements of the reviews. The plans and adherence to the quality procedures are audited on an annual basis. The plans are stored on the SCIRT IST network (G:\Designers\Quality Plans_all Design Teams).

5.3 DESIGN REVIEWS

The SCIRT design process provides several levels of review, both internal and external to the Design Team. Internal quality reviews are performed in both the Concept and Detailed Design phases in accordance with the LDOs Quality Plan. A peer review is also performed in the Detailed Design phase for projects which are subject to a building consent. The peer review is conducted externally by an organisation other than the LDO. Additionally, Concept Design and Detailed Design reports are provided to representatives from CERA, NZTA and the Council for review and comment (as appropriate).

5.4 DESIGN VERIFICATION

All four LDO's have similar verification procedures and documentation requirements as described in the individual LDO's Quality Plan. Design verification is carried out to confirm the correctness of outputs and compliance with the input requirements. Work outputs may include reports, specifications, drawings, construction cost estimates, data and other deliverables.

The LDOs document their verification on the following forms;

- Blue Team - SCIRT specific Design Review form,
- Orange Team - QA/Opus/PQP Form/01,
- Red Team - Request for Verification Form, FG06/03,
- Yellow Team – SCIRT specific Project QP Workflow and Checklist.

Drawing verification is performed in accordance with the SCIRT Draughting Manual.

5.5 DESIGN CERTIFICATES

For projects requiring Building Consent/Code of Compliance, Producer Statements are produced. The Design Team is responsible for the PS1, PS2, and PS4 certificates, with the Delivery Team responsible for the PS3 certificate. All certificates are forwarded to the territorial authority as part of the Handover documentation.

6 RISK MANAGEMENT

Risk management activities are defined in the Risk Management Plan.

Risk within the programme is managed at programme level and project level. The risks and their associated provisions are tracked in Risk Registers, and kept up to date for the life of the project.

7 CONSTRUCTION QUALITY CONTROL

7.1 EARLY CONTRACTOR INVOLVEMENT (ECI) PROCESS

The ECI process and deliverables are set out in process documents stored on Project Centre in Register / 006: Delivery Management / ECI. Key aspects relating to quality management are set out below.

An ECI Delivery Team is allocated at Gate 1 of the SCIRT process. The role of the ECI Delivery Team is to advise the Design Team on constructability issues and value opportunities, and develop the following preliminary plans:

- Risk Register
- Traffic Management Schedule
- Methodology (with key hold points noted)
- Construction Schedule
- Inspection and Test Plan

The ECI deliverables listed above are submitted at the start of TOC phase, and are refined into a final Construction Management Plan (CMP) by the Construction Delivery Team to meet their own home organisation quality requirements.

The ECI process ensures that the required quality procedures, specific to the project under development are identified and reviewed so that any physical limitations, restrictions or quality related issues for constructability or future operation are understood and resolved prior to construction.

7.2 INSPECTION TEST PLANS (ITP)

The preliminary ITPs will be developed by the ECI Delivery Team, then refined and finalised by the Construction Delivery Team.

The Construction Delivery Team is responsible for the development, review and authorisation of project specific ITPs, based on the Methodology, Construction Schedule, Design, CSS, IDS, IRTSG, NORs and other applicable standards and requirements.

In all cases it remains the responsibility of Design and Delivery Team to ensure that they are familiar with all appropriate standards and specifications. Delivery Team Quality Managers will ensure that regular awareness is created around certain key elements of the standards and specifications and subsequent changes to these.

7.3 CONSTRUCTION COMPLETION

On completion of the physical construction works, the delivery team will implement the SCIRT process for the Construction Completion phase (formerly known as Handover phase). This includes the commissioning of all work and delivery of required

documentation, including as-built drawings and relevant QA documentation. The construction completion documentation requirements are set out in Project Centre under Register / 006: Delivery Management / Handover Process.

All mechanical and electrical assets, reticulated networks sewers and water supply assets are included as Active Systems. The Delivery Teams will be required to provide all required QA documentation and test results checks, including the satisfactory commissioning and demonstration of the system.

All construction completion documentation, closure of RFIs, NCRs, WSCs, GIS network update, final as-built drawings, O&M Manuals and supporting information is required, before the project can enter the construction completion phase.

7.4 POST CONSTRUCTION DEFECT SURVEYS AND PERFORMANCE TESTING

The CSS requires performance and quality testing specific to the type of asset constructed. The Delivery Team is responsible for this testing before Practical Completion of the project with the results reported to SCIRT team.

In addition, a walkover survey is also undertaken between the Delivery Team and the Delivery Coordinator to assess reinstatement quality, landscaping and disestablishment standards also before Practical Completion is awarded.

8 CONSTRUCTION QUALITY ASSURANCE

8.1 INTERNAL QUALITY AUDITS

Project quality audits are undertaken during the construction phase by the Delivery Team. This is an internal check on quality performance and the successful implementation of the Construction Work Plan and ITP requirements. A project quality audit is undertaken on a monthly basis for all projects that are between 5% and 90% complete (measured by cost).

8.2 PROJECT QUALITY OF CONSTRUCTION AUDITS

One project Quality of Construction Audit (or Construction Verification Audit) is undertaken per delivery team per month by the Project Coordinators, during the project construction phase. These audit findings contribute to the DPS score, and are reported to the SCIRT Board and Delivery Teams. The audits verify compliance to the relevant construction standards, quality documentation requirements and other SCIRT requirements such as health and safety performance. These audits are a requirement of the KRA measurement process (KPI 2.2) and are subject to management review.

9 NON-CONFORMANCE MANAGEMENT

Defects and non-conformances are managed in order to ensure that delivery quality standards are met and continual improvement of systems and processes are achieved.

A Non-Conformance Record will be generated within Project Centre for all defects and non-conformance issues identified through the life of the project, i.e. including design, construction and post-construction phases. The NCR process is attached as Appendix 1.

NCR reporting is to ensure that;

- Defects and non-conformances are identified and documented in a timely manner.
- Informed decisions on resolution of the non-conformance are made and the reasoning documented.
- Root causes are identified and mitigated.
- Lessons learned are communicated effectively so as to prevent re-occurrences.
- Implemented actions monitored to ascertain effectiveness to prevent re-occurrences.
- Costs of rework is accurately recorded.

The Delivery Team or Design Team responsible for the non-conformance is responsible for identifying the appropriate resolution or corrective action, communicating lessons learned and close-out of the NCR. The Quality Manager will oversee the process and ensure that the issues raised are addressed, communicated and closed out in a timely fashion.

NCR information will be reported on a monthly basis to the SCIRT Board, and is available to SCIRT team members on HiViz.

All non-conformances must be closed out in accordance with the NCR process (Appendix 1) and records uploaded to the NCR on Project Centre before Practical Completion will be awarded.

10 QUALITY DOCUMENTATION

10.1 RECORD KEEPING

In conjunction with the Administration Team, certain processes will require formal documentation to be recorded and archived. These processes are outlined in the appropriate SCIRT procedures with a formal archiving system implemented both electronically and where required in a hard copy format.

In addition, certain quality records will be kept to demonstrate that equipment essential to the quality process is maintained according to certain prescribed standards.

All quality records and process documentation will be stored in a manner to ensure ease and timeliness of retrieval when required. The Delivery Team Quality Managers will ensure that these records are updated and maintained.

10.2 AS-BUILT INFORMATION

A consistent approach is in place to enable field data collection, processing and production of as-built plans to proceed as efficiently and accurately as possible. To achieve consistency between projects, a standard spreadsheet template has been developed for the capture of pipe and point data.

This standard Survey As-Built Guideline and Template can be found in (IST) Project Centre under: Register / 006: Delivery Management / Handover Process / As Built Information.

The Survey As-built Guideline contains the as-built requirements for gravity wastewater, pressure sewer systems, stormwater systems water supply and vacuum sewer systems.

The Delivery Teams are responsible for providing the as-built data and red-lined construction drawings.

10.3 OPERATION AND MAINTENANCE (O&M) MANUALS AND WARRANTIES

O&M Manuals, Product Manuals, Asset Data pickup sheets and Warranties shall be provided for all works in accordance with the works specification.

The Delivery Team shall ensure this requirement is adhered to, with designers providing guidance to the relevant Delivery Team to complete the as-built information prior to submission as part of the project construction completion documentation. The IST Commissioning Coordinator will conduct random reviews as an auditing function. A single hardcopy of the O&M manual will be required to be placed in the control cabinet on site, prior to construction completion.

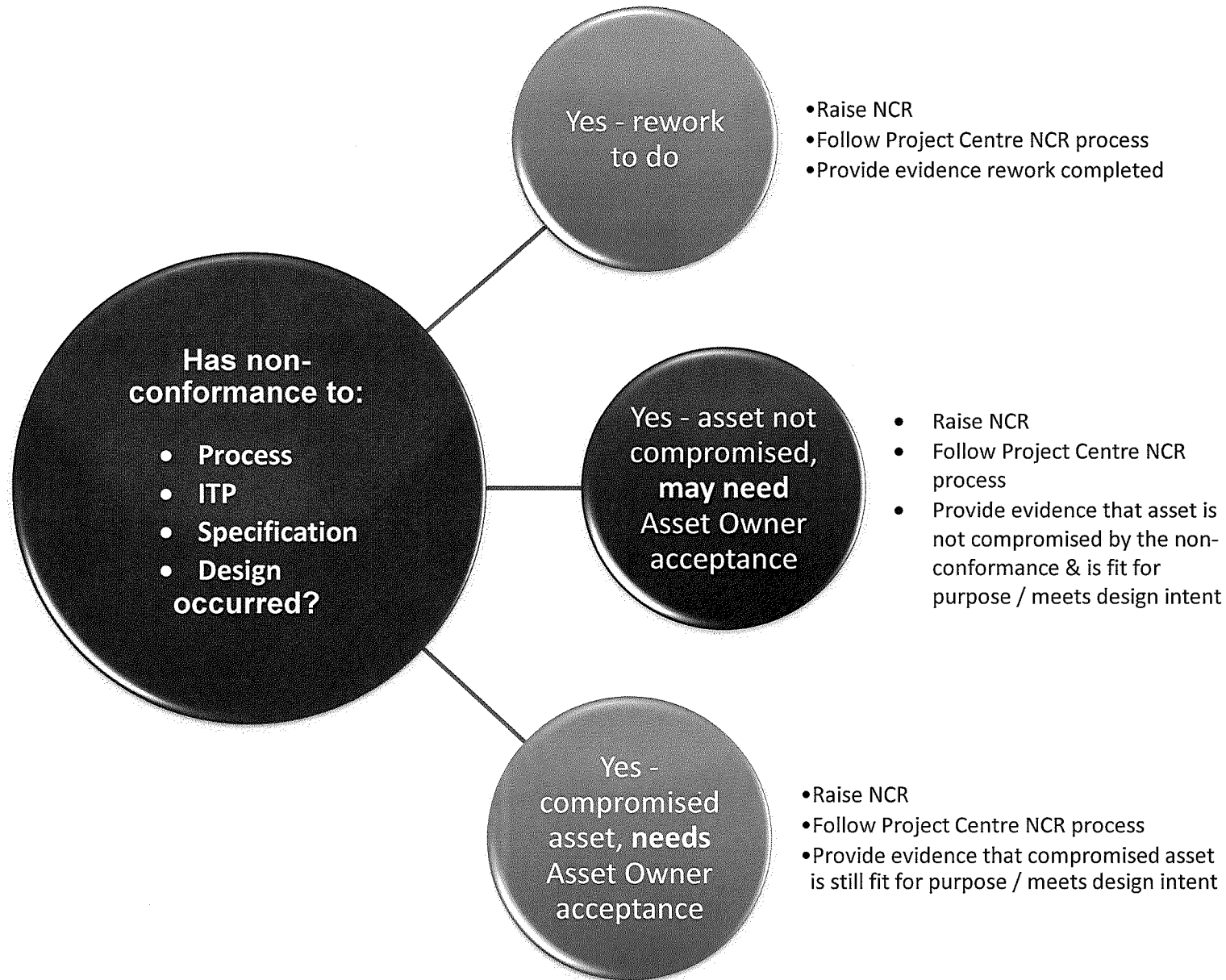
O&M Manual inclusions shall be in accordance with the relevant specification and/or standard and shall contain the following information as a minimum:

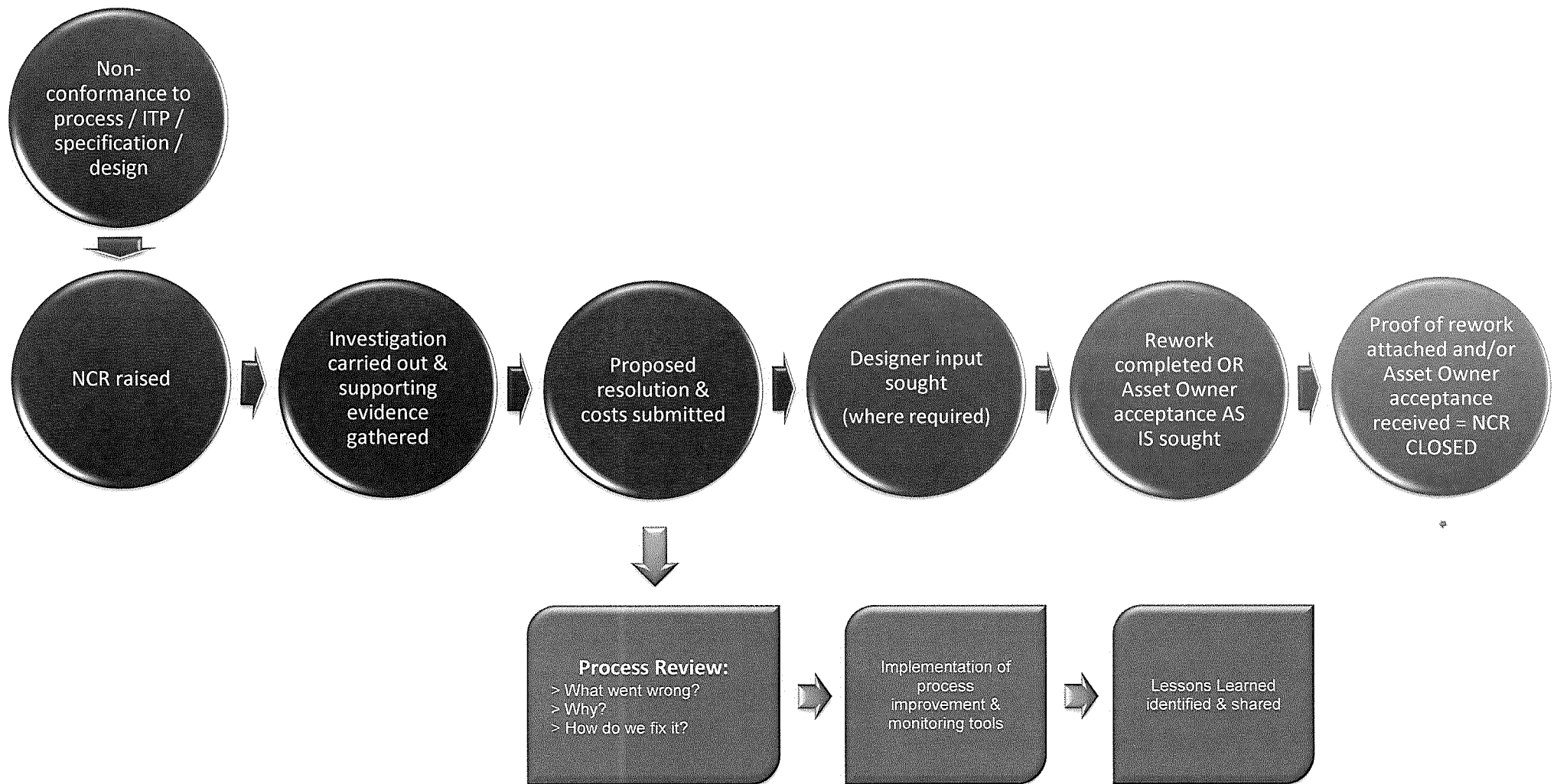
- Redline marked up drawings (for draft O&M manual) and final as built drawings (for final O&M manual)
- SCIRT O&M Manual completed for all required sections (including maintenance, replacement parts, and so forth)
- Warranties
- Product Manuals
- Others as identified within the relevant Specification/Standards
- Details of non-standard assets or approved concessions

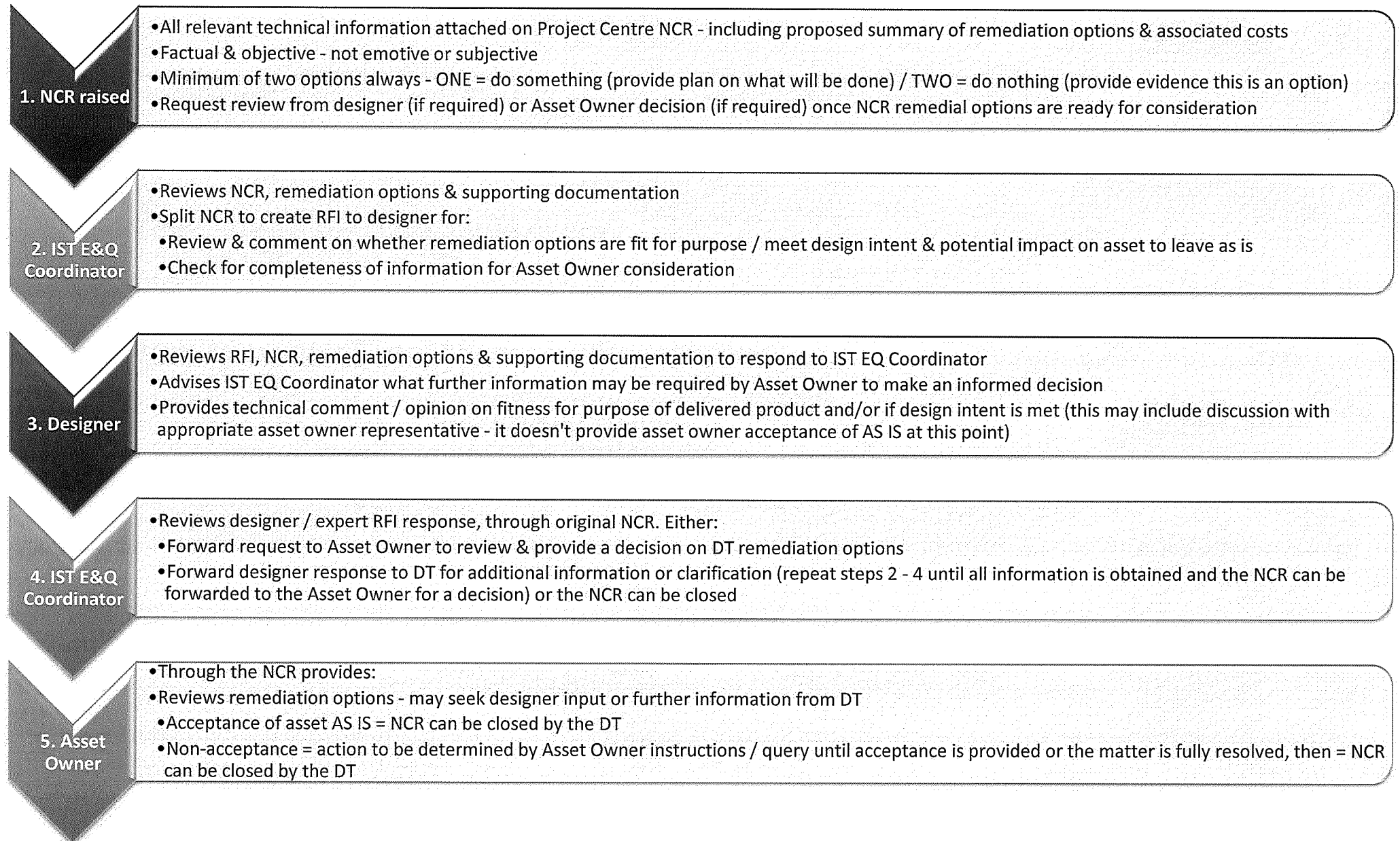
11 MANAGEMENT REVIEW

The SQE Manager is responsible for performance monitoring and evaluation, and annual review of this Quality Management Plan. More frequent updates as necessary may be made at the discretion of the SQE Manager. The Delivery Managers and Professional Services Manager will assist with QMP review.

APPENDIX 1 – NCR PROCESS







- An NCR must be raised for every non-conformance as soon as it is identified, and then the process to resolve it or provide remediation options is commenced.
- Multiple defects should not be bundled onto one NCR. One NCR is required per asset (e.g. lateral, MH to MH length of mainline).
- If the asset does not meet specification or a pre-agreed departure from specification, the NCR must go to the asset owner for consideration. The asset owner will nominate specific staff to review and decide these NCRs. Only people with delegated authority can accept a non-conformance on behalf of the asset owner.
- Remediation options need to be clearly provided with all supporting documentation attached to the NCR form before they can be sent to designer for technical comment or the asset owner for consideration.
 - Historical evidence to support the remediation options should be included too (for example, evidence of poor subgrade prior to SCIRT works being done / pre and post SCIRT works testing / correspondence with designers for changes to designs based on unexpected discovery or changes to conditions once in the planning and/or during works stages / and so on).
 - Ensure there are a minimum of two options presented for each NCR.
 - In each NCR an accurate cost to rework and what that rework entails must be included.
- An NCR requesting asset owner acceptance of a defect must include the following details:
 - The reasons for non-conformance with specification.
 - Clearly explain what the impact is on asset life, functionality or maintenance requirements, and identify any consequential risk for the Asset Owner if left as-is.
 - If possible compare alternative solutions.
 - Include all supporting plans, documentation and calculations.