

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.

## Design Management Plan

**Story:** SCIRT Management Plans

**Theme:** The SCIRT Model

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A plan which describes how SCIRT will carry out design work.

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](http://www.scirtlearninglegacy.org.nz)



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## Design Management Plan

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## DESIGN MANAGEMENT PLAN

### ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Term	Definition
AA	Alliance Agreement
CCC	Christchurch City Council
CER	Canterbury Earthquake Recovery
CERA	Canterbury Earthquake Recovery Authority
CSS	Construction Standard Specifications
DMP	Design Management Plan
DTL	Delivery Team Lead
EMP	Environmental Management Plan
GM	General Manager (previously known as Alliance Manager)
IDS	Infrastructure Design Standards
IDV	Independent Design Verifier
IRMO	Infrastructure Rebuild Management Office
IRTSG	Infrastructure Recovery Technical Standards and Guidelines
IST	Integrated Services Team
ITP	Inspection and Test Plan
JDE	JD Edwards Accounting System
KPI	Key Performance Indicator
KRA	Key Result Area
LDO	Lead Design Organisation
NZTA	New Zealand Transport Agency
PMP	Programme Management Plan
PQP	Project Quality Plan
QMP	Quality Management Plan
RFI	Request for Information
SAT	Survey As-Built Template
SCIRT	Stronger Christchurch Infrastructure Rebuild Team
SQE	Safety, Quality and Environmental
TOC	Target Out-turn Cost
WSC	Work Scope Change

# 1 INTRODUCTION

The Design Management Plan (DMP) is a working reference system to be used by Design personnel enabling them to understand the design managements systems and quickly locate design criteria and control data. The DMP is located electronically on Project Centre.

## 1.1 Purpose

The purpose of this plan is to define SCIRT's requirements and objectives that impact on design activities and explain how those activities are to be undertaken to meet SCIRT requirements and support achievement of SCIRT objectives.

## 1.2 Scope

This DMP is an integrated part of the SCIRT Programme Management Plan (PMP) and concerns all design activities associated with permanent works for the SCIRT programme. As described in the Alliance Agreement, SCIRT is tasked with the reconstruction of the horizontal infrastructure damaged in the earthquakes of 2010 and 2011. The SCIRT reconstruction and repair work in the city of Christchurch will cover the following networks:

- Water Supply
- Wastewater
- Stormwater
- Roading (including bridges and retaining walls)

Temporary works design activities are to be undertaken by the Delivery Teams following their home organisation's accredited quality management system, augmented as required to meet the SCIRT Health and Safety Management Plan.

## 1.3 Objectives

### 1.3.1 Alliance Agreement Objectives

The following objectives from the SCIRT Alliance Agreement (AA) are relevant to Design:

- Demonstrate best long term value for money for the infrastructure built
- Improve the resilience of infrastructure
- Provide price-tension within the alliance by allocating work based on performance
- Establish the lowest cost structure for the rebuild effort
- Coordinate work to minimise disruption to customers
- Deliver Asset Management Information that sets a benchmark for NZ
- Demonstrate improved productivity by reducing TOCs for like-for-like work
- Safety Objectives and Environmental Objectives
- Maximise use of local resource

### 1.3.2 Design Team Additional Objectives

The Management Team's overarching goal is to minimise durations for approvals/signoffs/reviews by streamlining and simplifying the design and construction process. SCIRT is a self-governing entity therefore some of the review and approval processes can be simplified whilst not compromising the overall quality of a final product. Co-locating most of the design staff, management, asset owner representatives and lead disciplines technical resources provides efficiency in coordination and cross referencing as well as helping in decision-making.

### 1.4 Requirements

When designing this management plan to meet the above objectives, SCIRT is bound to do so to meet the following:

#### 1.4.1 Legislative Requirements

- CER Act
- Building Act
- Local Government Act
- Resource Management Act
- Other Acts

#### 1.4.2 Alliance Agreement Requirements

The AA includes provision for the Board to change AA requirements when that change is considered to better support the achievement of the AA objectives. Rules and requirements of the Design Team engagement are referenced in the AA and PMP as guidelines.

#### 1.4.3 Design Scope and Standards

Designs are to be undertaken in accordance with the following standards:

- Christchurch City Council Infrastructure Design Standards (IDS)
- Christchurch City Construction Standard Specifications (CSS)
- CCC/CERA/NZTA Infrastructure Recovery Technical Standards and Guidelines (IRTSG)
- Network Guidelines (DG36 – roading; DG43B – wastewater and stormwater; and DG60 – water supply); with an additional option developed for consideration (DG43A-1 wastewater and stormwater)

Design Guidelines are prepared to give guidance to Designers on the application of the above Standards, and to ensure consistency of approach across the Design Team. Design Guidelines are approved for release by the Design Manager, and located electronically on Project Centre.

### 1.5 Relationship to other Management Plans

The DMP is an integral part of the SCIRT PMP. The Plan will link the Asset Investigation Plan and the Scope Management Plan especially in terms of the Project Definition process. Definitions and relationships with other SCIRT Plans are shown on the map included in the PMP.

## 2 DESIGN STRATEGY

The SCIRT programme is broken out into a number of discrete items of work known as Projects at the Project Definition stage.

A standardised Project Scoping Package which defines the technical parameters of each project is provided by the Project Definition Team to the Design Team.

The design of each Project is developed through two stages:

- Stage 1      Concept Design
- Stage 2      Detailed Design

### 2.1 Structure of Design Team

The overall Design Team was originally divided into four distinct teams, each with a Design Team Lead responsible for a programme of work allocated by the Design Manager.

Each team included Designers from the various Consultancies within Christchurch (and from Council), with the Design Team Lead being a representative from the Lead Design Organisation (LDO).

Since the start of 2015, the number of designers reduced (due to reduction in workload) such that the four teams merged into one Design Team, with the Design Team Lead reporting to the Design Manager.

### 2.2 Design Integration and Coordination

The Design Manager will manage the design process using this Plan to ensure effective integration of the following components during development of the design:

- The design is delivered to the agreed Project Programme and sequencing to match SCIRT's project priorities defined by Project Definition
- The design provides value for money and can be operated efficiently through consideration of Whole of Life Costs (where information is available) with the relevant asset owner
- The design includes consideration of Safety in Design and constructability issues through discussions with the allocated ECI Delivery Team
- Technical verification and process audits are undertaken throughout design development by internal and external reviewers as appropriate



### 2.3 Project Quality Plans

Even though the original four design 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. Each new project is therefore assigned a 'colour' as previously.

To ensure that the operational activities of the LDO's are kept within the 'business as usual' principal, each LDO has a Project Quality Plan (PQP) for use by their respective Design Team at SCIRT. This PQP shall be aligned with the parent organisation's ISO 9001 certification and DMP, and be tested and measured as part of the parent organisations inspection & test plan.

#### 2.3.1 Commonality of PQP's

To maintain commonality between each of the PQP's, standard SCIRT forms are included within the Designers Library on Project Centre. This shall not constitute adoption of the SCIRT system but merely provide a mechanism for common reporting across the LDO's.

## 3 DESIGN PROCESS DESCRIPTION

The Design Process is a part of overall SCIRT Programme and is detailed in the attached Appendix B and C.

### 3.1 Project Allocation

Work is allocated to Design Teams on the basis of resource availability, resource skill set, background knowledge of the project, and their workload. SCIRT will monitor Designer hours per project against industry standards to ensure best value achieved. This information is available on HiViz.

### 3.2 Concept Design Phase

The concept design phase is used to assess damage and consider various options to define the preferred/recommended option. During this phase, concepts are developed through interaction of the team with other SCIRT stakeholders.

Interaction will occur with the following SCIRT personnel:

- Asset Owner Representatives
- Project Definitions Team
- Asset Assessment Team
- ECI Delivery Team
- TOC Team
- SQE Team
- IST Communications Team
- Utility Co-ordinator
- Property Coordinator

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- Traffic Management Team
- Heritage Consultant (where Heritage structures or features are evident)

Interactions will occur at the following planned events and at other times as necessary:

- Start Up/Initiation Workshop
- Risk Workshop
- Constructability Workshop
- Option Selection Workshop (where considered appropriate)

Alternative options are prepared and their Whole of Life cost including Capital, Maintenance and Resilience assessed as appropriate. In addition a non-cost Multi Criteria Assessment can be undertaken for options which include variations in visual, heritage or environmental factors.

The Concept Design Report includes the following information:

- Scope of Work
- Asset Condition
- Options Considered
- Threats and Opportunities (Risk Register)
- Recommended Option
- A record of any Improvement included
- Estimated Construction Costs

Any preferred/recommended option which includes work beyond the scope of the IRTSG and/or Improvement funding will be approved through the Infrastructure Programme Co-ordination Team (IPCT)/Infrastructure Programme Steering Group (IPSG).

### **3.3 Detailed Design Phase**

The detailed design phase provides a level of documentation that clearly defines the design, specification, risks and extent of all elements in sufficient detail to enable it to be constructed.

Interaction will occur with the following SCIRT personnel:

- Technical Advisors
- ECI Delivery Team
- TOC Team
- SQE Team
- Delivery Communications Team
- Utility Co-ordinator
- Property Coordinator
- Traffic Management Team
- Heritage Consultant (where Heritage structures or features are evident)

Interactions will occur at the following planned events and at other times as necessary;

- Risk Workshop

- Constructability Workshop

This design phase completes the design and coordination of all design elements and incorporates agreed construction requirements, including consideration of significant or unusual health and safety issues; and will co-ordinate design with other disciplines and inter-related projects as required.

The detailed design includes the following items:

- Detailed Design Report (including)
  - Recommended/Approved Concept
  - Safety in Design Considerations
  - Agreed changes in Scope and/or Standards
  - Designers Intervention Points (Hold Points during construction)
  - A clear statement of any Improvement portion to allow pricing at TOC
- Construction Drawings
- Threats and Opportunities (Risk Register)
- Bill of Quantities
- Specifications

### **3.4 Concept/Detailed Design – Minor Works**

For projects which require minimal/no design and/or projects which result in construction works of a low value, a combined Concept and Detailed Design phase can be followed with one report being prepared. The report is to cover all aspects of both phases as appropriate.

The Design Team Lead is to liaise with the Design Manager to agree when combined phases are appropriate.

### **3.5 Construction Phase**

During construction SCIRT Designers will provide design support to the Delivery Teams. For example, necessary changes due to unforeseen site/ground conditions, changes in damage level since design completed and performance design elements may dictate changes to the design. In addition construction monitoring activities in this phase may include review of Delivery Team submissions and information (such as inspection and test plans), oversight of construction of key elements, and responding to Delivery Team requests for information.

The MSQA role is undertaken by the Delivery Team; the Designers do not carry out general site supervision, their work is Design related only. For projects subject to Building Consent, Designers will carry out construction monitoring to level CM1 as defined in the 'Guideline on the Briefing & Engagement for Consulting Engineering Services' APENZ/IPENZ 2004; including inspections identified as Hold Points to provide assurance to sign the PS4 Producer Statement.

### **3.6 Handover Phase**

The Handover phase input performed by Designers is the preparation of as-built drawings. Refer to Section 9 of this Plan.

## **4 DESIGN PROCESS MANAGEMENT**

The following processes are used to monitor, measure and evaluate the Progress of Designs.

### **4.1 Progress against Design Brief**

A design brief is created at the start of each design phase (Concept and Detailed) detailing the following information:

- Inputs
- Key Dates
- Target Outturn Hours
- Project Personnel
- Review points
- Outputs

The Design Team Lead is responsible for reporting progress against the brief.

Progress of the design work shall be regularly monitored against the programme and reviewed at weekly design team meetings. Issues relating to maintaining the programme and resources should be resolved between the Design Team Lead and the Design Manager.

### **4.2 Design Performance**

The performance of the Design Team will be monitored against the following factors:

- Quality – Internal quality audits (refer to Section 10.3)
- Cost – Performance against Target Outturn Hours
- Timeliness – Performance against Design Programme

Reports can be found on Project Centre (Quality Audit outcomes) and HiViz (cost and timeliness outcomes).

### **4.3 Design Reporting**

The Design Manager is responsible for providing information for inclusion in the monthly Operational Report detailing progress against programme, planned work activities and changes in processes.

## **5 DOCUMENT CONTROL**

### **5.1 General**

Design outputs including drawings, schedules, specifications and reports are issued and managed in controlled documents as defined in the SCIRT Quality Management Plan.

### **5.2 Design Approvals**

The Design Manager is responsible for approval of all Concept and Detailed Design Reports.

The Design Team Lead is responsible for the approval of all "For Construction" Drawings, Specifications and Bills of Quantity.

The development and approval of standard details and specifications may be undertaken by persons approved by the Design Manager.

### **5.3 Development of Drawings using CAD Systems**

All drawings are generated electronically using the approved CAD system (approved by the Design Manager).

CAD personnel prepare drawings and manage the drawing files in accordance with the CAD Drafting Manual which is located on Project Centre.

### **5.4 Naming Convention and Templates**

The document Naming Convention Manual is located on Project Centre. Templates for all documents are retained in the Library on Project Centre.

## **6 CORRESPONDENCE**

All correspondence and documentation is issued using Project Centre.

### **6.1 Correspondence with Delivery Teams**

All communications between Design and Delivery Teams are to be exchanged via the relevant Project Co-ordinator via Project Centre.

Correspondence can include project communication and design documents. Project communications, including 'memos', 'fax / letter registration' and 'meeting minutes' are to be used for formal communications.

### **6.2 Correspondence with the Owner Participants**

Any matter that requires written correspondence from Designers to the Owner Participants or their representatives shall be directed through the Design Manager to the Horizontal Infrastructure Management Team (HIMT) via Project Centre.

## 7 REQUESTS FOR INFORMATION

Requests For Information (RFI) are utilised to facilitate formal communication between SCIRT teams, such as Design and Delivery Teams.

Each RFI must include at least the following information:

- Date raised
- Raised by
- Project number, element of works, location, drawing or specification number and revision
- Detail of query
- Party to answer query
- Date response required by

The RFI template on Project Centre is to be used for all RFIs.

All RFI's raised between Design and Delivery Teams are to be exchanged via the relevant Delivery Project Co-ordinator.

## 8 WORK SCOPE CHANGE

Work Scope Changes (WSC) are utilised to facilitate the formal communication of changes in Scope and/or Standards to a Project. Changes to Standards which apply to all projects are also notified to the Delivery Teams using the Notice of Requirement system.

WSC's may be raised by any member of the IST using the process established on Project Centre. For WSC's raised by Project Coordinators (on behalf of Delivery Teams), it is expected that it will link to a Request for Information (RFI) addressed by the Designer.

The Designers are responsible for confirming the details of the proposed change and the source of the request to make the change. The Design Manager (or person approved by the Design Manager) is responsible for confirming if the WSC is related to a Design Change or other factor.

Each WSC must include at least the following information:

- Date raised
- Raised by
- Project number, element of works, location, drawing or specification number and revision
- Detail of change
- Source of request for change (Design, Owner Participant, Delivery Team)

The WSC template on Project Centre is to be used for all WSCs.

## **9 AS-BUILT DRAWINGS**

The Design Team provides a service to the Delivery Teams for the preparation of As-Built Drawings as part of the Handover phase.

Delivery Teams are to provide as-built survey information using the SCIRT developed Survey As-built Template (SAT), and associated guidelines. This template allows verification of information against the original design in 12D.

For all projects, 'red line' mark-up drawings are also to be provided by the Delivery Team.

The accuracy of the as-built information remains the responsibility of the project Delivery Team.

All communication with the Delivery Teams is through the Handover Co-ordinator.

## **10 MANAGEMENT PLAN CONTROL**

### **10.1 Authorisation**

Initial authorisation is in accordance with the AA, Section 6.1.1. All plans are also authorised by the General Manager (GM).

The initial plans were submitted to the Board for approval in the first Board meeting following the execution of the AA. Subsequent revisions to plans will be authorised by the GM unless the GM deems the revision requires endorsement by the Board.

### **10.2 Distribution**

The Design Management Plan is a controlled document and shall be distributed and revised in accordance with the SCIRT Quality Management Plan.

Hardcopies are Un-Controlled copies. The Controlled copies are maintained in a secure website "Project Centre" which supports various project management functions for the SCIRT Programme including "configuration management" i.e. version control of documents.

### **10.3 Auditing**

Internal audits will be undertaken to monitor compliance with this plan and to allow the plan to be assessed for suitability, relevance and effectiveness.

This is in the form of an audit carried out to ensure compliance with the LDO's PQP.

A copy of the audit report is located electronically on Project Centre.

External audits may also be requested by the SQE.

### 10.4 Management Plan Review and Revision

This plan is a dynamic document that is current at the time of issue. The process for monitoring and review of the plan or its implementation and operation are detailed within the SCIRT Quality Plan.

Alliance management will conduct a reassessment for the purpose of continuous improvement. The review will consider the results of management monitoring, audit results, analysis of data, corrective and preventive actions as well as feedback from the Board, Management Team, IST, Design Team, Delivery Teams and site personnel. The frequency of the review will typically be as detailed in the Review and Audit section of the Quality Plan.

Implementation of resolutions from the review will contribute to continuous improvement.

Revisions to any management plan will always involve the Quality Manager who is responsible for ensuring the management plan set remains co-ordinated when revisions occur.

The document may be revised and updated in response to areas identified for improvement, such as:

- Changes in the Requirements and Minimum Standards defined in Schedule 5 of the AA
- Substantial changes in design or scope, construction sequence, staging, methodology, process or resource
- Requests by any Statutory Authority
- Internal and external audits
- Suggestions and comments from personnel
- Preventative action following a non-conformance
- Necessity for corrective action
- Senior management review
- Recommendations of the Independent Design Verifier, Independent Estimator or Strategic Review Panel

## 11 DESIGN TEAM STRUCTURE AND ROLE

The Design Team structure and lines of responsibilities are depicted in the attached Appendix A.

## 12 ROLES AND RESPONSIBILITIES

The overall Design Team was originally divided into four distinct teams, each with a Design Team Lead responsible for a programme of work allocated by the Design Manager.



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Each team included Designers from the various Consultancies within Christchurch (and from Council), with the Design Team Lead being a representative from the Lead Design Organisation (LDO).

Since the start of 2015, the number of designers reduced (due to reduction in workload) such that the four teams merged into one Design Team, with the Design Team Lead reporting to the Design Manager.

While it is expected that the original Lead Design Organisations contribute a significant portion of the resources, other design organisations are well represented.

### 12.1 Design Team Lead

The Design Team Lead is responsible to the Design Manager for the delivery of the design, including the day to day management of the project, monitoring and updating the work programme, allocation of staff resources, and reporting. The Design Team Lead is the primary point of contact with the Design Manager, maintaining close and regular contact, and is responsible for:

- The project staff within the design team
- The planning and monitoring of projects
- Reviewing all incoming project documents and circulating to appropriate staff
- The satisfactory delivery of each project in terms of scope, time, quality, risk and procurement of sub-consultants
- Liaising with SCIRT Planners to obtain statutory approvals as necessary
- Co-ordinating all Designers' staff to deliver the project within the programmed time
- Attending meetings when requested
- Establishing and maintaining the document control procedure in accordance with Section 5 above
- Maintaining the work scope change procedure in accordance with Section 8 above
- Ensuring the As-built Drawing process is expedited to avoid delay in project Handover

The Design Team Lead's authority includes:

- Approval of Drawings, Specifications and Bills of Quantity for issue

The Design Team Lead's authority does not include:

- Procurement of sub-consultants/external personnel. Proposals are to be forwarded to the Design Manager for approval.

The responsibilities and authorities of the Design Team Lead, in his absence, shall be delegated to any other person nominated by the Design Team Lead and approved by the Design Manager.

### 12.2 Design Team General Responsibilities

- To ensure the total design process conforms with AS/NZS-ISO 9001

## DESIGN MANAGEMENT PLAN

- To provide the agreed deliverables in accordance with the Design Briefs
- To participate in the design review process, review for constructability, ensure compliance with all conditions of approval, provide information for cost management purposes
- To develop the design according to the decisions agreed at the design review meetings in accordance with the Designer Guidelines, which are prepared and updated from time to time
- To facilitate the interface and relationships between Designers and the ECI/project Delivery Team
- To manage and facilitate third party participation in the design process, and review of design deliverables
- To comply with the SCIRT design verification and quality assurance procedures, and those of the respective LDO
- To maintain the design files and execution records in accordance with the document control procedures
- To inform and advise the Design Team Lead on all design issues which may impact on the project execution and assessment of risk
- Process As-built drawing information expeditiously on behalf of the Delivery Teams to avoid project Handover delay

### 12.3 Professional Services and Design Manager

From the start of 2015, the previous roles of Professional Services Manager and Design Manager have been integrated to form a single role. The responsibilities of the Professional Services and Design Manager are:

- Overall responsibility for all aspects of projects up to completion of the design process
- Reporting to the Management Team
- Management of the process to seek changes to Scope and/or Standards
- Liaising with the Client's Asset Managers on current/proposed design standards
- Managing the Asset Assessment, Project Definition, and Design processes (now known as the Professional Services Team processes)
- Ensure resource expenditure is controlled and within budget
- Ensuring As-built drawings are processed in a timely manner to facilitate Delivery Team project Handover

Specific design related responsibilities are:

- Overall responsibility for design outputs
- Liaising with key suppliers where required for design inputs
- Managing the design programme to ensure deliverable milestones are met and the interface with overall SCIRT programme is maintained
- Reviewing design outputs for compliance with Scope and/or Standards
- Establishment of a controlled communication system for all correspondence
- Liaising with the Design Team Lead and members of the Design Team to initiate investigation into cost savings in alternative design and construction solutions and change management

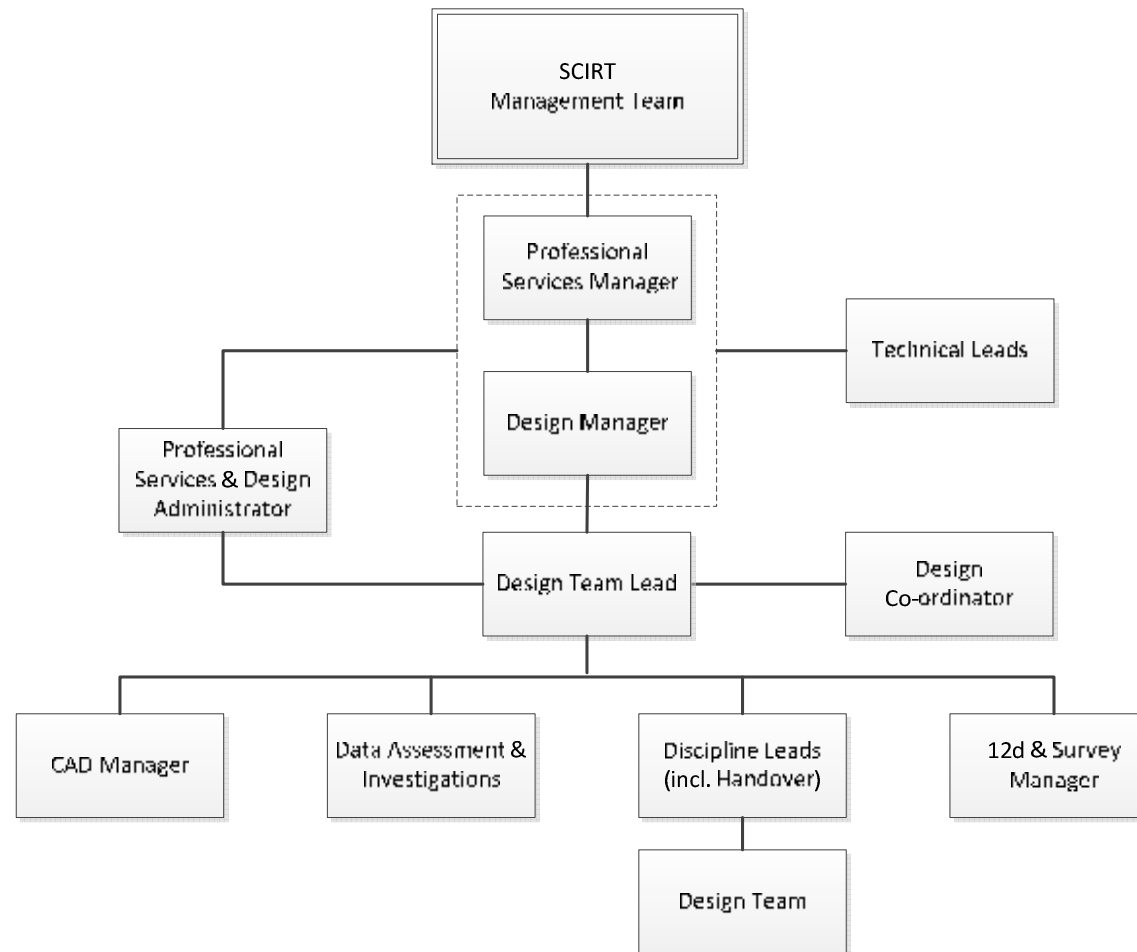
## **DESIGN MANAGEMENT PLAN**

The Design Manager (role) authority includes:

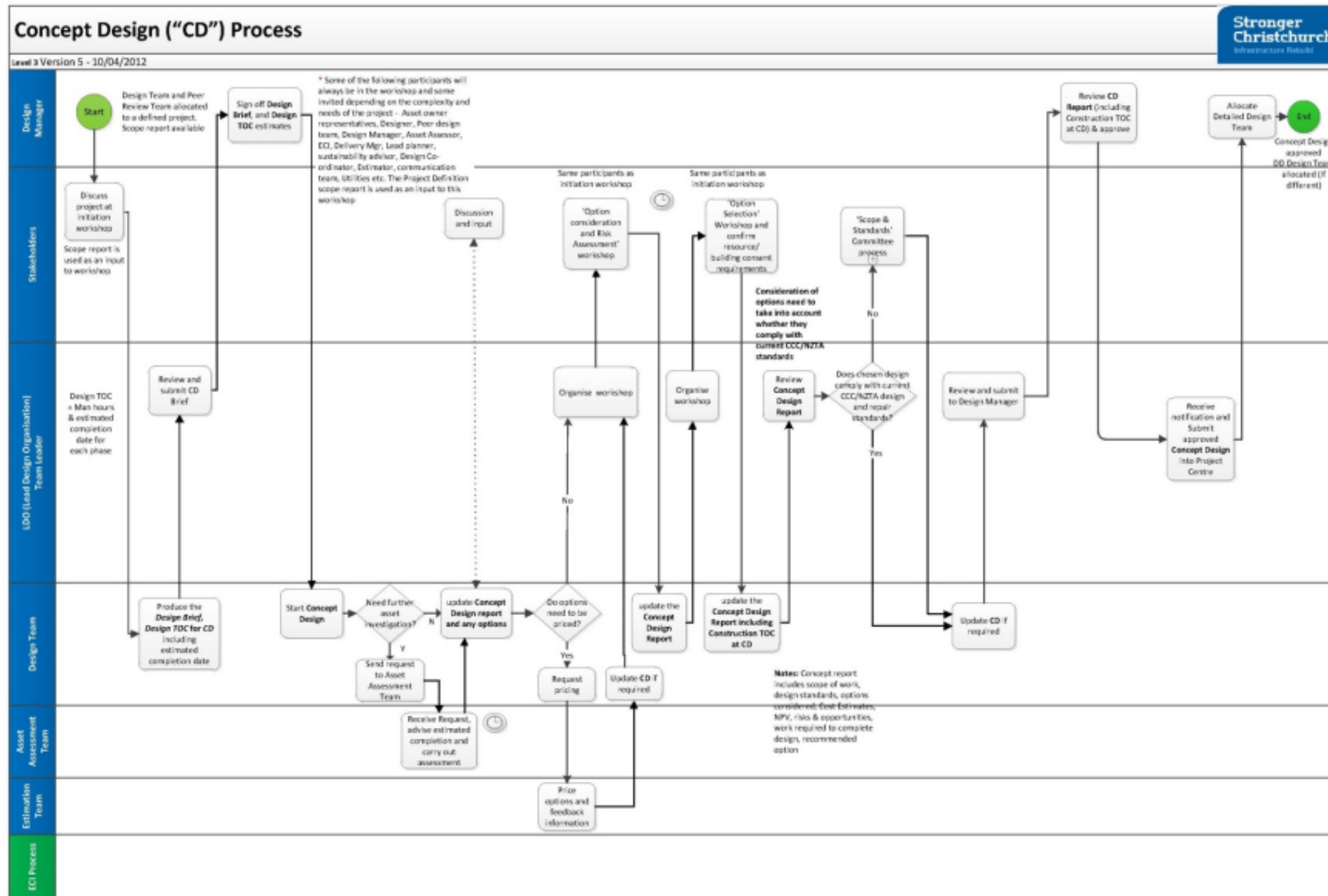
- Procurement of sub-consultants/external personnel to support the IST (SCIRT Office based) Design Team
- Approval of Work Scope Changes (in principle) as being a requirement of a Design change

## DESIGN MANAGEMENT PLAN

### APPENDIX A – DESIGN TEAM STRUCTURE



# APPENDIX B – CONCEPT DESIGN PROCESS



## APPENDIX C - DETAILED DESIGN PROCESS

