Controller and Auditor-General
Tumuaki o te Mana Arotake

B.29[13h]

Effectiveness and efficiency of arrangements to repair pipes and roads in Christchurch

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Effectiveness and efficiency of arrangements to repair pipes and roads in Christchurch

This is an independent assurance report about a performance audit carried out under section 16 of the Public Audit Act 2001.

November 2013

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Auditor-General's overview

Recovery from major disasters is a complex undertaking that involves the combined efforts of all levels of government in order to succeed.

Stanley J. Czerwinski, Director Strategic Issues, United States Government Accountability Office

The scale of earthquake damage in Canterbury is massive, and the Treasury estimates that the cost to the Crown will be about $13.5 billion. Christchurch City Council forecasts that the recovery effort will cost it about $2.6 billion. I have made a commitment to provide assurance that the recovery is being carried out effectively, efficiently, and appropriately.

This report is one of a series and covers one of the most significant and complex contracts in the Canterbury recovery to rebuild the roads and underground water, wastewater, and stormwater pipes in Christchurch (commonly referred to as horizontal infrastructure). It examines how effectively and efficiently the Canterbury Earthquake Recovery Authority, the New Zealand Transport Agency, and Christchurch City Council are reinstating horizontal infrastructure through an alliance called the Stronger Christchurch Infrastructure Rebuild Team (SCIRT).

The roads and underground water, wastewater, and stormwater pipes are necessary to support basic human health needs and the future growth and economic well-being of Christchurch. They span the interface between residential and commercial areas, and connect the city. Reinstating this infrastructure will be completed over several years.

The Crown has agreed to contribute a maximum amount of $1.8 billion towards the rebuild of horizontal infrastructure. Christchurch City Council will fund a total of $1.14 billion. This arrangement between the Crown and Christchurch City Council is subject to review, due to be completed by December 2014, as further damage assessment information becomes available.

SCIRT demonstrates many of the good practice characteristics of alliance contracts

I conclude that the choice of an alliance (a mixed team of public and private organisations working together) for the reinstatement of the horizontal infrastructure in Christchurch was a good fit with the post-earthquake situation in Canterbury and provided a useful approach for the risks to be managed in a suitable way.

SCIRT has been designed in a way that demonstrates many of the good practice characteristics of alliancing. It has sound business systems that create operational efficiencies. It is capitalising on its valuable resource of highly trained specialists

to develop practical solutions and project scoping is done well. The Alliance Agreement also requires a minimum of 40% of the work to be subcontracted by the main contractors, which gives opportunities to other contractors. SCIRT began allocating work to the alliance delivery teams based on performance scores in June 2012 and performance increased sharply. This indicates that work allocation is important to delivery teams and can be used as an incentive.

We heard differing views on the merits of alliance contracts. As circumstances change, the Canterbury Earthquake Recovery Authority, the New Zealand Transport Agency, and Christchurch City Council need to consider whether the alliance continues to be suitable.

When relevant variables are considered, SCIRT projects seem reasonably priced

We commissioned an engineering expert to look at how construction rates for pricing SCIRT projects compare with those for similar projects in Canterbury and throughout New Zealand. The wastewater network is the deepest, suffered the most damage, and represents the largest proportion of the overall costs (67% of the 2012/13 budget), so it proved to be the most useful reference.

The benchmarking study found that wastewater construction rates vary significantly. SCIRT rates are consistent with similar projects in Canterbury and between 30% and 50% higher than for similar projects elsewhere in New Zealand. This is because ground conditions and the need to work around existing utilities have a significant effect on price. SCIRT's rates for water supply were similar to greater Canterbury rates and higher than New Zealand rates. SCIRT rates for stormwater were lower than both greater Canterbury and New Zealand rates.

Our expert concluded that the ground conditions for SCIRT projects were among the worst in the country and, in this context, SCIRT's prices compared reasonably favourably.

Other benefits

SCIRT is delivering more than construction work. It is aiming to lift the capability of the construction sector workforce, improve the resilience of infrastructure, and foster innovation. An example of an innovation developed by SCIRT is the Pipe Damage Assessment Tool. It provides a reliable and accurate desktop method for predicting the condition of earthquake-damaged pipes, saving time and money. SCIRT has also achieved efficiencies by customising the software application it uses for computer-aided design and drafting.

Risks that need to be managed

Dealing with the challenges and risks associated with the horizontal infrastructure rebuild is a continuous task. There are two major risks that I consider could disrupt the rebuild, making it difficult for SCIRT to confidently put the right infrastructure in the right places to the right standard.

First, SCIRT's effectiveness is increasingly hindered by a lack of clarity about roles and limited involvement from the Canterbury Earthquake Recovery Authority. At the time of our audit, the Canterbury Earthquake Recovery Authority had not engaged with SCIRT to the extent needed to effectively help with planning to rebuild the horizontal infrastructure. SCIRT's rapid operational pace was misaligned with the slower progress of strategic planning for the wider rebuild. Protracted decision-making, especially in the central city, could gradually reduce SCIRT's ability to deliver repairs.

Secondly, the Canterbury Earthquake Recovery, New Zealand Transport Agency, and Christchurch City Council do not have a common understanding about levels of service. There is not enough clear guidance from the public entities funding the alliance for SCIRT to know what levels of service to deliver and where, for optimal reinstatement of the infrastructure.

There are two controls that must operate effectively. The independent estimator's review of SCIRT's target costs for projects to check that they represent fair market pricing is critical to maintaining commercial tension and driving efficiencies. Also, the independent audit of delivery teams' claims is critical to providing assurance that claims are properly validated.

SCIRT is entering the third year of a five-year programme of work. The work will continue to evolve as new information is revealed and new ways of doing things are developed. There is opportunity to learn from the recovery so far and to address the matters identified in this report. I have made recommendations to help the public entities in doing this.

I thank the staff from the Canterbury Earthquake Recovery Authority, the New Zealand Transport Agency, Christchurch City Council, and SCIRT for their assistance and co-operation during our audit.

Lyn Provost
Controller and Auditor-General

9 November 2013

Our recommendations

These recommendations are to assist the Canterbury Earthquake Recovery Authority, New Zealand Transport Agency, Christchurch City Council, and the Stronger Christchurch Infrastructure Rebuild Team in dealing with the challenges and risks associated with the horizontal infrastructure rebuild.

We acknowledge the changes that were taking place at the time of our audit, such as the revised governance arrangements that were being introduced, work on clarifying the levels of service to be delivered, and work on strengthening how the Stronger Christchurch Infrastructure Rebuild Team's performance is measured to provide greater assurance over the value the alliance is delivering. Our recommendations encourage ongoing improvement.

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency:

1. change the governance framework to address ambiguity about roles and responsibilities, including the role and responsibilities of the independent chairperson.

We recommend that the Canterbury Earthquake Recovery Authority:

2. contribute more consistently to effective leadership and strategic direction for the Stronger Christchurch Infrastructure Rebuild Team.

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency:

3. use the governance arrangements to provide timely guidance to the Stronger Christchurch Infrastructure Rebuild Team on the priorities and direction of the rebuild;
4. agree on the levels of service and quality of infrastructure that the rebuild will deliver, in conjunction with confirming funding arrangements, and consider a second independent review of the Infrastructure Recovery Technical Standards and Guidelines;
5. use a coherent framework for measuring key aspects of the Stronger Christchurch Infrastructure Rebuild Team's performance that integrates project-level delivery team performance with alliance objectives and overall programme delivery, and is based on sound measures tested through the Stronger Christchurch Infrastructure Rebuild Team's internal auditing regime;
6. ensure that their framework for auditing the Stronger Christchurch Infrastructure Rebuild Team provides them with adequate assurance that the Stronger Christchurch Infrastructure Rebuild Team is well managed and delivering value for money; and

7. in conjunction with strengthening performance measures, provide feedback to the Stronger Christchurch Infrastructure Rebuild Team to improve the analysis and information included in reports to the Stronger Christchurch Infrastructure Rebuild Team Board and make these reports more useful.

Part 1
Introduction

1.1 In this Part, we set out:

- why we did our audit;
- who and what we audited;
- how we carried out our audit;
- our expectations;
- the context of our audit; and
- what we did not audit.

Why we did our audit

1.2 A significant amount of taxpayer and ratepayer money is being spent on the Canterbury earthquake recovery and rebuild. A large proportion of this expenditure is on providing basic services, such as wastewater collection, stormwater drainage, fresh water supply, and roading (horizontal infrastructure).

1.3 Many public entities are engaged in procuring goods and services as part of the recovery effort. These involve significant, large-scale contracts.

1.4 We considered it important to provide assurance to Parliament that public money is being spent in an effective and efficient way, and that the public entities involved are managing the risks of the rebuild.

Who and what we audited

1.5 We carried out a performance audit of how effectively and efficiently three public entities are managing the rebuild of Christchurch's horizontal infrastructure through the Stronger Christchurch Infrastructure Rebuild Team (SCIRT). The three public entities (also known as clients) are Christchurch City Council (CCC), the Canterbury Earthquake Recovery Authority (CERA), and the New Zealand Transport Agency (NZTA).

1.6 Although SCIRT is not a public entity, it is rebuilding the horizontal infrastructure with public money.

1.7 We looked at the scope of works that SCIRT is responsible for, which is confined to the city boundaries of Christchurch City Council. Some other works are being delivered under business-as-usual arrangements referred to as non-SCIRT works, which we did not look at.

How we carried out our audit

1.8 To carry out our audit, we:

- interviewed staff from the three public entities, SCIRT, and external parties involved in independent review roles;
- reviewed and analysed relevant documents, mostly from SCIRT and the three public entities;
- reviewed information and data from six SCIRT projects, looking at controls, layers of review and quality assurance, the target cost process, processing of claims, and any additional illustrative information;
- visited a construction site and spoke with the contractors working there; and
- carried out a benchmarking study to compare and contrast the construction costs incurred by SCIRT with those obtained from local government contracts throughout Canterbury and New Zealand.

1.9 We carried out our fieldwork and analysis in 2013.

Our expectations

1.10 To draw our conclusions on how effectively and efficiently the three public entities are managing the rebuild of Christchurch horizontal infrastructure through SCIRT, we established some expectations about what an effective and efficient approach would look like.

1.11 For the decision to choose an alliance as a procurement approach, we expected that the three public entities would have put in place appropriate strategic arrangements that promote effective and efficient procurement in the context of post-disaster recovery and in a manner consistent with their respective roles and responsibilities. We expected a compelling value proposition that supported the use of an alliance and that the adopted alliance model would contain critical success factors in its design.

1.12 We expected that operational project delivery would be effective and efficient in the circumstances. This would include a system of programme delivery where projects are of an appropriate size and configuration to optimise resources and where there is an effective prioritisation method.

1.13 We expected that the system would provide enough layers of quality assurance checks and controls to ensure that projects are delivered to a reasonable level of quality and that there is adequate scrutiny of business at all levels to safeguard its integrity.

1.14 We expected that the commercial arrangements provide enough tension to constrain costs and that the cost of the rebuild on the three public entities is fair and reasonable.

1.15 We expected that high-level strategic planning would ensure, where possible, that the horizontal infrastructure rebuild repairs the right infrastructure, in the right place, at the right time, to the right standard. Where trade-offs are necessary, we expected that they would be made to support the Canterbury earthquake recovery.

1.16 We expected that the three public entities would agree on the scope of works that SCIRT would deliver and clearly express what value means in the context of the horizontal infrastructure rebuild programme. We expected that this value proposition would address the original and any updated business objectives and that the three public entities would measure SCIRT's achievement against a cohesive framework.

Audit context

1.17 We carried out our audit almost two years after SCIRT was formed. SCIRT was formed during an earthquake emergency response phase that transitioned into earthquake recovery. Ongoing seismic activity in Canterbury means that the distinction between response and recovery is not well defined.

1.18 Appendix 1 summarises the transition from the procurement arrangements that were put in place after the 4 September 2010 earthquake to the arrangements after the 22 February 2011 earthquake.

1.19 Because Christchurch's horizontal infrastructure was damaged by a natural disaster, there has been some overlap between planning and implementation. Consequently, at the time of our audit, SCIRT was implementing final layers of assurance processes and controls. The Crown and CCC were also negotiating a cost-sharing agreement and reviewing their client governance arrangements in parallel with our work.

1.20 It is expected that SCIRT's design will continue to be subject to review and improvement as the rebuild progresses.

What we did not audit

1.21 We did not inspect construction work nor carry out a technical review of the engineering design solutions that SCIRT developed.

1.22 We did not look at infrastructure outside the scope of SCIRT's mandate, such as other types of infrastructure or infrastructure outside Christchurch's city boundaries.

1.23 We did not assess the performance of the private companies involved in SCIRT.

Part 2
About the Stronger Christchurch Infrastructure Rebuild Team

2.1 In this Part, we describe:

- what an alliance contract is;
- the structure of SCIRT and the roles of its participants;
- the governance framework of SCIRT;
- the organisational culture of SCIRT; and
- the commercial framework of SCIRT.

Summary of this Part

2.2 The main points outlined in this Part are:

- SCIRT is a team of public and private organisations, formed to rebuild the pipes and roads in Christchurch.
- SCIRT was established after the 22 February 2011 Canterbury earthquake to cope with the increased scale of damage.
- SCIRT has three functional layers – a governance framework, an Integrated Services Team, and five delivery teams.
- The SCIRT model has features designed to promote efficiency, contain cost inflation, and encourage behaviours that support an effective and efficient rebuild.

What is SCIRT and what does it do?

2.3 SCIRT is a mixed team of public and private organisations that have agreed to participate in a contract arrangement called an alliance.

2.4 An alliance is formed between public entity funders and asset owners, which are also referred to as "owner participants" or "clients", and private contractors, which are known as "non-owner participants". Each non-owner participant provides a delivery team to carry out the physical construction works. The alliance arrangement is the delivery vehicle used to carry out a construction project or programme of works.

2.5 The SCIRT alliance involves three owner participants (the three public entities) – CCC, NZTA, and CERA – and five non-owner participants. The five non-owner participants are City Care Limited (City Care), Downer New Zealand Limited (Downer), Fletcher Construction Company Limited (Fletcher Construction), Fulton Hogan Limited (Fulton Hogan), and McConnell Dowell Constructors Limited (McConnell Dowell). Among the three public entities, CERA is a funder only, CCC is a funder and asset owner, and NZTA is a funder and asset owner.

2.6 SCIRT is tasked with repairing and reconstructing the horizontal infrastructure damaged during the two major earthquakes of 4 September 2010 and 22 February 2011, as well as damage from the aftershocks and earthquakes that followed. The term "horizontal infrastructure" refers to the pipes that form the water supply network, the wastewater or sewer network, and the stormwater drainage network, as well as the roading network, which includes walls and roading structures.

2.7 Planning for the horizontal infrastructure rebuild connects closely with the Land Building and Infrastructure Recovery Plan. Planning is informed by the CERA Recovery Strategy and the Christchurch Central Recovery Plan. It should also be co-ordinated with other utilities' recovery plans, as co-ordinated by CERA, and other CCC plans to inform infrastructure recovery.

2.8 On 4 May 2011, the participants entered into an initial alliance agreement to repair horizontal infrastructure in Christchurch. This established SCIRT. The Alliance Agreement was signed on 22 September 2011.

2.9 The participants agreed to a scope of repair work, limited to the city boundaries of CCC, that included:

- repairing and reinstating the water supply, stormwater drainage, and wastewater drainage systems (including reticulation, pressure mains, pumping stations, reservoirs, and waterways);
- repairing and reinstating the local road network, the state highway network, bridges, and some retaining walls; and
- other works as agreed.

2.10 It was agreed that this work would be to a standard and level of service comparable to that which existed immediately before the September 2010 earthquake. There is flexibility in the Alliance Agreement to include other works in the scope of repair work if they promote value for money.

2.11 Because the condition of below-ground assets takes time to assess, there remains uncertainty about what the final cost will be. Waiting for decisions to be made about the wider rebuild, such as identifying land to be assigned to the red zones, has also added to this uncertainty. These decisions affect the configuration and design of future infrastructure.

2.12 The initial estimated cost to repair Christchurch's damaged horizontal infrastructure was $2.015 billion (this figure includes SCIRT and non-SCIRT work). In 2013, a revised estimate for the SCIRT component of the work assessed the costs as $2.496 billion. It will be funded by CCC, NZTA, and CERA.

2.13 In June 2013, the Crown agreed to contribute a maximum amount of $1.8 billion to the rebuild of horizontal infrastructure. The maximum amount includes CERA

funding 60% of costs for the water infrastructure, and NZTA funding 83% of the roading infrastructure. CCC will fund a total of $1.14 billion.

2.14 An independent assessor will review the extent of damage to infrastructure and the cost for repair before December 2014. The Crown's agreed level of contribution could go up or down as a result of the review.

2.15 Appendix 1 summarises the circumstances leading to the formation of SCIRT.

Features of an alliance

2.16 The Australian Government National Alliancing Contracting Guidelines note that one of the most significant aspects of alliancing is the treatment of risk. In a traditional contract, the buyer's terms and requirements are often in the form of a request for tender, to which the seller responds with a solution and a price. The risk assessment is built into the price for each party, and each will stand to win or lose depending on whether the actual cost is higher or lower than predicted. The higher the seller's perception of risk, the higher their tendered price.

2.17 Alliance contracting offers an alternative for particularly complex and risky projects. The buyer and seller collaborate to prepare the requirements and the proposal. The team works together in good faith with a "no disputes" arrangement, fostering a "no blame" culture. Participants collectively share the project's risks and outcomes. This provides the foundation for collaboration and best-for-project decisions, and encourages innovation.

2.18 The Australian Guidelines say that successfully setting up an alliance depends on several main factors:

- forming an integrated team, containing staff from non-owner and owner organisations with good collaboration and project culture;
- a project solution along with a design solution, construction methodology, and project delivery arrangements;
- commercial arrangements that are intended to foster alignment, desirable team behaviours, and project outcomes; and
- a target out-turn cost or "TOC".[1]

2.19 Alliances have been adopted overseas for large and complex construction projects. For example, the British Airports Authority[2] adopted a partnering approach to construct Terminal 5 at Heathrow Airport in the United Kingdom. The project posed multiple challenges, including a large scale, highly material risk, constrained site access, and design changes expected during the project.

1 Referred to as "target cost" in this report.

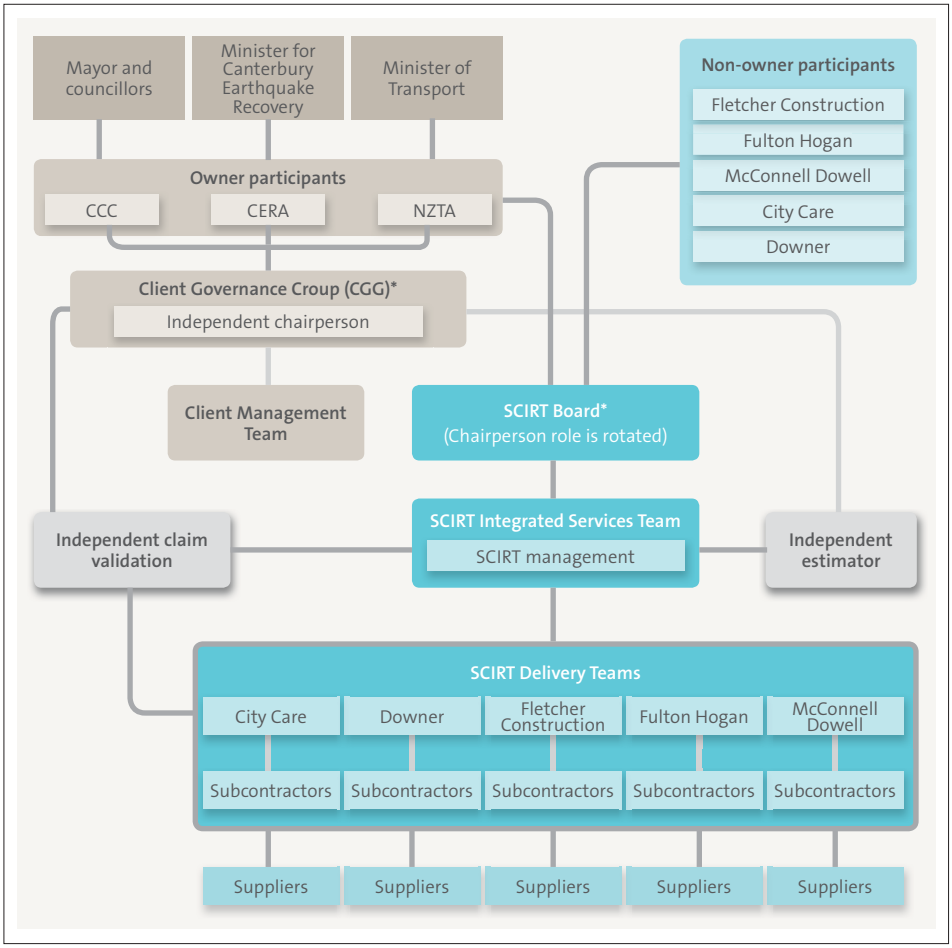
2 The British Airports Authority is now known as Heathrow Airport Holdings.

2.20 Alliances are in use in New Zealand for large infrastructure projects, such as NZTA's Waterview Connection project to complete a motorway ring route around Auckland City. Examples of alliance contracting used in New Zealand for small-scale reconstruction after disasters are uncommon. However, research by the University of Auckland has shown that reconstruction favours a collaborative environment where there is large-scale disaster, such as the situations experienced in China after the Yangtze River flooded in 1998 and an earthquake in Sichuan in 2008.

Structure and role of SCIRT participants

2.21 Figure 1 sets out the organisational structure of SCIRT. The following section explains the roles of the various parts.

Figure 1
Organisational structure of SCIRT



*The representatives for CCC, CERA, and NZTA on the CGG are the same officials who represent the three public entities on the SCIRT Board. The CGG was renamed the Horizontal Infrastructure Governance Group in October 2013 (see paragraph 5.12).

The three public entities

New Zealand Transport Agency

2.22 NZTA is a funder and asset owner in SCIRT. It has a significant role in the Canterbury earthquake recovery, which is explained in our 2012 report, *Roles, responsibilities, and funding of public entities after the Canterbury earthquakes*.[3]

2.23 NZTA funds 83% of the cost of reinstating local roads.

Christchurch City Council

2.24 CCC owns most of the assets and is a funder of SCIRT. As a territorial authority, it is required by the Local Government Act 2002 to act on behalf of its community. Under that Act, CCC is expected to meet current and future needs for good quality local infrastructure, public services, and regulation, in a way that is most cost-effective for households and businesses. Good quality local infrastructure means efficient, effective, and appropriate to present and anticipated circumstances.

Canterbury Earthquake Recovery Authority

2.25 CERA does not own any of the infrastructure assets, but it is a significant funder. CERA was established under the Canterbury Earthquake Recovery Act 2011 to provide strategic leadership and to co-ordinate activities to ensure an effective, timely, and co-ordinated rebuilding and recovery effort in Canterbury.

2.26 When SCIRT was established, CERA had only just been formed.[4]

2.27 The three public entities are able to give directions to ensure that the work SCIRT completes is consistent with, and integrated into, the wider recovery for Canterbury.

The non-owner participants

2.28 The non-owner participants are the private construction companies from which the delivery teams are derived. They are Downer, Fulton Hogan, McConnell Dowell, Fletcher Construction, and City Care. We briefly describe each company in Appendix 2.

SCIRT structure

2.29 SCIRT is organised into three functional layers:

- SCIRT governance;
- the Integrated Services Team (IST); and
- the delivery teams.

3 Available at www.oag.govt.nz.

4 CERA was formed on 29 March 2011. Its full powers were brought into force on 19 April 2011 by the Canterbury Earthquake Recovery Act 2011.

2.30 There are two governing bodies with different membership and functions. The Client Governance Group (CGG) consists of the three public entity members only, with an independent chairperson appointed by the Minister for Canterbury Earthquake Recovery. The SCIRT Board consists of member representatives from each of the owner and non-owner participants. The position of chairperson is rotated through the participants. In combination, these bodies, along with the parent organisations, provide the governance framework for SCIRT.

2.31 The IST is at the operational level of SCIRT. It consists of managers and staff who are a mixture of secondees from the participating entities and various consulting practices. It fulfils a project-managing function to define, design, price, and oversee projects of work for construction.

2.32 The lead contractors of the delivery teams are subgroups of the non-owner participants. The delivery teams also include companies subcontracted by the lead contractors. They compete for work based on performance against cost and service measures.

2.33 The delivery teams operate within the management systems of their parent companies but report back to the IST and must conform to SCIRT standards and expectations. The IST monitors and reports on the delivery teams' performance to the SCIRT Board.

SCIRT governance

Client Governance Group

2.34 The CGG was set up in December 2011. The CGG was created after SCIRT was already operating, so it is not mentioned in the Alliance Agreement.

2.35 There are three full members on the CGG, one from each of the three public entities, as well as an independent chairperson. The independent chairperson received a letter of appointment from the Minister for Canterbury Earthquake Recovery. However, further information about expectations and delegations has not been provided.

Purpose

2.36 The purpose of the CGG is stated in its terms of reference:

> *... to provide leadership so that CCC, CERA and NZTA will work together to deliver the recovery of the City's Horizontal Infrastructure, which is effective, efficient and resilient, for the People of Christchurch and New Zealand.*

2.37 The CGG's terms of reference require it to approve a purpose and set of performance objectives/outcomes that give clear direction to team members participating in the infrastructure rebuild.

Responsibilities

2.38 The terms of reference also define specific responsibilities for the CGG. The CGG's role is to produce and maintain a governance framework for delivering the Infrastructure Rebuild Plan. This includes providing a process for escalating issues and making decisions about infrastructure, and appointing subcommittees as needed.

2.39 The CGG has several strategic and planning roles. It is to inform the development of wider recovery strategies and to ensure that work delivered under the SCIRT alliance is consistent with the wider recovery strategies. Also, the CGG has to prepare a process for approving decisions about betterment and exceptions to standards. External factors can affect the work of the Alliance, and the CGG is responsible for considering and responding to the effect of those factors.

2.40 All members of the CGG are directly or indirectly funders of SCIRT. Therefore, the CGG approves the annual work programme and budgets, and co-ordinates SCIRT's funding requirements. It also reviews audit reports and the implementation of controls.

2.41 The CGG is responsible for meeting the clients' obligations under the Alliance Agreement. It monitors SCIRT's progress and budget through annual and monthly reports that cover progress, trends, and performance against milestones and performance objectives. Importantly, the CGG is to ensure value for money and manage prioritisation of costs.

Subcommittees

2.42 Four subgroups or subcommittees support the CGG in its role: Scope and Standards, Infrastructure Funding, Strategy, and Communications.

2.43 As well, a Client Manager and the Client Management Team provide governance, operational, and secretariat support to the CGG. They are responsible for providing a single point of contact between the CGG, its subgroups, and SCIRT management.

2.44 A Scope and Standards Review Committee preceded the formation of the CGG. It was set up to agree on standards for the infrastructure repairs and renewals in keeping with good practice and to ensure that the right type of infrastructure is provided.

SCIRT Board

2.45 The SCIRT Board (previously known as the Alliance Leadership Team) comprises senior executives of the three public entities and the non-owner participants. The representatives from the three public entities on the SCIRT Board are the same representatives as on the CGG.

Purpose

2.46 The role of the SCIRT Board is to:

- administer the Alliance Agreement;
- provide guidance to the participants on the work done under the alliance; and
- provide a forum for the participants to discuss and resolve issues under the alliance.

Responsibilities

2.47 Under the Alliance Agreement, the duties of the SCIRT Board include:

- setting policy and giving philosophical and strategic direction to successfully deliver the works and achieve SCIRT's other objectives;
- deciding, approving, or reviewing issues and resolving any differences as required under the agreement;
- approving the commitment of resources to work; and
- confirming appointments to, and monitoring the performance of, SCIRT's management team.

2.48 The SCIRT Board's decisions are made through voting by all participants (owner and non-owner), with a requirement that all decisions must be unanimous.

2.49 The SCIRT Board is focused on governing SCIRT so that it fulfils its principles and achieves its objectives. The CGG is focused on ensuring that SCIRT delivers outcomes that are consistent with the entities' objectives.

SCIRT operations

Integrated Services Team

2.50 The IST is made up of various specialist professional staff, including closed-circuit television (CCTV) specialists, engineers, geographic information systems operators, estimators, planners, and business analysts.

2.51 The SCIRT Management Team is part of the IST and provides SCIRT's everyday management. It is headed by the Alliance General Manager, who is appointed by the SCIRT Board. The Alliance General Manager reports monthly to the Board on behalf of the IST.

2.52 The IST maintains plans and procedures to manage all important aspects of SCIRT's work. Currently, about 290 people are in the IST, which includes staff seconded from NZTA and CCC and each of the non-owner participants.[5] IST staff are seconded, rather than directly employed by SCIRT.

Delivery teams

2.53 The delivery teams are the non-owner participants that have entered into an unincorporated joint venture. They are still independent entities, and they compete for work.

2.54 A minimum of 40% of the work completed under SCIRT, by cost, must be subcontracted to parties outside SCIRT. A competitive process must be followed to select suitable subcontractors. The non-owner participants are then responsible for ensuring that subcontractors meet the same standards of operation and key result area (KRA) reporting that they do.

Commercial framework

2.55 SCIRT's commercial framework has features designed to promote efficiency, prevent rapid price increases, and foster behaviours that support an effective and efficient rebuild. In Part 4, we assess whether this framework is achieving that. The features are designed to motivate delivery teams to compete and to collaborate. We discuss some of the features below.

Fee structure

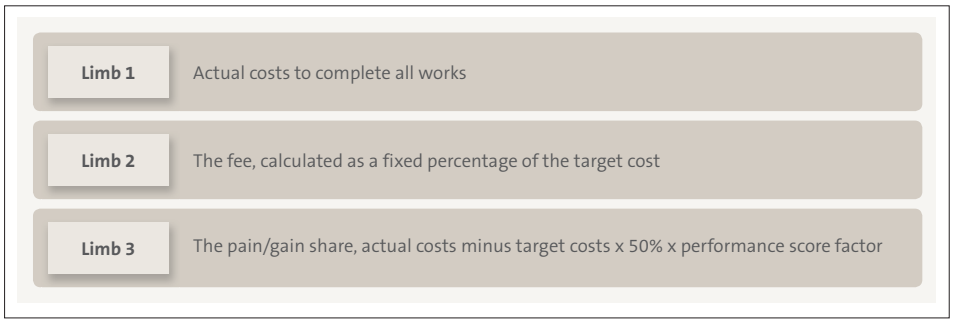
2.56 The fee structure consists of three components called "limbs":

- Limb 1 – a reimbursement of actual costs;
- Limb 2 – a fixed margin for profit and overhead; and
- Limb 3 – a performance-based incentive payment or penalty shared among owner and non-owner participants.

2.57 Figure 2 sets out the three-limb fee structure. We discuss this fee structure in more detail in Part 4 (see paragraphs 4.133-4.142).

5 Thirty are from CCC, one from NZTA, eight from City Care, 16 from Downer, nine from Fletcher, 26 from Fulton Hogan, and eight from McConnell Dowell. More than 20 other organisations have seconded staff to SCIRT, mostly design staff.

Figure 2
Breakdown of the three-limb commercial arrangement



Behaviours

2.58 The commercial framework comprises a system of penalties and rewards that are intended to foster certain behaviours:

- Delivery teams aim to deliver projects below target cost, to avoid overruns that would result in a penalty or "pain" situation.
- Delivery teams compete to increase their share of work because this increases their fee income.
- Work allocation is based on performance against target cost and performance across KRAs. To get more work, delivery teams strive to improve against cost and service performance areas.
- The delivery teams performing better will be allocated more work.
- The incentive payment or penalty (Limb 3) is shared among delivery teams, which encourages collaboration to maximise profit and minimise loss, because they win or lose together.
- The size of Limb 3 is modified by an overall performance score, which further encourages delivery teams to collaborate to improve on aspects of service performance.

Allocation and performance measures

2.59 The allocation of work is determined by performance against target cost and against five service performance KRAs. These were established in the Alliance Agreement and are intended to drive behaviours consistent with the Alliance's objectives. The five areas are:

- safety;
- value;
- "our team";
- customer satisfaction; and
- environment.

2.60 The KRAs are broken down further into key performance indicators (KPIs) and measures against which delivery teams are assessed. A performance score is generated from the assessment. The KRAs and respective KPIs are weighted to place greater importance on particular areas. We discuss this in more detail in Part 4.

2.61 A delivery performance score (DPS) is generated for each delivery team, to influence the allocation of projects. A team with higher DPS will have a higher target share of the total programme.

2.62 An overall performance score (OPS) is generated as a consolidated measure for all delivery teams to adjust the final Limb 3 payment.

Part 3
An alliance procurement strategy

3.1 In this Part, we assess whether the selection of an alliance as a procurement strategy in the context of the Canterbury earthquake recovery was appropriate. We also note some complexities brought about by the alliance model.

3.2 We looked at the rationale behind the three public entities' proposal to form an alliance to rebuild the horizontal infrastructure in Christchurch and how they selected their alliance partners.

3.3 We expected that the three public entities would have carefully considered which procurement approach was the most suitable for the situation and have based their recommendation on a compelling value proposition that supported the use of an alliance.

Summary of this Part

3.4 Selecting an alliance to carry out the horizontal infrastructure rebuild in Christchurch was, in our opinion, an appropriate choice for the circumstances that the three public entities were dealing with.

3.5 Because of the large scale of damage, uncertainty, and urgency of repairs, an alliance provided a useful approach for the three public entities to better manage the risks that would emerge from this situation than a more traditional style of contracting arrangement.

3.6 Although SCIRT exhibits many attributes typical of an alliance, having multiple owners and non-owners is unusual. Also, the extensive scale of the damage and a programme of works rather than a single project makes SCIRT more complex. We discuss how well the three public entities manage these risks in Part 5.

Selection of an alliance as the procurement method

The entities recognised a need to reassess their procurement model after the second major earthquake and used an established methodology to select an approach that was suitable for the circumstances.

3.7 A developing body of literature describes alliance contracting and discusses the circumstances in which it is an appropriate procurement method. The National Alliance Contracting Guidelines from the Australian Department of Infrastructure and Transport say that projects suitable for alliance contracting generally have one or more of the following characteristics:

- The project has risk that cannot be adequately defined or measured in a business case or before tendering.
- The cost of transferring risk is prohibitive.

- The project needs to be started as early as possible before the risks can be fully identified and/or project(s) scope can be finalised, and the owner is prepared to take the commercial risk of a suboptimal price outcome.
- The owner has superior knowledge, skills, and capacity to influence or participate in the development and delivery of the project.
- A collective approach to assessing and managing risk will produce a better outcome.

3.8 Our literature review also suggested that alliancing might be appropriate for reconstruction projects after a major earthquake because of the following factors:

- uncertainty about the availability and cost of people and other resources, which might limit competition;
- the large scale of the work programme;
- the large scale of uncertainty and complexity;
- the short time for rebuilding;
- the need to use local materials, labour, and plant;
- local industry familiarity with construction procurement and delivering construction projects;
- the need for a target-cost type of payment mechanism to allow for variation in the scope of work and promotion of innovation in its execution; and
- the generation of a co-operative culture because of the wider social incentives to work together for the benefit of the whole community.

3.9 CCC and NZTA considered that an alliance delivery model was a more suitable way of delivering the reinstatement works than scaling up the existing arrangements. (CERA was not involved because it had only recently been formed.) CCC and NZTA considered that the alliance model would foster a high degree of trust between parties and focus on high-performing expectations, because of the system of rewards and sanctions for achieving or missing mutually agreed targets.

3.10 It was thought that other possible models, such as "Design and Construct" or "Managed Contractor Model", would not deliver with the speed required, would have complex administrative layers, and would not effectively bring together organisations with differing objectives. CCC had experience and capability in asset management, and NZTA has had a number of successful experiences with alliancing. The situation matched the criteria for using an alliance and provided a useful approach for CCC and NZTA to manage the risks.

3.11 The alliance approach was also favoured because of the benefits that the approach usually delivers. These benefits include reduced overheads, streamlined approvals, increased private sector participation, increased agility to deal with an evolving scope of works, and achieving multiple objectives. An alliance would also provide incentives to reduce start-up times and finish ahead of schedule and encourage high performance in areas such as stakeholder relations, communication, maximising use of the local labour force and contractors, and increasing general workforce skill levels as a consequence.

Selection of alliance non-owner participants

The selection of non-owner participants was not a competitive process run specifically for SCIRT. CCC had selected the contractors through competitive tender a few months before SCIRT was formed. These contractors became the non-owner participants. Mechanisms are built into SCIRT's commercial framework to create competitive tension between non-owner participants, and there are opportunities for other contractors to carry out work.

3.12 Our literature review on alliance contracting showed that the process for selecting the non-owner participant(s) for an alliance is important. Alliance contracting envisages a competitive process that takes account of the requirements of alliancing and incorporates consideration of both price and non-price aspects.

3.13 In response to the September 2010 earthquake, CCC set up the Infrastructure Rebuild Management Office (IRMO) to project-manage the reinstatement of infrastructure. The IRMO comprised CCC staff. CCC selected the construction companies that would rebuild the damaged areas and entered into four design-build contract arrangements through a competitive tender process.

3.14 The situation changed on 22 February 2011, when another earthquake struck Christchurch much closer to the central city. The damage was more widespread, and CCC recognised that its arrangement was no longer suitable for the size and scale of the task. Appendix 1 describes the circumstances leading to the formation of SCIRT in more detail.

3.15 CCC and NZTA decided that the IRMO contractors would become the non-owner participants in SCIRT. They made this decision because of the contractors' recent selection for IRMO work, their local presence, and a judgement about the workable number of non-owner participants in SCIRT.

3.16 The number of non-owner participants was limited to five, because CCC and NZTA considered this to be the maximum number for a well-functioning alliance. It was noted that other contractors might wish to be involved as head contractors, but five made sense in terms of the scale of their local presence and workable alliance function.

3.17 Mechanisms are built into SCIRT's commercial framework to create competitive tension between non-owner participants, encourage high levels of performance, and constrain cost inflation. SCIRT is unique in that it is designed to have both competitive and collaborative mechanisms operating concurrently. We evaluate the effectiveness of these tensions in Part 4.

3.18 The selection of non-owner participants was not a competitive process carried out specifically for SCIRT, but we have no means of assessing whether a more competitive process would have yielded a better result. The principles of a competitive process were met when lead contractors were selected for IRMO during the previous year. In our view, it was a practical decision to carry the lead contractors over from IRMO into SCIRT as non-owner participants. We also note that the Alliance Agreement requires non-owner participants to subcontract a minimum of 40% of the work, which gives opportunities to other contractors.

Complexities of SCIRT as an alliance

SCIRT is more complex than a usual alliance because it involves multiple owners and non-owners, an unprecedented scale of damage, a programme of projects, and a team formed entirely from contractors and secondees. The three public entities and SCIRT have taken steps to address this complexity, but there are ongoing risks that they will have to manage during the rebuild.

3.19 Although SCIRT exhibits many of the attributes typical of an alliance, it is more complex than most. The presence of multiple owners is an unusual feature and immediately makes planning and decision-making more complicated. The three public entities have responded by creating the CGG, which provides a forum for them to discuss issues pertinent to the asset owners and funders.

3.20 The extent of damage to buildings and infrastructure in Christchurch is unprecedented in New Zealand. Ultimately, about 1500 buildings will be demolished in the CBD, making it the country's largest construction site. More than half of the urban roads were damaged, and there is damage to almost 800km of water reticulation infrastructure. Most of this damage is to the wastewater network. A typical NZTA alliance, such as construction of the Waterview Connection in Auckland, consists of only one project. SCIRT consists of hundreds of projects in a programme of works. SCIRT's operational systems have been customised to deal with this complexity, although we were told that getting

these systems up and running does not happen all at once. In our view, there are ongoing risks that will have to be managed during the rebuild. We discuss how well the three public entities are managing these risks in Part 5.

3.21 One of the main challenges for SCIRT is to bring together a mixture of staff from different organisations to work together as a team and deliver for the people of Christchurch. As performance is important to SCIRT, the SCIRT Management Team has prepared a Peak Performance Plan that is renewed annually. Its purpose is to provide SCIRT with a strategic map for building and sustaining outstanding performance.

3.22 The Peak Performance Plan is monitored through engagement surveys and exit interviews. It was externally reviewed in 2012.[6] The review concluded that the Plan was having a positive effect and also remarked:

> *SCIRT is best described as an organisation that despite operating in a complex and uncertain environment has a clear sense of purpose, an outcome focus and a team of aligned and committed members.*
>
> *In our view SCIRT has made extraordinary progress towards its goals over a very short timeframe; undoubtedly the Board and leadership teams' focus on both creating and expecting a culture of high performance has been an integral part of SCIRT's success.*
>
> *One of the key strategic mechanisms that SCIRT has used to achieve these results has been its Peak Performance Framework ... It is a best practice example of intentionally designing key organisational structures and processes to develop a high performance culture.*

3.23 Supported by the KRA framework, SCIRT aims to set high standards and drive improvement in safety, environment, quality, community, and stakeholder relationships. SCIRT has a focus on positively affecting the social well-being of the city and the people of Christchurch.

6 External review carried out by the University of Canterbury, NZTA, and Idea Creation Limited.

Part 4
SCIRT as a delivery model

4.1 In this Part, we describe whether SCIRT is operating effectively and efficiently.

4.2 We looked at SCIRT's project definition and delivery model, and how quality assurance is provided throughout the delivery chain. We looked at how work is allocated to the delivery teams and how commercial tension is maintained. We reviewed the major cost drivers (design standards and guidelines, target cost-setting, and KRA framework) to evaluate whether they are working and delivering the intended outcomes.

4.3 We also carried out a benchmarking study to measure SCIRT's construction costs against local government databases within Canterbury and throughout New Zealand. We wanted to see how costs compared and to examine the effect that environmental conditions and contracting arrangements had on price.

4.4 We expected that SCIRT would have a system to deliver projects of appropriate size and configuration to optimise resources and that there would be an effective prioritisation method. The system should enable managers to track and monitor progress and provide good stakeholder engagement.

4.5 We expected that commercial arrangements and performance measures would provide enough competitive tension to constrain cost inflation and encourage collaboration between participants in the manner intended.

Summary of this Part

4.6 At the time of our fieldwork, SCIRT's operational design created efficiencies that facilitated good oversight and reduced costs. SCIRT was capitalising on its resource of technical specialists and experts to carry out thorough scoping and develop practical solutions. It had good mechanisms to constrain cost inflation. Although these required continued testing to ensure the integrity of the system, they were generally working well.

4.7 There are two major controls that must operate effectively. The independent estimator's review of SCIRT's target costs for projects to check that they represent fair market pricing is critical to maintaining commercial tension and driving efficiencies. Also, the independent audit of delivery teams claims is critical to provide assurance that claims are properly validated. There are risks to the effective operation of these controls that need to be managed.

4.8 We commissioned an engineering expert to look at how construction rates for pricing SCIRT projects compare those for similar projects in Canterbury and throughout New Zealand. The wastewater network is the deepest, suffered the most damage, and represents the largest proportion of the overall costs

(67% of the 2012/13 budget), so it proved to be the most useful reference. The benchmarking study found that wastewater construction rates vary significantly.

4.9 SCIRT rates are consistent with similar projects in Canterbury and between 30% and 50% higher than for similar projects elsewhere in New Zealand. This is because the ground conditions and the need to work around existing utilities has a significant effect on price. SCIRT's rates for water supply were similar to greater Canterbury rates and higher than New Zealand rates. SCIRT rates for stormwater were lower than both greater Canterbury and New Zealand rates. Our expert concluded that the ground conditions for SCIRT projects were among the worst in the country and, in this context, SCIRT's prices compared reasonably favourably.

4.10 SCIRT manages the effect of these factors through a consistent approach to pricing, sound risk management, and use of its collective experience and learning.

4.11 SCIRT is delivering more than construction work. It is aiming to lift the capability of the construction sector workforce, improve the resilience of infrastructure, and foster innovation.

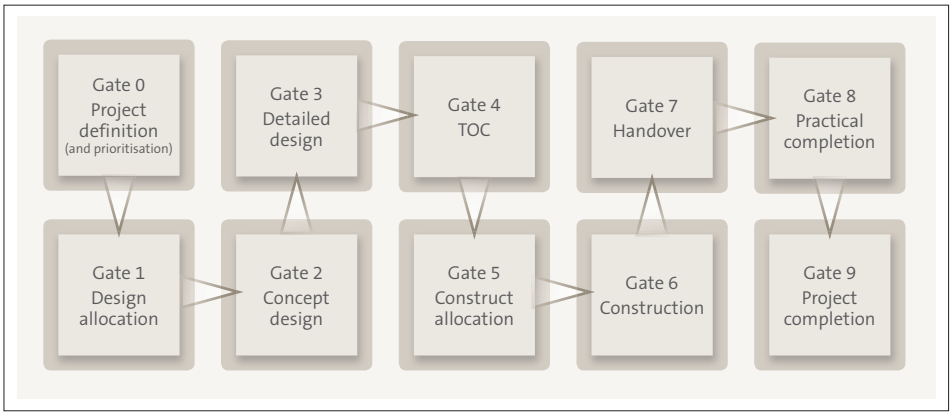
4.12 An example of an innovation developed by SCIRT is the Pipe Damage Assessment Tool to provide a reliable and accurate desktop method for predicting the condition of earthquake-damaged pipes, saving time and money. Another example of efficiencies achieved is the customisation of the software SCIRT uses for computer-aided design and drafting.

Workstream planning

SCIRT's workstream planning is designed to streamline the progress of projects towards completion using integrated information technology systems to provide good oversight, monitoring, and control. There are long-term benefits to be gained by the three public entities when the intellectual property and technology is transferred at programme completion. Enough information is collected to support future asset management.

4.13 SCIRT is structured to manage and deliver projects all the way from project definition and prioritisation through to project completion (see Figure 3). Projects progress through a series of "gates" for each stage, similar to a production line. The process is supported by an integrated information technology system to ensure the correct level of oversight and that approvals are gained throughout.

Figure 3
SCIRT delivery model



4.14 SCIRT uses a range of applications to manage specialist aspects of project delivery, such as geographic information, document archiving, estimating, financial management, schedule management, and business intelligence reporting tools. The applications have been selected to be user-friendly and are linked to create one data source.

4.15 SCIRT's business systems ensure that all relevant project information is easily accessible, can be managed centrally, and is capable of producing customised reports for individuals or for the SCIRT Board or the CGG to consider. All material information and data is archived for future use and to ensure that costs can be apportioned to the appropriate asset owner.

4.16 There are long-term benefits expected by the asset owners, CCC, and NZTA, who will inherit the information and technology at the end of the rebuild. The asset assessment being carried out for the rebuild is extensive, and CCC will have comprehensive asset condition information as a result. Software applications are being streamlined and customised for SCIRT's purpose, and the efficiencies created become the property of CCC.

4.17 The Chief Advisor for Engineering Assurance at NZTA reviewed the process for preparing estimates in October 2012. He found that SCIRT's database could record all asset data necessary for the rebuild and could easily be updated for use as an ongoing source document.

Project definition and prioritisation (Gate 0)

The method used to plan and prioritise projects is effective and efficient at the operational level. SCIRT depends on information from the three public entities to complete the prioritisation process, as discussed in Part 5.

4.18 SCIRT prepared a plan to outline its principles and methodology for scoping projects. Project boundaries are defined at two levels by looking at various relationships between assets. Network interdependencies are considered first to define hydraulic catchments boundaries, and then proximity interdependencies are used to define project boundaries within those catchments.

4.19 Hydraulic catchment areas are made up of network assets such as wastewater and stormwater pipes that have been grouped. Individual lengths of pipe cannot be replaced in isolation because of the widespread ground settlement caused by the earthquakes. Some gradients have changed and might no longer meet hydraulic capacity or velocity requirements. SCIRT refers to this grouping of network assets as "catchment areas".

4.20 A catchment area is broken into a series of projects to progress through to the design and delivery phases. The boundaries for projects are established after the catchment concept design is complete. Assets are grouped based on geographical proximity interdependencies to achieve, where possible, a target project value of $10 million (an optimum level), or a "one pass" approach. Structures such as bridges, reservoirs, and retaining walls are also grouped if there is an opportunity to do so. If there are no interdependencies, a standalone project is created.

4.21 The smaller project value of IRMO projects has reduced the average project value for SCIRT. At the time of our audit, SCIRT was increasing its work to reach peak production levels in June 2013. Over time, it is gradually increasing the value of defined projects and moving toward more optimum levels. When SCIRT was established, it took on 148 projects from IRMO in September 2011 that were in the design, construction, and handover phases. These projects had a total value of $77 million and an average project value of around $0.52 million. SCIRT also took over 125 IRMO projects that were in early design phases and were carried over into SCIRT processes. These projects had a combined value of $275 million and an average value of $2.2 million.

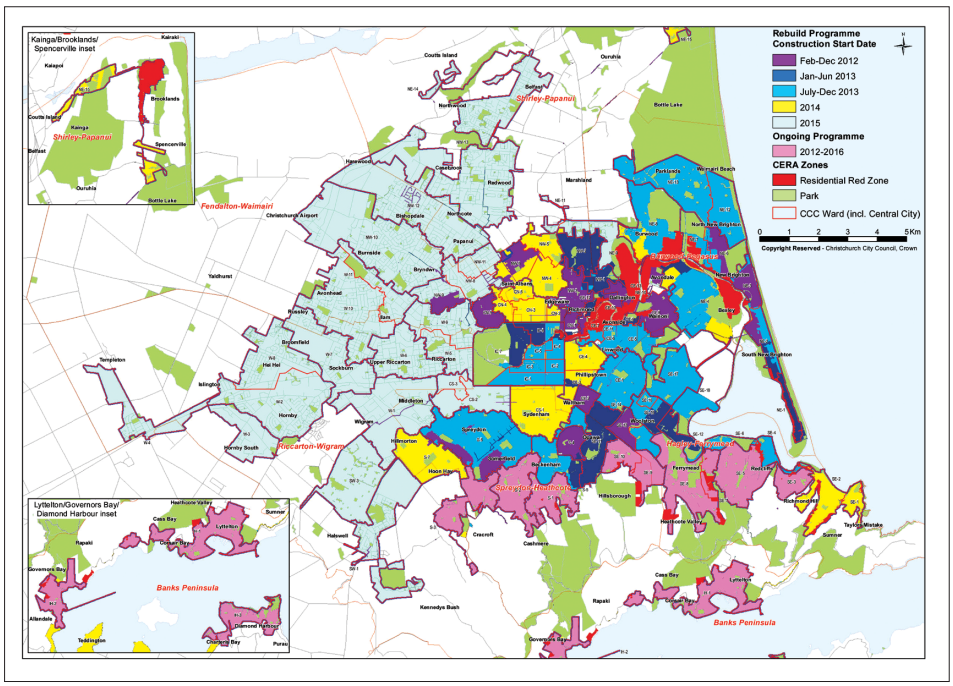
4.22 More than a year into the rebuild programme, the average target cost value for a SCIRT project was $4.1 million in December 2012 and $5.4 million in January 2013. In February 2013, the average target cost value for SCIRT projects dropped to $2.6 million, although this was in part because two projects, with a combined value of about $35 million, were carried over into March. At the time of our audit, most projects were not defined to meet the $10 million optimum size, but the value of defined projects was steadily increasing.

4.23 The definition of a project is contained within a scope report. Once the catchment or project has been defined, the prioritisation process is applied. This process applies four criteria. (SCIRT depends on information from the three public entities for the fourth criteria, which we discuss in Part 5.) The four criteria are:

- calculating an operational priority score based on engineering principles and field data analysis, without taking into account any constraints;
- considering interdependencies between assets, which are primarily interdependencies within a catchment area or proximity dependencies;
- ensuring that services to important medical and emergency facilities, schools, or important public transport links and strategic routes are maintained; and
- external factors (geographic and timing) that are linked to specific client goals and targets or support specific requirements of the wider recovery process.

4.24 The prioritisation process determines the order in which projects are released to the design teams. It is run at three-monthly intervals to enable reprioritisation based on new information and data, and to ensure that SCIRT is doing the "right things at the right time". The prioritisation is used to prepare a rebuild schedule, which is shown in Figure 4. Generally, this leads to SCIRT working from east to west.

Figure 4
SCIRT rebuild schedule at catchment level, as at February 2013



Source: SCIRT.

4.25 SCIRT uses this process to reinstate services where they are needed most and provide the greatest benefit, despite the complexity of the situation. SCIRT is transparent in its scheduling, making the information publicly available.

4.26 The system uses computer software to automate the process, but it can be adjusted manually to respond to shifting priorities identified by the asset owners. From our observations during our audit, the process to define projects and prioritise them is effective and efficient.

Quality assurance in the design stages (Gates 1, 2, and 3)

SCIRT has focused on developing a high-performance team as an alternative to using a competitive model within the IST. This approach was particularly effective in the design stages. As a result, SCIRT is able to leverage the collective expertise of its staff to achieve thorough project scoping. Processes, including quality assurance, have evolved and are improving.

4.27 SCIRT encourages high levels of performance from its staff in several ways. It was originally planned that the teams of design engineers (who are responsible for developing solutions to reinstate damaged infrastructure) would move to a competitive model and eventually be measured against a target cost in a manner similar to the delivery teams. We were told that SCIRT considered this approach, but thought that competition between design teams would inhibit the gains to be made from collaboration.

4.28 Instead, a project is allocated to one of the four design teams based on existing workload and appropriate skill sets. Staff try to create a buffer between the design phase and the construction phase so that there is a source of projects ready for allocation to delivery teams. Their performance is monitored against the quality, cost, and timeliness of their work. KPIs for the design process include the quality of design and documentation, innovations used in projects, and waste minimisation.

4.29 The four design teams are composed of staff seconded from different organisations, bringing together a range of methods, experiences, and ideas. By working collaboratively, SCIRT encourages its staff to leverage their collective skills and knowledge. Staff and asset owner representatives consider different options for a project during the design process, before recommending a preferred option.

4.30 The designers consult with other IST staff, and early contractor involvement provides advice on constructability. There are a number of planned workshops, including a risk workshop. As well as carrying out the two major design stages, designers also provide support to the construction and handover phases.

4.31 The design teams have been co-located to increase efficiency. Staff spoke positively about SCIRT and appeared consistently enthusiastic about their work. One relatively new member commented that SCIRT was "like a giant consultancy on steroids". SCIRT has worked effectively to build team spirit among a group of individual contractors. One of the advantages we observed from SCIRT having a skilled team is that project scoping is done well.[7]

4.32 The design process has been refined over time, meaning that not as much detail about earlier projects was recorded. Relevant project information to aid planning and decision-making is now well documented.

Layers of review and inspection (Gates 0-9)

There are layers of internal review and inspection throughout the design and construction stages that form part of an appropriate quality control system. In our view, periodic testing by the three public entities would provide greater assurance that the controls continue to be effective.

4.33 Layers of review and quality assurance have been built into the design and construction phases to ensure good standards. For instance, the design manager signs off the concept design and the detailed design, all designs are internally peer reviewed, technical leads[8] internally peer review designs relating to their expertise, and higher risk projects such as structures or specific geotechnical situations require independent external review.

4.34 The IST oversees the delivery teams when projects move into construction. The IST manages the interface between delivery teams and external agencies such as the three public entities and regulatory authorities. The construction inspection programme and test plan for the delivery team to follow are determined during detailed design. The asset owner's standards and guidelines that SCIRT works to prescribe the tests that must be carried out at various stages, and the delivery teams must hold records of these tests.

4.35 Project co-ordinators carry out construction verification audits to check that prescribed processes have been adopted. They also carry out handover audits to ensure that all relevant documents and data are completed and available.[9] The relevant responsible manager carries out additional audits on KRA performance. Quality managers and site engineers are appointed within each delivery team. Nonconformance records are raised when defects are identified and are reported monthly. Although these layers of internal review are comprehensive,

7 We discuss the basis for, and effect of, this finding further in paragraphs 4.67-4.86.

8 Technical leads are all CCC secondees who have a working knowledge of CCC standards.

9 Includes design reports, construction drawings, records of reviews, CCTV footage, photos during and after construction, non-compliance reports, consent details, as-built records, audit reports, completion certificates, and cost of work to asset levels.

periodic testing by the three public entities would provide assurance that the system continues to operate in the manner described. The CGG has approved an audit and monitoring framework that, at the time of our audit, was yet to be implemented.

External review

Stakeholders and surveys

SCIRT is open to external review and actively seeks objective views to inform its strategies.

4.36 SCIRT have actively engaged with companies that could perform subcontracted work for the SCIRT delivery teams. Feedback has been sought through a series of surveys and focus groups on whether subcontractors have enough capacity, and appetite, to "ramp up" with additional resources to deliver SCIRT's programme. The feedback also provided subcontractors' views on SCIRT as an organisation, their perception of fairness, and risks to sustainability for the duration of the rebuild. SCIRT collects data weekly on numbers of workers, their trades/skills, and major plant and equipment.

4.37 The results of SCIRT's surveys indicated that the attitude towards doing more SCIRT work was positive for just over half the respondents and neutral for almost a third. Several contractors had limited capacity to take on more work when they were surveyed. The discussion forums generated a wide range of concerns, such as wanting more opportunity to participate in early contractor involvement, wanting more work, rates being too low, costs of compliance being too high, lack of local knowledge, and staff retention challenges.

4.38 SCIRT protected the identity of respondents to ensure that the feedback was open and honest. It uses the information to better understand market dynamics, forecast skill shortages, inform human resources strategy, and improve its processes in preparation for increasing resource scarcity as the vertical rebuild[10] accelerates. SCIRT has found the focus groups particularly useful. It plans to continue using these methods to inform strategy.

4.39 SCIRT carries out independent and internal surveys on staff engagement and community views. Results of these surveys are discussed in other sections of this Part.

10 The vertical rebuild involves buildings and associated infrastructure.

Independent audit

The independent audit of claims is an essential control to provide assurance that the financial systems at SCIRT are appropriate. It also contributes to fraud detection. There has been a delay with the audit because the quality of information provided by some delivery teams was lacking. The independent auditor of claims made recommendations to improve the process, which should be given due consideration by the three public entities.

4.40 The independent audit of claims is an essential control to provide assurance that the financial systems in place at SCIRT are appropriate. It also contributes to fraud detection.

4.41 The three public entities ask an independent commercial firm to audit the monthly claims made by delivery teams for the actual costs they incur on SCIRT projects. These costs are known as Limb 1 construction costs (see paragraphs 2.56 and 4.133-4.134). The audit also covers the corresponding payments back from CCC to the delivery teams through SCIRT. The auditor examines the claims in detail and produces a monthly progress report to the three public entities that includes comment on any issues arising.

4.42 The independent auditor has reported that the claims validation process has been delayed for several reasons, including hold-ups from delivery teams when their claims are queried. Several issues are hindering, complicating, and preventing cost validation.

4.43 First, several delivery teams are not presenting claims in a format that is easy to audit. The format requires the independent auditor to review portions of a claim at separate intervals instead of all at once. Formats also differ between delivery teams, and the auditor has to manipulate the documents received to make them suitable for review. The delivery teams have been slow in responding to questions of clarification and substantiation from the auditor.

4.44 The resulting effect is that fewer claims are validated than originally anticipated, and a backlog of claims still to be reviewed is growing. The independent auditor commented that it was not clear when particular agreed-to rates were to be applied and for what periods. The independent auditor also reported that they have to revisit projects more frequently than necessary, which is forming an inefficient working pattern.

4.45 The independent auditor suggested adding incentives to the claims validation process to provide more motivation for the delivery teams to improve their process. They have also proposed reduced validation of payments to the IST because of its low error rate.

Target cost (Gate 4)

The target cost is an important element of the commercial model. It is intended to provide commercial tension. The process for setting project target costs is transparent and well documented, and there is a clear rationale for pricing inputs to the project costs.

4.46 SCIRT estimators create a target cost for every construction project. The target cost is an important element of the commercial model. It provides the standard against which project cost performance is measured and is the most significant factor in determining the Limb 3 pain/gain payment (see paragraphs 2.56 and 4.133-4.142). It is also intended to provide commercial tension.

4.47 SCIRT's estimators are part of IST. They are experienced in the construction industry, but involve other team members and industry experts to test their assumptions and judgement. The estimators set target costs independently of the non-owner participants, and early contractor involvement during this stage is limited to a methodology statement.

4.48 We were told that conflicts of interest are managed by ensuring that staff seconded from one of the five non-owner participants are not involved in projects allocated to their parent company, although SCIRT was unable to provide us with a formal policy. Also, the estimating manager reviews all target costs to ensure consistency and adherence to the master pricing schedule.

4.49 A target cost is built up from pricing inputs for key components using a master pricing schedule containing a common database of rates for labour, materials, plant, productivity, and so on. It is the product of an assumed level of resource, productivity, and unit costs. Master files are created for standard jobs to avoid duplication. The process for setting project target costs is transparent and well-documented, and there is a clear rationale for pricing inputs to the project costs.

4.50 Risk was initially calculated as an allowance within the target cost. Mid-way through 2012, risk registers were implemented as a way to identify and account for risk. The risk register is initiated during the design phase, added to as a project progresses through to the estimation phase, and debated during risk workshops.

4.51 The estimators complete the register and price construction risks only. Priced risks are a small proportion of the whole register, because the design risks are mostly resolved by this stage. The project incurs actual costs, irrespective of risk allowances in target costs. The risk allowance is based on the total cost of the risk materialising multiplied by a probability factor of the risk occurring.

4.52 We had an engineering expert review the target cost process as part of a benchmarking study to compare rates and construction costs within SCIRT (see paragraphs 4.66-4.86). Our expert concluded that pricing for job requirements such as dewatering[11] were more precise because of good scoping and that cost savings would be likely to be achieved in high-level efficiencies, rather than the basic rates for labour, plant, and materials.

4.53 The target cost can be adjusted by a variation that the SCIRT General Manager approves. A variation is allowed if there is an increase or decrease in the scope of a project, if there is a fundamental change to design, if the three public entities suspend work, or in other circumstances approved by the SCIRT Board. Variations are for only these reasons, not events that are listed and priced in the risk register. An approved variation is the only authorisation to change the target cost after it has been set.

Independent target cost estimator

The independent estimator's role is to ensure that target costs represent fair market pricing that is equitable to both owner and non-owner participants. This role is critical to maintaining commercial tension and signalling risks. His expertise and independence is valuable, but his balance of work should remain on core responsibilities to ensure that target costs continue to drive efficiencies.

4.54 The three public entities engage an independent estimator to provide two important aspects of independent assurance: the validation of target cost estimates and an independent commercial audit of non-owner participant's rate, allowances, and terms of compensation. He is not part of SCIRT but provides services directly to the three public entities.

4.55 The independent estimator reports monthly to the three public entities on target cost reconciliation, market behaviour, and price inflation, and other general conclusions and recommendations. Pricing inputs are updated by the independent estimator as new information becomes available. He also completes a formal six-monthly review and update of the master pricing schedule.

4.56 The independent estimator's validation role is to ensure that target costs represent fair market pricing (while taking into account the conditions in Christchurch), are equitable to both owner and non-owner participants, are prepared in a transparent manner, and could withstand scrutiny if audited.

4.57 The independent estimator attends feedback sessions with SCIRT and carries out project site visits to ensure that productivity and pricing assumptions are achievable and equitable. He monitors price inflation for a selection of typical supply items to develop a cost inflation index specific to SCIRT works. He

11 Dewatering is the removal of water from solid materials or soil.

compares that index with other published construction indices regionally and nationally. He assessed that the overall cost inflation specific to SCIRT would be 4.7% for the 12 months before April 2013.

4.58 The independent estimator reported in February 2013 (based on the results of price inflation monitoring) that labour and salaried staff rates could increase by up to 6% between February and December 2013. He sees an increasing shortage of skilled labour as a risk, along with the need to provide travel and accommodation for people brought in from outside Canterbury.

4.59 The independent estimator creates a target cost for each project independently from SCIRT. This target cost is compared with the target cost from the SCIRT estimator during a pricing review. If the independent target costs differ by more than 2%, there is a discussion to identify the reasons for the difference and to debate the assumptions influencing the estimate.

4.60 SCIRT's price might be higher or lower than the independent estimator's price. Each party adjusts its price as it sees fit until the difference is less than 2%. At the end of the negotiation, the adjusted SCIRT target cost is always selected as the project target cost. The independent estimator has reported that, in February 2013, the combined agreed target costs after the review process were 3% lower than the value of SCIRT's original target costs. The independent estimator's role is critical to maintaining commercial tension.

4.61 The independent estimator has reviewed the rules around Limb 1 reimbursement for delivery teams (see paragraphs 4.133-4.134) and sought to improve definitions to reduce misinterpretation and dispute in the monthly claim process. He has increasingly become involved in the early contractor involvement process and can challenge the methods delivery teams propose. He has also been used to resolve disputes about commercial aspects of SCIRT.

4.62 Although his expertise and impartiality is an asset, the balance of his work should remain on core responsibilities to ensure that target costs continue to drive efficiencies.

Productivity rates

Delivery teams are achieving productivities lower than the rates initially set. Despite an improving trend, it is not expected that they will reach the targeted productivity rates. Initial rates were taken from industry norms and moderated to account for Christchurch's post-earthquake conditions. The independent estimator concluded that these rates needed to decrease to account for the experience in the field. Several challenges unique to Christchurch were the reasons for this.

4.63 Productivity rates are a measure of how quickly a construction task can be completed. These rates require group discussion because of their subjective nature and sensitivity to external factors. Industry norms were used as a starting point for productivity rates, which were then moderated to account for the conditions in Christchurch. Delivery teams have not been meeting the set productivity rates, despite an improving trend, which affects their overall performance against the target cost.

4.64 The independent estimator's review of productivity rates concluded that these needed to decrease to reflect a more realistic target. It said that the delivery teams were unable to achieve the original target rates because of:

- ground conditions in Christchurch being worse than expected;
- contractors from other areas lacking familiarity with Christchurch conditions;
- the prevalence of deep gravity sewers;
- the design, resilience, and compliance features of SCIRT; and
- traffic disruption restricting movement around the city.

4.65 After the independent estimator's scheduled six-monthly formal review of rates in April 2013, SCIRT agreed on 10 May 2013 to reduce labour rates by about 10%, reduce productivity rates, and increase resource levels slightly. The combined effect of changes to pricing inputs was expected to result in an increase to the average wastewater project target cost of around 2%-4%. The average annual escalation provision in the estimate for the SCIRT horizontal infrastructure rebuild programme is 5.5%.

Comparing SCIRT construction costs

We commissioned an engineering expert to look at how construction rates for pricing SCIRT projects compare to those for similar projects elsewhere in Canterbury and New Zealand. SCIRT's rates for wastewater construction were consistent with similar projects in Canterbury and 30-50% higher than elsewhere. SCIRT's rates for water supply were similar to Canterbury rates and higher than elsewhere. SCIRT's rates for stormwater were lower, for Canterbury and elsewhere.

Ground conditions and the need to work around existing utilities have a significant effect on price. SCIRT manages the effect of these factors through a consistent approach to pricing, sound risk management, and use of its collective experience and learning. When relevant variables are considered, SCIRT projects seem reasonably priced.

4.66 We commissioned an engineering expert to carry out a benchmarking study on our behalf. Our expert looked at how rates and construction costs for SCIRT projects compare to rates and costs for similar projects in greater Canterbury and throughout New Zealand. It was difficult to make exact comparisons between projects, because each of them has been carried out in differing market conditions, in differing ground conditions, and to varying specifications. Our expert took these variables into consideration before forming a view for this report.

Scope and methodology

4.67 The study compared SCIRT's construction costs with those obtained from local government databases throughout the country. It compared the construction rates used to compile the target costs with rates used for similar types of work within Canterbury and in other parts of New Zealand.[12]

4.68 The other contracts used for comparisons were a mixture of direct procurement and competitive tender contracts. The SCIRT projects were carried out in late 2011 and throughout most of 2012. The projects for greater Canterbury and New Zealand were carried out between 2009 and 2012. The inflation movement during this time was between 3% and 6%. As this movement is not likely to affect the overall trends identified in the benchmarking work, the data was not adjusted for inflation.

4.69 The study focused on wastewater, stormwater, and water reticulation. It selected projects representing a good cross-section of these assets. Our expert made comparisons for each of these three main assets. The wastewater network is the deepest of the three water systems, suffered the most damage in the

12 To make accurate comparisons, the Limb 2 profit and corporate overhead margin has been applied to SCIRT target costs, because the costs for greater Canterbury and New Zealand would also have had similar margins included.

earthquakes, and represents the largest proportion of the overall costs (67% of the 2012/13 budget), so it proved to be the most useful reference for the benchmarking exercise. The study also compared preliminary and general (onsite overheads) aspects of the projects, the traffic management component, and the risk and contingency aspects, as well as reasons for any differences.

4.70 We considered including road repairs in the benchmarking review. However, because SCIRT has completed only a small proportion of repair work of roads in the rebuild programme so far, we considered that it was less useful to compare costs now. This and the variations in the types of road repairs would make any benchmarking exercise problematic without a significant amount of appropriate data.

4.71 Our expert stressed that comparing rates of different projects within the civil construction market can never be an exact science. Many variables can affect the outcome. For the purchasers of services, this adds uncertainty to the outcome being procured. A prudent client will review the prevailing market and determine the most appropriate procurement option to maximise the chances of obtaining the best "value for money" outcome.

4.72 Some of the variables that can affect the outcome are:

- the scale and value of the project within the context of the market;
- the demand for resources;
- the timing and urgency of the project;
- the complexity of the project;
- the risk allocated to the contract and the appetite of the contractor for taking on risk;
- the contractor's confidence in the purchaser (client); and
- the purchaser's capacity and ability to scope the works, manage the contract, and comply with contractual obligations.

Main findings

4.73 The benchmarking study found that wastewater construction rates vary significantly. Ground conditions (affecting the requirement for dewatering and/or special bedding) and a requirement to work around existing utilities can have a significant effect on price. The average greater Canterbury rates and SCIRT rates are between 30% and 50% higher than the New Zealand rates. Our expert concluded that the ground conditions were among the worst in the country for this type of construction and that, in this context, SCIRT's prices compared reasonably favourably.

4.74 The study also compared cost trends for various pipe diameters at different depths for wastewater projects. In all instances, average cost per metre to lay pipe

increased with increasing depth for SCIRT, greater Canterbury, and New Zealand projects. Our expert showed that although prices for SCIRT projects were slightly higher than greater Canterbury projects at shallower depths, the rates for the SCIRT projects were consistently less than greater Canterbury projects the deeper pipes were laid. He concluded from these trends that SCIRT is managing the risks associated with poor ground conditions effectively.

4.75 The cost of manholes at various depths also showed that projects in greater Canterbury are trending higher than SCIRT. It is difficult to explain why, although it is likely that this reflects the different ways that contractors price projects, with other costs being included in the manhole rate. Our expert found that SCIRT's approach to pricing and management of risk was more consistent than the other projects used for comparison.

4.76 Less information was available for water supply and stormwater than for wastewater. Rates for water supply were reasonably consistent between projects, apart from a few outliers. Variation in price related to ground conditions, the diameter and length of pipe being laid, the design criteria, and the context within which the work was being done. SCIRT's rates for water supply were similar to greater Canterbury rates, and higher than New Zealand rates. The average SCIRT rates for stormwater were lower than both greater Canterbury and New Zealand rates.

4.77 SCIRT might be experiencing some efficiency gains in repairing stormwater reticulation because the work is being carried out concurrently with roading repairs. Our expert concluded that there was less variation throughout the region and country for stormwater projects because of the shallower depths that pipes are laid at.

4.78 Preliminary and general costs are those associated with the establishment, management (for example, site supervision and overheads), and disestablishment of projects. The benchmarking study found that SCIRT's costs for onsite overheads were consistent with greater Canterbury costs and slightly higher than costs in other parts of New Zealand. Our expert concluded that SCIRT does not have excessively high construction project overheads and matches the construction project overheads on more traditionally bid contracts within greater Canterbury.

4.79 Our expert found that traffic management planning and implementation costs for SCIRT were consistent with greater Canterbury and higher than the rest of New Zealand. Two of the projects in the New Zealand data set did not allocate all the traffic management costs separately, which lowered the average cost for New Zealand. The rates for SCIRT were considered appropriate for the traffic management needs in Christchurch and the safety standards required by SCIRT.

4.80 Every project has a degree of risk associated with its delivery and a contingency allowance to cover additional works. Our expert compared the percentage of the project cost attributed to risk and contingency. The study found that the risk and contingency costs were lower for SCIRT than the projects from greater Canterbury and New Zealand, suggesting that SCIRT is managing its risks well.

4.81 SCIRT manages risks early, rather than transferring them to the delivery teams. This is achieved through thorough scoping, greater pricing transparency, and being precise about its rates. Transferring risk to the private sector during construction projects comes at a price and can result in a different standard or quality of infrastructure to that really needed.

4.82 SCIRT's effectiveness is also linked to strong design work and the availability of experts. The more detailed the design and the more detailed the development of the bill of quantities, the lower the potential of contracting risk. SCIRT is capitalising on its collective experience and learning. In some other parts of Canterbury, the ground conditions are just as bad and prices reflect this.

4.83 Choosing the right procurement method is largely driven by the most appropriate way to manage risk. Transferring all the risks to the private sector partner can be costly and there can also be perverse incentives when a contractor is preoccupied with concerns about liability. In our view, SCIRT is managing the risk appropriately.

4.84 The review of plant and labour rates indicates that SCIRT's rates compare reasonably favourably. SCIRT's rates were generally lower across all categories used in the study for comparison. Our expert said that SCIRT's rates are transparent and do not include a "preliminary and general" cost margin. Productivity rates are likely to show the greatest movement during the rebuild. It is expected that, as SCIRT progresses and work generally moves west to areas of lesser damage, productivity rates will increase.

4.85 Our engineering expert told us that ground conditions and a requirement to work around existing utilities have a significant effect on price. The specific challenges SCIRT faces are:

- carrying out projects in the most damaged and physically challenging areas of Christchurch and in geotechnically challenging areas;
- a significantly greater requirement for dewatering and shoring up the sides of trenches;
- a requirement for higher technical standards to be applied because of the ground conditions and the need for resilience;
- greater traffic management requirements because of traffic density and safety standards; and
- the size and complexity of the rebuild in Christchurch.

4.86 SCIRT manages the effect of these factors through a consistent approach to pricing, sound risk management, and use of its collective experience and learning.

Allocating projects to delivery teams (Gates 1 and 5)

Relative performance between delivery teams fluctuates. The system allows for poorer performing delivery teams to improve their performance and increase their share of work accordingly. Likewise, high-performing delivery teams must continue to improve or risk being outperformed by another delivery team and losing their share of work. This suggests that the allocation model is working as intended and is providing the desired incentive to delivery teams to compete for work.

4.87 Project allocation is part of the system of penalties and incentives that foster desirable behaviours and constrain cost inflation. The target allocation for work is determined by a delivery performance score (DPS) and financial performance against target cost, although the project allocation of work is determined by several factors.

4.88 Effective project allocation is important because it supports good performance in delivery teams and provides a safeguard against conflicts of interest. The integrity of the system also depends on the quality of performance measurement and the system for establishing target costs.

4.89 The allocation process consists of two parts. The first is the generation of a DPS, which determines the targeted percentage of work by cost to be allocated to each delivery team (target allocation). This score is a measure of cost and service performance in current projects. Initially, the target allocation was set at 20% for each delivery team until there was enough performance data to begin differentiating shares based on performance.

4.90 The second part considers factors that might influence why a delivery team should not be allocated a project. These factors include the delivery team's capability and capacity, proximity to a project, and safety performance.

4.91 Early contractor involvement allocation is done early in the process to gain construction expertise and advice during the design and estimating phases. Performance scoring is used only for construction allocation, and early contractor involvement allocation is generally equal for all teams.

4.92 The delivery team that is allocated early contractor involvement is not guaranteed construction allocation. However, if a delivery team has been allocated early contractor involvement, SCIRT says there is value in having that team continue with the construction of that project.

4.93 Figure 5 shows changes in the target allocation of work (targeted percentage of the total work by cost to be allocated to them) for each of the delivery teams' target scores, and the actual allocation of projects to delivery teams, between January, and April, and September 2013.

4.94 Target scores are represented as a percentage of the total work that has been allocated to the delivery teams, by target cost value. Continual change in the target allocation from one month to the next might suggest that there is tension in the system and delivery teams are competing for work.

4.95 Figure 5 shows that the target allocation increased for some delivery teams during this period and for others decreased, with target allocations for each delivery team changing independently of each other. Figure 5 also shows the difference between the highest value and the lowest value (the range) for each delivery team. There was a greater difference between delivery teams' target allocations in April than there was in January and September 2013.

Figure 5
Target allocation for delivery teams in January, April, and September 2013

Delivery team	A	B	C	D	E	Range
Target allocation* (%) January	19	22	21	18	20	4
Target allocation* (%) April	16	24	23	18	19	8
Target allocation* (%) September	18.4	20.9	23.1	19.0	18.5	4.7
Change in target allocation from January to April	-3	+2	+2	0	-1	
Change in target allocation from April to September	+2.4	-3.1	+0.1	+1.0	-0.5	

* Percentage of the total work by target cost value.

4.96 Figure 6 shows the changes in actual project allocation (percentage of total work by cost actually allocated to them) for each of the delivery teams between January, April, and September 2013). Figure 6 also shows the difference between the highest percentage and the lowest percentage (the range) of work allocated to each delivery team.

4.97 There are similar trends in Figure 6 to those in Figure 5. The actual project allocation increased for some delivery teams during this period and for others decreased, with the project allocations for each delivery team changing independently of each other. There was a greater difference between delivery teams' actual project allocations in April than there was in January and September 2013.

Figure 6
Project allocation for delivery teams in January, April, and September 2013

Delivery team	A	B	C	D	E	Range
Project allocation (%) January	17	20	20	21	22	5
Project allocation (%) April	14	24	21	22	19	10
Project allocation (%) September	17.1	21.4	22.1	19.8	19.7	5
Change in allocation from January to April	-3	+4	+1	+1	-3	
Change in allocation from April to September	+3.1	-2.6	+1.1	-2.2	+0.7	

Note: Project allocation is the percentage of the total work by target cost value.

4.98 To determine whether project allocations were more or less following target allocations, we compared them for each of the delivery teams for each of the months (see Figure 7). In January and April, there was between 0% and 4% difference between target allocations and project allocations. In September, the difference in target allocations and project allocations had narrowed and was between 0.5% and 1.3%.

Figure 7
Difference between target allocations and project allocations for delivery teams in January, April, and September 2013

Delivery team	A	B	C	D	E
Difference between target allocations and project allocations in January	2	2	1	3	2
Difference between target allocations and project allocations in April	2	0	2	4	0
Difference between target allocations and project allocations in September	1.3	0.5	1.0	0.8	1.2

4.99 We have shown two significant trends in this snapshot from January 2013 to September 2013. First, there was movement in delivery teams' target allocations and actual project allocations between months, and the allocations for each

delivery team moved independently of each other. The range in target allocations and in actual project allocations between delivery teams was greater in April than in January and September 2013.

4.100 Secondly, the changes in target allocations from January to April and from April to September were more or less consistent with the changes in actual project allocations in the same periods. For example, where there was an increase in target allocation for a delivery team, there was a corresponding increase to project allocation of similar magnitude for that delivery team.

4.101 These trends indicate that there is tension in the system for delivery teams when competing for work. It provides an incentive for poorer-performing delivery teams to improve their performance and increase their share of work. Likewise, high-performing delivery teams must continue to improve or risk being outperformed by another delivery team and lose their share of work.

4.102 In practice, there are some imperfections that affect delivery teams being allocated their target share. Each of the delivery teams originally had an uneven share of the work. This was because of the different quantity of work they completed under the IRMO arrangement. Also, there is only a short history of performance measurement on which to base allocation decisions. Particularly in the early stages, the allocation of a large project can significantly affect the difference between target and actual allocations. SCIRT expects this inevitable "lumpy" phenomenon to even out as more projects are completed.

4.103 Changing the allocation targets too frequently can also create uncertainty for the delivery teams. SCIRT works with delivery teams to achieve a balance between maintaining competitive tension and facilitating future work planning.

4.104 We conclude from these observations that, at the time of our audit, the allocation model was working and providing the intended incentives for delivery teams to compete for work. We could not determine from this analysis to what extent the delivery teams are collaborating or whether collaboration influences performance. The integrity of the system depends on the quality of KRA measurement and the quality of the target costs.

Measuring service performance

Ensuring the quality of KRA measures is of fundamental importance to maintaining the integrity of the wider commercial framework. The KRAs provide good coverage of service performance, help realise benefits, and mitigate operational risks.

4.105 The framework for performance measurement of delivery teams is laid out in the Alliance Agreement and the Key Result Areas Management Plan. KRAs are used to measure aspects of delivery team performance that do not relate to cost but that are identified as important to the three public entities.

4.106 The KRA monitoring information contributes to two important performance scores:

- A DPS is generated for each delivery team, to determine the allocation of projects and intended to drive competition between delivery teams. The DPS is based on performance against KRAs and performance against target cost. The DPS determines the target share for each delivery team.
- An OPS is generated as a consolidated measure for all delivery teams to adjust the non-owner participant's remuneration through the pain/gain part of the commercial framework. This mechanism is described in the next section on the three-limb commercial framework.

The KRA framework

4.107 The KRA framework covers the following service-related areas: safety, value, our team, customer satisfaction, and environment. They are designed to cover important aspects of project delivery, are operationally focused, and link to the programme objectives in the Alliance Agreement.

4.108 The KRAs are broken down further into KPIs and measures against which delivery teams are assessed. Delivery teams self-report the KRAs, although IST audits the raw data.

Safety

4.109 SCIRT considers safety to be very important. It is considered as a separate factor in the second part of project allocation (see paragraph 4.90), rather than contributing to the DPS. This is why the safety KRA carries a weighting of 0.

4.110 By considering safety during the second part of the allocation model, SCIRT can stop allocating work to a delivery team that has a poor safety record. If it were included as part of the DPS, it would have less effect.

Value

4.111 The value KRA includes measures for productivity, quality, and innovation. It is one of the few KRAs that measure performance of IST, rather than of delivery teams. Delivery teams contribute to the design process through early contractor involvement.

4.112 Innovations[13] are captured in the value register, are reviewed by IST management, and are costed by the Resource Co-ordinator. Innovations count towards the DPS only when they have been approved and taken up by other delivery teams. This is a source of tension for the delivery teams because there is a time lag for the measure to have an effect on their DPS.

Our Team

4.113 The "Our Team" KRA is a measure unique to SCIRT. This measure comes from an understanding of the stress and hardship that staff experience from being affected by circumstances in Christchurch while continuing to work as professionals in the rebuild. This measure indicates that SCIRT values staff wellness.

4.114 The Our Team KRA also includes up-skilling the workforce, with a focus on numbers completing NZQA qualifications, to support the higher objective of "lifting the capability of the sector-wide workforce". Good performance in this KRA can help to address labour shortages by improving the capability of those already working with SCIRT and attracting others.

Customer satisfaction

4.115 SCIRT measures customer satisfaction for both the product and communication. It uses a combination of results from three surveys to determine the score. The surveys are:

- community in areas where work was finished (shortly after work completed);
- a representative sample from the wider Christchurch community (repeated six-monthly); and
- identified representatives from key stakeholder organisations (repeated quarterly).

4.116 SCIRT states:

> *The results to date show excellent levels of satisfaction that have been due to a focussed effort in engaging affected members of the community with the programme.*

4.117 The New Zealand Council for Infrastructural Development (the infrastructure industry body) carried out research during February to April 2013 to assess perceptions of the Christchurch rebuild. The research involved a mixture

13 An innovation is defined as a feature of a system, operation, or built work that gives better performance at the same cost or same performance at less cost.

of stakeholder interviews and an online survey, to obtain feedback from infrastructure leaders, industry, members of Parliament and other community leaders, and members of the New Zealand Council for Infrastructural Development. Two-thirds of the respondents lived in Canterbury, and the rest were spread throughout New Zealand.

4.118 SCIRT featured in the list of things that were seen as going well in Christchurch. When asked about specific aspects of SCIRT, respondents rated its capacity to deliver, its leadership, and its communications particularly highly.

Environment

4.119 The final KRA is a measure of environmental awareness and waste minimisation. The KRAs are designed to encourage desirable behaviours, not just on the particular element measured but also for general matters relating to the KRA. For example, measuring the number of initiatives to improve environmental performance is intended to make environmental matters "front of mind" more generally. This is an assumption that should be tested through compliance audits on other aspects of environmental performance.

Implementing the KRA framework

It is appropriate that the KRAs continue to be reassessed to keep measures relevant. The performance scores need accompanying context to assess performance. They are a measure of the relative performance of delivery teams, not of SCIRT. Performance since July 2012 suggests that the scores are now a better reflection of performance.

4.120 SCIRT has recognised the fundamental importance of the KRA framework. An example of this is when SCIRT reviewed the weighting given to KRAs. The KRAs and respective KPIs are weighted to place greater importance on particular areas. The weighting has changed since the signing of the Alliance Agreement, and is currently 0% for safety, 35% for value for money, 20% for "our team", 30% for customer satisfaction, and 15% for environment.

4.121 In our view, it is appropriate that the weightings have changed and continue to be reassessed. This shows a willingness to respond to the changing circumstances and to keep measures relevant.

4.122 The KRAs are used to influence behaviours, to identify trends, and to differentiate performance between delivery teams. The DPS and OPS are grouped into levels of 0-50 unsatisfactory, 50-65 minimum condition of satisfaction, 65-80 stretch, and 80-100 outstanding. The scores themselves are meaningless without context and should not be viewed as an overall measure of SCIRT's performance.

4.123 Some of the wording and definitions of measures had scope for interpretation or for variable reporting when we reviewed them. For example, it is not clear what constitutes a "safety conversation", and delivery teams could manipulate the score for some measures by including or excluding subcontractors in staff numbers. SCIRT is aware of these reporting anomalies and is working towards setting firmer standards on how information is collected and reported.

4.124 SCIRT began allocating work based on performance scores in June 2012. This had a dramatic effect on delivery team performance against KRAs, which increased sharply (see Figure 8).

Figure 8
Delivery Performance Scores for delivery teams, from November 2011 to March 2013

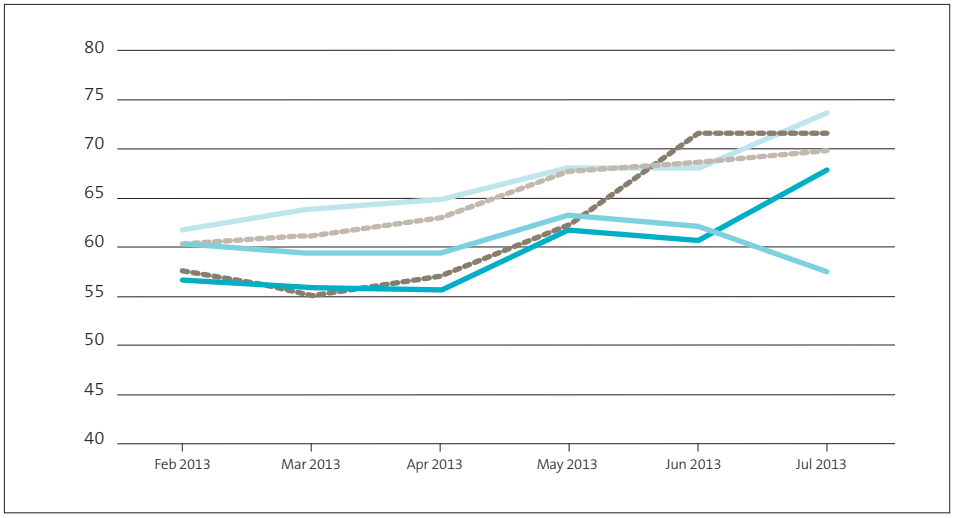
Note: Delivery team names have been omitted for confidentiality reasons.

4.125 Figure 8 shows that, from November 2011 to May 2012, the measured performance of delivery teams was relatively constant. Between June and July 2012, there was a sudden increase in performance scores. This was when SCIRT began using the scores for project allocation. The performance scores then reach a peak in October 2012. Between October and December 2012, the scores generally decrease before recovering around January 2013.

4.126 SCIRT staff consider that the sharp increase in performance scores was partly because of improved performance and partly because of better reporting of that performance in response to the scores having an effect on project allocation.

4.127 Figure 9 shows the performance of delivery teams from February 2013 to July 2013.

Figure 9
Delivery team performance against key result areas, from February 2013 to July 2013



Note: Delivery team names have been omitted for confidentiality reasons.

4.128 Since February 2013, there has been no further sudden increases in scores and trends have been more gradual.

4.129 The rapid increase in performance scores shown in Figure 8 is, in our view, a reflection of delivery teams improving their reporting systems. The more constant trends in Figure 9 show that there have been no further fluctuations of this nature and that the scores are a better reflection of actual performance.

4.130 Delivery teams hold records on the actions they have taken to meet KRA measures. They report to SCIRT on each measure at intervals specified in the KRA framework. Although the system uses self-reporting, IST staff audit documentation and records and carry out site inspections. The KRAs provide an incentive to perform well, but also for delivery teams to hold good records to prove they acted in the manner claimed. As time goes on, delivery teams will have longer to prepare more accurate and efficient methods of reporting.

4.131 Figure 8 indicates that, when performance scores began having an effect on project allocation, the delivery teams responded in a way to improve their scores

and get more work. This indicates that work allocation is important to delivery teams and can be used as an incentive.

4.132 Although SCIRT has the emphasis in the right place, it needs to resolve any reporting issues to ensure that delivery teams maintain confidence in the system and that SCIRT realises the benefits of an alliance. During discussion with SCIRT staff, we saw a desire to improve the effectiveness of the KRAs.

Three-limb payment framework

The delivery teams receive payment under a three-limb commercial framework. We had an engineering expert review the size of Limb 2 and comment on its comparability with industry standards. He concluded that the Limb 2 combined profit margin and corporate overheads were within the usual range and appropriate for SCIRT. It is not clear yet whether the pain/gain incentive payment is influencing the behaviour of delivery teams.

4.133 The delivery teams receive payment under a three-limb commercial framework, with Limb 1 a reimbursement of actual costs, Limb 2 a profit and corporate overhead margin on the target cost, and Limb 3 a payment or penalty determined by achievement against financial and service performance measures (see Figure 2 in Part 2). Financial performance is measured by comparing the actual costs of a project against a target cost. Service performance is measured against KRAs (see paragraphs 4.105-4.119).

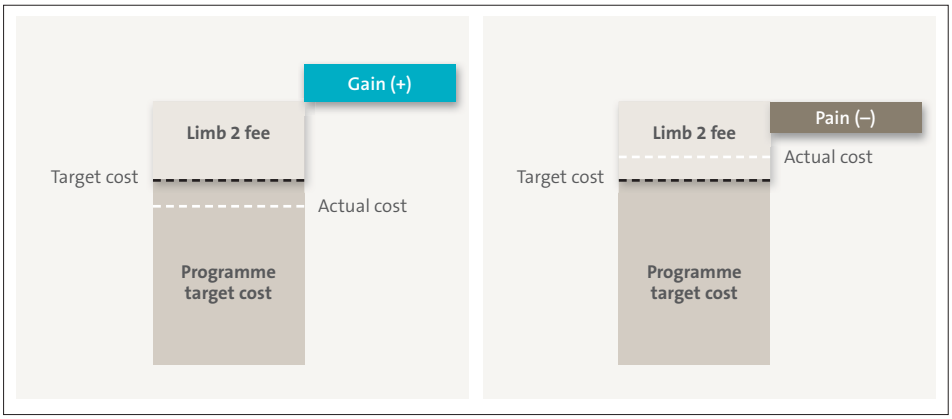
4.134 Limb 1 is the total of the actual costs of the project claimed by the delivery team. It includes costs such as labour, plant, materials, transport, site facilities, communication, and advertising. It does not include any off-site overheads or profit. All costs are coded and reported to show that they have been allocated correctly, and an independent audit provides assurance to the three public entities that rates and expenses charged to the project are as defined in the Alliance Agreement.

4.135 Limb 2 is paid as a fixed lump sum to cover profit and corporate overheads. It is a set margin. For projects, this is calculated by applying the margin to the Limb 1 costs of the *target cost* (not the actual costs) incurred by the delivery team under Limb 1 for the project. Once the target cost is set, the amount paid under Limb 2 does not change unless there is an approved variation to the target cost.

4.136 We had an engineering expert review the size of Limb 2 as a percentage of target cost and comment on its comparability with industry standards. He concluded that the Limb 2 combined profit margin and corporate overheads were well within the usual range and appropriate for SCIRT.

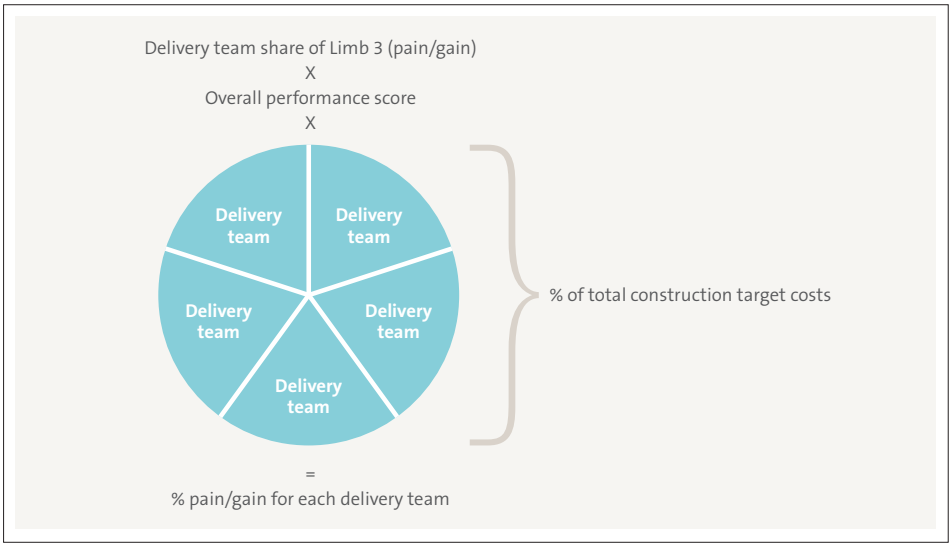
4.137 Limb 3 is also known as the "pain/gain" share. It is an incentive payment determined by both financial and service performance. If the actual cost of a project is less than the target cost, a "gain" is created. If actual costs are greater than the target cost, "pain" is created (see Figure 10).

Figure 10
Illustration of Limb 3 pain/gain model



4.138 The final Limb 3 payment is calculated by adding up all the pain and gain for every project and sharing this 50/50 between the three public entities and the delivery teams. The delivery teams' share is then adjusted by the OPS and shared between each delivery team in proportion to the value of work completed, as shown in Figure 11.

Figure 11
Allocation of Limb 3 to delivery teams, by % of work completed



4.139 The primary intended benefit of Limb 3 is to motivate delivery teams to achieve the best cost results. A "pain" result will reduce the earnings of delivery teams, while a "gain" will reward delivery teams.

4.140 A secondary intended benefit of Limb 3 is to encourage delivery teams that are performing well, to assist under-performing delivery teams, and to ensure that the final result will be a gain, rather than a pain.

4.141 At the time of our audit, the delivery teams were in a position of pain, and there was an increasing gap between the highest-performing delivery team and the lowest-performing team.

4.142 It is too early in the programme to form a view on whether Limb 3 is encouraging collaboration between the delivery teams. However, SCIRT suggested that this behaviour would become stronger towards the end of the programme, when the size and effect of Limb 3 becomes more certain.

Added benefits of SCIRT

SCIRT's objectives go beyond standard industry requirements to include building capability and resilience. Systems and incentives are in place to record and implement innovations that create efficiencies for the Christchurch rebuild and of wider value to the construction industry. SCIRT should continue to demonstrate the complete bundle of benefits and monitor emerging risks.

4.143 The independent estimator told us that, although commercial tension in an alliance is always softer than in a traditional tendering process, this is offset by the gains of collaboration. SCIRT's objectives not only contain all the standard requirements such as health and safety, environmental protection, and consultation but they also include additional benefits, such as lifting the capability of the sector workforce and improving the resilience of infrastructure.

4.144 In reporting on performance, SCIRT maintains a register of innovations and initiatives. In February 2013, SCIRT reported that 161 innovations were at various stages of deliberation. Of these, 34 were in use, with estimated benefits of almost $10 million. Initiatives include wellness initiatives, such as providing bicycles for staff to use around the city to encourage fitness, reduce cost, and reduce their carbon footprint. Some delivery teams have held volunteer days, where they help a local family in need.

4.145 Other initiatives relate more directly to improvements in construction work. For example, a contractor has come up with several modifications to their trench shield. The first includes a bracket that holds the geotextile roll, which speeds up the process of installing it into the trench. The second modification sees the

addition of a bracket and wheels to lift the trench shield off the bottom of the trench. This allows the compaction of bedding material against the ground, and the wheels enable the shield to be moved along the trench with ease.

4.146 An example of an innovation developed by SCIRT with an effect at a programme level and long-term benefits for local government is the Pipe Damage Assessment Tool. The tool was developed to provide a desktop assessment of the condition of wastewater and stormwater pipes.

4.147 SCIRT had more than 1600km of gravity wastewater and 900km of stormwater pipes to assess for damage. The cost of collecting all the data needed using traditional CCTV methods was estimated to be around $125 million and might have taken more than four years. There was a need to reliably predict CCTV outputs and provide estimates of damage based on a range of inputs using representative sampling.

4.148 The geographic information systems and spreadsheet-based tool that SCIRT produced is able provide information on the recommended action for pipes with an accuracy of 75%-95% to the observed CCTV outcome. The tool is now a reliable and accurate method for predicting the condition of earthquake-damaged pipes, saving significant amounts of time and money. The tool could be used in other cities affected by earthquake damage.

4.149 Another example of significant efficiencies achieved is the customisation of AutoCAD, a software application for computer-aided design and drafting. SCIRT started its design work using a standard AutoCAD tool. However, it realised that design work needed to speed up and that it would need to create efficiencies rather than hire more engineers. The team worked on automating a number of time-consuming and repetitive tasks. They also developed the capacity for design managers to monitor AutoCAD usage. SCIRT was able to quantify the time saved for each task and the overall increase in efficiency. It has now set a savings target from drafting of about $22 million.

4.150 SCIRT has a major initiative called “For Real” to meet its objective of building capability and to address the risk of resource scarcity. The For Real scheme is designed to fast-track potential new apprentices into the workforce. The scheme offers successful candidates free training, New Zealand Qualifications Authority qualifications, and continued on-the-job training with one of the lead contractors.

4.151 SCIRT aims to train 1000 people for the Canterbury rebuild under this scheme. We were told that uptake of this initiative has been reduced because of the slow start of the vertical rebuild and the lack of demand on SCIRT resources.

Part 5
Managing risks

5.1 In this Part, we describe how well the three public entities are leading the strategic direction of SCIRT and how they identify and manage the high-level risks of the horizontal infrastructure rebuild.

5.2 We looked at the governance arrangements for SCIRT and how roles and responsibilities are defined. We also looked at how the three public entities carry out strategic planning and provide direction for SCIRT. We looked at whether the three public entities had determined what value would look like for the horizontal infrastructure rebuild, how they measure SCIRT's delivery of that value, how information is shared and communicated, and how decisions are made.

5.3 We expected that:

- the three public entities would have defined important roles and responsibilities, and that there would be a clear governance framework, appropriate delegations, and good communication;
- high-level strategic planning would be carried out to ensure that the horizontal infrastructure rebuild programme is linked with the wider Canterbury recovery and is repairing the right things, in the right place, at the right time, to the right standard;
- the three public entities would have agreed on the scope of works that SCIRT will deliver, have clearly expressed what value means in the context of the horizontal infrastructure rebuild, and are measuring SCIRT's achievement of that value within a cohesive performance framework; and
- information and reporting provided to the CGG and to the SCIRT Board would be enough, pitched at the right level, timely, and accurate, to ensure that progress towards objectives can be monitored, that risks can be managed, and that decision-makers are well informed.

Summary of this Part

5.4 We identified two main risks that could have a significant effect on the horizontal infrastructure rebuild if they remain unresolved. Several smaller issues pose more moderate risk.

5.5 The first main risk is the three public entities' strategic leadership of SCIRT. The effectiveness of the CGG is undermined by a lack of clarity about its role and the role of the independent chairperson. CERA has not fully engaged with the CGG or with SCIRT to the extent needed to effectively facilitate planning for the horizontal infrastructure rebuild. CCC and NZTA are engaged enough.

5.6 CERA, through the CGG, needs to facilitate better connections between SCIRT and other government agencies to better integrate the horizontal infrastructure with the rest of the Canterbury recovery. SCIRT's rapid pace of operation is misaligned with the slower progression of strategic planning. Protracted decision-making for the wider rebuild, especially for the central city rebuild, could reduce SCIRT's ability to deliver optimum value.

5.7 The second main risk is that the three public entities have not clearly defined the scope of the horizontal infrastructure rebuild. At the time of our audit, the three public entities had not been able to reach a common understanding of what levels of service and quality of infrastructure the rebuild will deliver. Construction work was under way, but there was not enough clear guidance for SCIRT to confidently deliver the right levels of service in the right places.

5.8 Several issues pose a more moderate risk to SCIRT's effective and efficient operation. The three public entities are still defining what value would look like for SCIRT. There is also no coherent framework for measuring SCIRT's performance and the overall achievement of programme objectives. SCIRT can draw on a large pool of data, but it could improve its use of that data to inform its Board and the three public entities on progress towards the rebuild's objectives. A proposed audit framework will also provide better assurance that SCIRT is well managed, once it is implemented.

Main risk 1: Strategic leadership of SCIRT

Roles, relationships, delegations, and communications

The effectiveness of the CGG is undermined by a lack of clarity about its role and the role of the independent chairperson. CERA has not fully engaged with the CGG or with SCIRT to the extent needed to effectively facilitate planning for the horizontal infrastructure rebuild.

5.9 The CGG was established to bring alignment between the three public entities and to bring a united owner-participant voice to the SCIRT Board. No business case was completed. Therefore, the outcomes sought at the strategic level were not formally or well defined at the beginning. This means that defining outcomes has been an iterative process. The CGG drafted its own terms of reference to provide direction to it and its subcommittees. The three public entities also told us that conversations about funding arrangements in the presence of non-owner participants were uncomfortable, especially while there were unresolved issues about funding between the three public entities.

5.10 The Minister for Canterbury Earthquake Recovery appointed an independent chairperson, who has worked with the CGG for more than a year. However, the role has not been formally defined. This lack of clarity about the role of the independent chairperson does not help the CGG to understand its own role. Nor does it help the operational parts of the SCIRT structure to understand how to relate to the CGG.

5.11 The respective roles of the CGG and the SCIRT Board are sometimes blurred. For example, in the Board papers, there is an overlap in the matters that each body considers. It appears that client representatives have sometimes revisited matters at the CGG that they had already discussed with the SCIRT Board.

5.12 A new governance structure was proposed to address the lack of clarity of roles. The new structure was established in October 2013. New terms of reference will also be prepared. The proposed changes would rename the CGG to the Horizontal Infrastructure Governance Group (HIGG). The HIGG would focus on funding, scope and standards, strategy, and prioritisation. Reporting lines were still being confirmed at the time of our audit.

5.13 CERA staff told us that the governance changes would not alter the Alliance Agreement. The SCIRT Board would still exist, although its mandate would be much more focused on operational matters.

Recommendation 1

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency change the governance framework to address ambiguity about roles and responsibilities, including the role and responsibilities of the independent chairperson.

5.14 CCC and NZTA have provided consistent representation on the SCIRT Board and the CGG since SCIRT was established. Both NZTA and CCC changed their nominated representatives in late 2012. This meant that they would each have only one staff member fulfilling both the SCIRT Board and CGG appointments for their respective organisations. Previously, they had two. This was done to improve the passage of information and speed up processes. The established relationship between NZTA and CCC has helped them to share advice and work together.

5.15 Several different staff members have represented CERA on the CGG and the SCIRT Board in the past 18 months. Currently, CERA's official SCIRT governance representative has delegated their responsibility for attending meetings to a

subordinate staff member. The delegate does not have a similar level of authority to the other client representatives on the CGG, and this has contributed to slower approval processes. Some of the subcommittees of the CGG also lack continuity because staff members at CERA have left.

5.16 This is a problem because part of CERA's purpose under the Canterbury Earthquake Recovery Act is to facilitate, co-ordinate, and direct planning, rebuilding, and recovery of infrastructure. We note that CERA also faces some challenges, because a high proportion of staff are on secondments or short-term contracts.

5.17 CERA cannot effectively co-ordinate and direct the infrastructure rebuild if it does not get fully involved in the governance of SCIRT. CERA informed us that some portfolios were being reassigned internally, so that the appropriate person would have more time to attend meetings.

Recommendation 2

We recommend that the Canterbury Earthquake Recovery Authority contribute more consistently to effective leadership and strategic direction for the Stronger Christchurch Infrastructure Rebuild Team.

Integration of SCIRT with the Canterbury rebuild

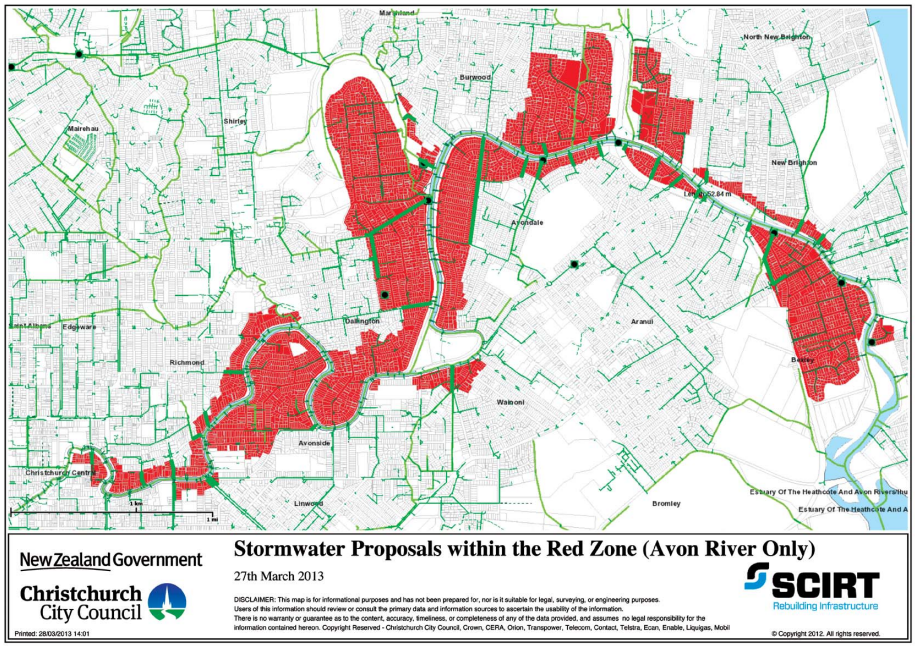
SCIRT's work on the horizontal infrastructure needs to be better integrated with the rest of the Canterbury recovery, particularly through CERA facilitating better connections between SCIRT and other government agencies. SCIRT's rapid pace of operation is misaligned with the slower progression of strategic planning for the wider rebuild. Delays in decision-making for the wider rebuild, especially for the central city rebuild, could reduce SCIRT's ability to deliver optimum value.

5.18 SCIRT has a four-phase project prioritisation process (described in Part 4). The last phase requires SCIRT to engage with the three public entities and other organisations to understand external influences, such as their geographic, time, or schedule-related goals, that might affect prioritisation or support specific requirements of the wider recovery process. SCIRT's planning is ahead of the other agencies working on the rebuild.

5.19 Several examples show some of the complex planning that needs to be carried out and just how important it is for the horizontal rebuild to be integrated with other work. One example is planning for the future design of flood defences on the Avon River. Lateral spreading has affected the stopbanks on the Avon River, which is also bordered by red zone land. Lateral spreading is where the ground

moves, opening up cracks. It is most severe near streams or waterways. It affects the stability of dwellings, buildings, and other structures. Figure 12 shows where SCIRT proposes to construct stormwater pipes through red zone land on either side of the Avon River.

Figure 12
Red zone land around the Avon River with stormwater reinstatement proposals



5.20 Any repairs or reconstruction work done on the flood defences will affect the overall capacity of the river network and will subsequently affect stormwater infrastructure needs.

5.21 SCIRT has informed the CGG that, because no decisions have been made about the future of red zone land and flood defence options, stormwater repair works will be delayed. CERA is responsible for resolving the future of red zone land. SCIRT has explained that delaying stormwater repair work would also delay critical roading repairs. It anticipates that these decisions could be delayed for 12 months or more.

5.22 Other examples of external factors that SCIRT must take into account include the Housing New Zealand intensification project, the Ministry of Education's school roll proposals, and Christchurch's *An Accessible City* draft transport plan.

5.23 Of all the external factors, the central city rebuild has the most effect on current operations. The availability of land for road corridors in the central city will become a problem once the vertical rebuild intensifies, because the various parties contributing to different aspects of the rebuild will want access to the same areas at the same time. How to manage competition for space is still being worked on. If this is not resolved soon, the vertical rebuild in the central city will be inefficient.

5.24 Co-ordination between SCIRT and CERA and between SCIRT and the Christchurch Central Development Unit has been problematic. SCIRT has lost important communication contacts in CERA because of CERA's staff turnover and restructuring. The disestablishment of CERA's infrastructure department as part of its restructure in November 2012 has made co-ordination more difficult for SCIRT.[14]

5.25 SCIRT and the horizontal infrastructure rebuild are part of the wider recovery programme for Canterbury and need to be integrated with other recovery plans prepared by CERA. For SCIRT to achieve the Alliance Agreement objective of doing "the right thing right, at the right time to the right standard every time", and "complete the rebuild effort to prescribed standards with minimal rework", it must be linked with, and fully informed about, the wider rebuild programme.

Recommendation 3

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and New Zealand Transport Authority use the governance arrangements to provide timely guidance to the Stronger Christchurch Infrastructure Rebuild Team on the priorities and direction of the rebuild.

Main risk 2: Defining the scope of the horizontal infrastructure rebuild

Funding and scope uncertainty

Estimating the scale of damage to repair has been difficult and is being revised over time. The three public entities have not reached a common understanding of the appropriate levels of service and the desired quality of infrastructure that the rebuild will deliver. As a result, construction work is under way, but there is not enough clear guidance for SCIRT to confidently deliver the right levels of service and quality needed in the right places.

5.26 It is reasonable to expect that, after a disaster, the extent of damage would be assessed over time, that the costs for the rebuild would be estimated, and that the estimate would become more accurate as more information is gathered. An

14 Management positions in the infrastructure unit were disestablished, and reporting lines for staff were realigned to the Christchurch Central Development Unit.

initial estimate in 2011/12 for the cost of the horizontal infrastructure rebuild was reported as $2.015 billion (including SCIRT and non-SCIRT work). However, very little of the asset assessment had been completed at that stage, so less information was available to assess the extent of damage.

5.27 The estimate for SCIRT work only was redeveloped using more accurate information and approved in 2013. The updated SCIRT estimate of "most likely cost" is $2.496 billion (about the mid-point of a "best cost" estimate of $2.283 billion and a "worst cost" estimate of $3.189 billion, which includes targeting potential savings of $300 million). An independent assessor will review this estimate again and report on the finalised rebuild work and costs by December 2014.

5.28 The funding arrangements require CCC and the Crown to agree on the proportion of the costs that they will each fund. CCC represents the interests and expectations of the residents of Christchurch. The Crown must consider the financial effect on, and fairness to, New Zealand taxpayers generally. These are difficult trade-offs, which require support from all levels of government.

5.29 In June 2013, the three public entities formalised their cost-sharing arrangements for the horizontal infrastructure rebuild, as well as costs for residential red zone land, residential red zone land subject to rock fall and rock roll, and the anchor projects.[15] The Crown has agreed to contribute a maximum amount of $1.8 billion towards the rebuild of horizontal infrastructure (SCIRT and non-SCIRT work). This includes CERA funding 60% of costs for the water infrastructure and NZTA funding 83% of the roading infrastructure. CCC will fund a total of $1.14 billion. The report produced by the independent assessor will provide the basis for any further discussion on cost sharing, and the contribution from each could go up or down.

5.30 The need for the three public entities to formalise cost-sharing arrangements has led to a more rigid budget than the estimate SCIRT was previously working to. To adjust to this arrangement, SCIRT has rescoped some of its work with the Scope and Standards Committee to identify opportunities for savings. This approach will place a focus on remaining asset life, ongoing operational costs, and overall network levels of service when considering what interventions are required for the rebuild. SCIRT has recommended to the CGG to apportion the funding available on an area basis and allocate finance to projects in the best way it can to achieve the level of service required with the money available.

5.31 The Alliance Agreement outlines the scope of SCIRT works. It defines the desired level of repair for horizontal infrastructure as "a standard and level of service comparable with that which existed immediately prior to the September 2010 earthquake". At the time of our audit, the three public entities had not reached

15 Anchor projects are the major projects (defined in the Christchurch Central Recovery Plan) that will form the foundations of the central city rebuild and are intended to stimulate further development and recovery of central Christchurch.

a common understanding of what this means. Although construction work was under way, there was not enough clear guidance for SCIRT to confidently deliver the right levels of service in the right places.

Design standards and guidelines have been revised over time

The Infrastructure Recovery Technical Standards and Guidelines have an immediate and long-term effect on cost and quality. At the time of our audit, the three public entities had not provided guidance with the detail necessary for SCIRT to make decisions about trade-offs and to deliver optimal solutions.

5.32 Design is guided by several standards and guidelines. The most significant of these are the Infrastructure Recovery Technical Standards and Guidelines (IRTSG). The IRTSG were produced by CCC, CERA, and NZTA to identify the scope, objectives, intervention levels, and defined standards for the response to the Christchurch earthquakes.[16]

5.33 The Scope and Standards Committee is responsible for ensuring that the IRTSG are applied consistently. It considers scope, betterment, and proposals to depart from the standards for individual projects. The representatives on the Scope and Standards Committee are not an even representation from the three public entities. Most are CCC representatives.[17]

5.34 SCIRT told us that it is sometimes hard to get agreement on the right balance between building resilience into the system and betterment. How to backfill trenches is an example of an issue where SCIRT and CCC staff have differing views on the most appropriate solution. A working group has been set up to consider and test alternative solutions.

5.35 The scale of work being carried out in Christchurch is significant, so the design solutions adopted must be carefully considered. They will have an extensive effect on the cost and quality of the infrastructure network. It is necessary for decision-making and planning that the three public entities funding the rebuild are involved in setting standards.

5.36 The IRTSG were produced specifically for SCIRT and the post-earthquake horizontal infrastructure rebuild. They are intended to inform and guide the technical assessment of damage, the design and construction of the repair and renewal of Council-owned infrastructure, and the handover process back to CCC. They also provide definitions for infrastructure resilience and betterment for the purposes of the rebuild.

16 Two other standards set out the design or enhancement of infrastructural assets in Christchurch and the technical requirements for the construction of land and asset developments that are carried out on behalf of CCC or that are intended to be taken over or maintained by CCC.

17 The committee is chaired by CCC and attended by six CCC representatives, one NZTA representative, and one CERA representative.

5.37 The IRTSG defines the primary and secondary objectives for the infrastructure recovery:

- Primary: "To return the infrastructure network to a condition that meets the levels of service prior to the September 2010 earthquake within the timing constraints of the rebuild."
- Secondary: "Where restoration work is undertaken, and where reasonably possible and economically viable, greater resilience is to be incorporated into the network."

5.38 The CGG's Scope and Standards Committee maintains and amends the IRTSG. The Committee forwards its recommended changes to the CGG for approval.

5.39 The IRTSG were also independently reviewed on behalf of the CGG in December 2011. The reviewers were asked to consider whether the IRTSG provided enough information about intervention strategies. The reviewers were also asked to consider whether the IRTSG provided adequate guidance to enable the achievement of the potentially competing objectives of reinstating the infrastructure to pre-2010 earthquake levels and ensuring that there is enough rigour in determining intervention strategies to avoid "over-renewing" the assets.[18] We interpret over-renewing to mean repairing or replacing assets to a level of service or quality that is better than that considered necessary.

5.40 The reviewers found that the IRTSG needed to be clearer. Of particular significance, the review found that the IRTSG allowed for significant latitude and variable standards to be applied. It also recommended clarifying how the term "resilience" should be applied in a technical sense.

5.41 It was difficult for the reviewers to draw specific conclusions on cost implications. However, the reviewers noted that, because of the flat nature of Christchurch, it is not always possible or practical to comply with standard gradients and that steeper gradients would mean additional costs for pumping stations and flushing chambers.

5.42 As a result of the review, the CGG compiled a timetable of action and responses. The IRTSG were revised, and SCIRT reported that it was a much easier document to use and to apply. However, the IRTSG still did not adequately define levels of service for assets. At the time of our audit, SCIRT reported that it was difficult to know what levels of service existed in September 2010 and to work out how to achieve that.

5.43 The earlier versions of the IRTSG essentially required SCIRT to fix broken assets, based on the assumption that a repair or replacement would return the asset to the former level of service provided. This worked well for the worst damaged areas and emergency works, because these were largely all replacements.

18 The reviewers were also asked to specify where CCC standards differed from New Zealand industry standards, why they differed, and the cost implications of the differences.

5.44 Now that the rebuild is getting into less damaged areas, a more considered assessment is needed because it is possible to use remaining asset life. Trade-offs can be made about repairing or replacing an asset now or doing it later if, for example, the pipe or road is still doing what it is supposed to do. Network performance, ongoing maintenance costs, and estimated remaining asset life are also considered.

5.45 We were told that the Scope and Standards Committee has amended the IRTSG to include a table of levels of service for each asset type, to better address the shift from fixing damage to restoring levels of service. We have not had an opportunity to review the recent changes, so cannot comment on their effectiveness. However, it is essential that the amended version delivers the guidance needed.

Recommendation 4

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency agree on the levels of service and quality of infrastructure that the rebuild will deliver, in conjunction with confirming funding arrangements, and consider a second independent review of the Infrastructure Recovery Technical Standards and Guidelines.

Other issues posing more moderate risks

Defining value

Work is in progress to outline the value proposition in a coherent way, which will help with refining the performance framework.

5.46 When approving the signing of the Alliance Agreement, the responsible Ministers noted that CERA and the Treasury were continuing to work with SCIRT on defining value for money.

5.47 A series of documents set out the reasons for establishing SCIRT and its intended purpose. The original proposals to the Government and CCC described the benefits of alliance contracting. For example, the CCC proposal said that choosing an alliance would reduce overheads, streamline approvals, and increase the participation of the private sector. An alliance would be the most agile method of dealing with the evolving scope of the works. It was expected that SCIRT would support CCC's strategic objectives and achieve value for money.

5.48 More specific benefits about SCIRT can be found in the Alliance Agreement under several different clauses, beginning with an overall commitment to work together in good faith, with trust, mutual respect, and a "no blame" culture. The three public entities started, but did not complete, a business case to link the Alliance Agreement to the original proposal for an alliance.

5.49 The Alliance Agreement contains 12 objectives. These cover a range of matters, including safety, communication and community engagement, minimising rework, environmental standards, building resilience, co-ordinating with others, innovation, lifting the capability of the work force, and maintaining a sustainable market condition.

5.50 Over time, SCIRT has been preparing a document to describe SCIRT's value. The CGG reviewed this document in March 2013. It is an attempt to describe SCIRT's historical context, including its formation and intended benefits, and present the results achieved to the end of January 2013. Its structure is guided by the Australian Government National Alliance Contracting Guidelines (Guidance Note 4). The document lists several advantages that SCIRT considered an alliance model would deliver to the Christchurch rebuild. These included the ability to adapt to an evolving scope and the need to build more resilient assets.

5.51 The original proposal for SCIRT focused on the generic benefits of the alliance model. Beyond this and the Alliance Agreement objectives, work on defining SCIRT's specific value in a concise way is incomplete. Resolving this issue will also help the three public entities to define a performance measurement framework.

Providing assurance about SCIRT's performance

There is no complete framework for measuring SCIRT's performance. At the time of our audit, the three public entities were working closely with SCIRT on a form of earned-value reporting, intended to provide a more strategic view of progress.

5.52 SCIRT and the three public entities have been developing ways to measure performance. Although the Alliance Agreement contains 12 objectives, it is not clear how all the objectives are measured at a programme level or to what extent they are being achieved. Some of the objectives are relatively general, while others outline quite specific tasks and timeframes. Many of the objectives are covered by the KRAs, but the KRAs primarily measure the performance of delivery teams and projects. However, when those results are aggregated, they reflect SCIRT's performance as an organisation for those nominated areas.

5.53 When approving the signing of the Alliance Agreement, the responsible Ministers also noted that CERA would independently audit the quality of the works carried out and monitor the actual costs of the work programme against budgeted costs. CERA would also carry out an independent review of SCIRT to assess its performance in planning and managing the delivery of horizontal infrastructure. Although a proposal was prepared to evaluate SCIRT's operations, the evaluation did not proceed.

5.54 Some aspects of the review were overtaken by work that the CGG commissioned through an external consultancy. The CGG wanted to gain an independent view on the adequacy of its performance metrics.

5.55 The CGG received the report from the external consultancy in March 2013. The report gave a high-level review and was followed by a proposal to carry out further work on the metrics. The CGG asked SCIRT to progress its earned-value work and asked the external consultancy to prepare a proposal for additional work. At the time of our audit, the three public entities were working closely with SCIRT on a form of earned-value reporting that will provide a more strategic view of progress.

Recommendation 5

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency use a coherent framework for measuring key aspects of the Stronger Christchurch Infrastructure Rebuild Team's performance that integrates project-level delivery team performance with alliance objectives and overall programme delivery, and is based on sound measures tested through the Stronger Christchurch Infrastructure Rebuild Team's internal auditing regime.

The client's audit framework

NZTA's reviews of SCIRT's systems and processes have been positive. A proposed audit framework, which started in October 2013, will provide better assurance.

5.56 In October 2012, NZTA reviewed SCIRT's estimation systems and processes to provide assurance that these were consistent with NZTA's processes. Overall, the NZTA engineering advisor was comfortable that robust processes were being applied and that SCIRT had a mature approach to risk and opportunity management. The advisor suggested that there were opportunities to increase efficiencies by increasing the size of packages (project size) and suggested that temporary traffic management standards were too high (which increases cost).

5.57 As part of an investment audit of CCC in April 2013, NZTA reviewed claims for earthquake-recovery work. NZTA's audit concluded that there were very good processes and controls to ensure that projects followed the authorised delivery process, that there were excellent checks on how target costs were calculated, and that, although quality assurance processes appeared to be lean to start with, they had improved as SCIRT systems matured.

5.58 NZTA recommended that thought be given to the completion of the rebuild programme – in particular, the calculation and payment of pain/gain, the

management of defects liability, and the final realisation of SCIRT's assets. This was an audit activity carried out under a wider audit framework that the three public entities were preparing at the time.

5.59 The three public entities have worked with SCIRT to produce an audit framework to provide assurance to the funding partners and other interested parties that SCIRT is well managed and delivering value for money. NZTA has led the planning for the work, with contributions from CCC and SCIRT. NZTA has waited more than a year for feedback from CERA, which recently included fraud detection as a heading in the framework.

5.60 The proposed audit framework has good coverage of important SCIRT systems and processes. There is an appropriate mixture of one-off reviews, ongoing monitoring, and spot checking. Resources to carry out the work have recently been identified. NZTA and a commercial firm acting on behalf of the three entities started audit work on 14 October 2013 under three areas of the framework. The continued implementation of the audit framework will provide a much needed layer of assurance.

Recommendation 6

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency ensure that their framework for auditing the Stronger Christchurch Infrastructure Rebuild Team provides them with adequate assurance that the Stronger Christchurch Infrastructure Rebuild Team is well managed and delivering value for money.

Information, reporting, and decision-making

SCIRT has lots of data and the capacity to produce customised reports. However, the three public entities have not confirmed what information is needed to gain assurance that SCIRT is meeting its rebuild objectives. As a result, operational information provided in Board papers covers many topics but lacks focus in its analysis.

5.61 SCIRT has information available for most aspects of performance. The SCIRT Board receives a quarterly one-page report covering several areas, with high-level measures.[19] It also receives a monthly operational report from the General Manager of SCIRT with much more detail (for example, activities carried out, types of safety events, main issues, and forthcoming priorities).

19 Performance against KRAs forms part of this.

5.62 Updates on other aspects of the rebuild are provided as required, through separate reports from the responsible manager. A separate set of papers compiled for the CGG provide well-presented information to address appropriate issues. The CGG also reviews the minutes of SCIRT Board meetings to note any client-specific action points.

5.63 In the SCIRT Board papers, the analysis presented for the operational report is highly detailed and not conducive to understanding how well SCIRT is performing overall. There are a range of reports on different aspects of performance, but it is not easy to form a coherent view because different measures are used for various aspects of SCIRT's operation.

5.64 SCIRT reports a summary of high, very high, or extreme programme risks. In the papers we reviewed, it was not clear how the risks were trending or how effective mitigating actions were. The quarterly report provides a useful snapshot of performance in a one-page format, with traffic light indicators of achievement. The SCIRT Board and the CGG should provide more clarity about what information is important for their review and what further analysis is needed to demonstrate value for money.

5.65 The volume of paper that goes to the CGG is substantial. There is a high level of detail, which sometimes reaches into operational matters. This reflects ambiguity about the respective roles of the SCIRT Board and the CGG and can lead to matters being passed between them. We discussed this ambiguity about roles in paragraphs 5.9-5.13.

5.66 Both bodies could benefit from more strategic analysis and better reporting of high-level risk. The CGG has identified that earned-value reporting is still needed to track performance against planned cost and schedule at a programme level, as we discussed in paragraph 5.55.

Recommendation 7

We recommend that the Canterbury Earthquake Recovery Authority, Christchurch City Council, and the New Zealand Transport Agency, in conjunction with strengthening performance measures, provide feedback to the Stronger Christchurch Infrastructure Rebuild Team to improve the analysis and information included in reports to the Stronger Christchurch Infrastructure Rebuild Team Board and make these reports more useful.

Appendix 1
Circumstances leading to the formation of the Stronger Christchurch Infrastructure Rebuild Team

In response to the earthquake in Canterbury on 4 September 2010, Christchurch City Council (CCC) set up an Infrastructure Rebuild Management Office (IRMO) with a team of 20-30 staff to manage the reinstatement of infrastructure and oversee repairs. IRMO was responsible for design, construction management, finance, communication, programming, procurement, and project administration.

CCC discovered that the most damaged infrastructure was concentrated in four areas of Christchurch, so it entered into four design-build contract arrangements with four construction companies to rebuild one area each. The aim was to repair the worst affected areas as quickly as possible. McConnell Dowell Constructors Limited and Fletcher Construction Company Limited (working together in a joint venture), Fulton Hogan Limited, Downer New Zealand Limited, and City Care Limited were selected through a competitive tender process. (Appendix 2 contains further information on these companies.)

The situation changed on 22 February 2011, when another earthquake struck Christchurch just 10km from the central city. The second earthquake caused much more widespread damage than the first, and CCC soon recognised that the arrangement it had was no longer suitable for the larger size and scale of the task.

The Government also recognised the need for a different approach. It set up the Canterbury Earthquake Recovery Authority (CERA) through the Canterbury Earthquake Recovery Act 2011 to ensure the effective, timely, and co-ordinated rebuild and recovery of Canterbury. The Government sought guidance from the New Zealand Transport Agency (NZTA) on an appropriate response to deliver the horizontal infrastructure rebuild. NZTA is experienced in alliancing-style contracts.

NZTA supported the alliance approach, believing that it would be the fastest way to meet the needs of the people of Christchurch. As the foremost authority on alliancing-style contracts in New Zealand, NZTA offered to work alongside CERA, acting on its behalf until the central government agency was fully established.

CCC and NZTA worked together to review various options. Based on their analysis, they concluded that an alliance delivery model would deliver the best outcome. It was thought that other possible models, such as “Design and Construct” or “Managed Contractor Model”, would not deliver with the speed required, would be complex in administrative layers, and would not effectively bring together organisations with differing objectives.

By 22 February 2011, the four contractors working under the IRMO arrangement were either starting physical works or planning to start physical works in

their areas later that month. It was therefore proposed that the existing head contractors would be engaged to work as part of SCIRT.[20]

The contractors were asked to produce a co-ordinated response to a request for proposal. They formed an unincorporated joint venture, known as the Stronger Christchurch Infrastructure Rebuild Team Joint Venture, so that they could participate in a collaborative alliance with the owner participants. The Alliance Agreement sets out the roles and obligations of the owner and non-owner participants in the Alliance.

It was acknowledged at the time that decisions made for the wider Canterbury recovery would affect the scope and scale of the horizontal infrastructure required. Reinstatement planning would have to be done with the future needs of Christchurch in mind. It would also need to be integrated with the proposed recovery plans to be prepared by CERA.

The programme is planned to be completed by December 2016, although this could be subject to further review.

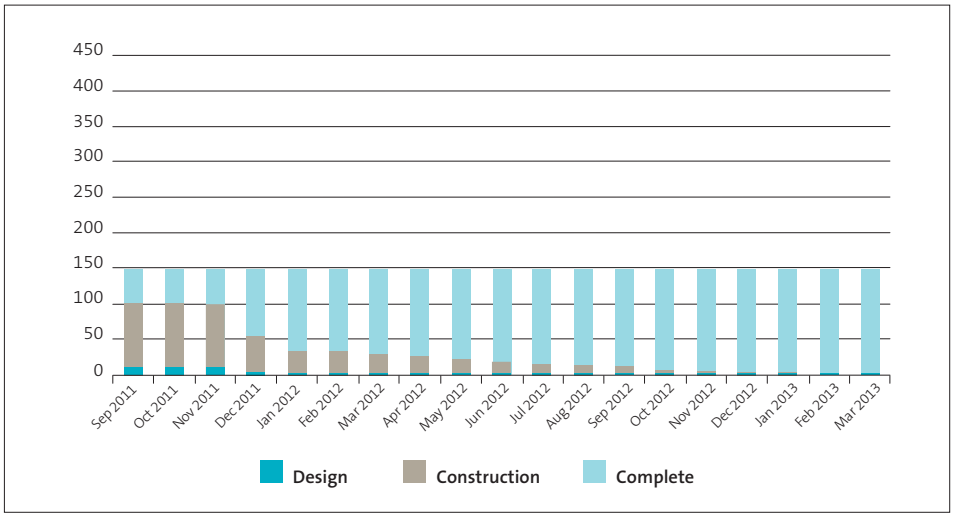
Transition from IRMO to SCIRT

We note that, although SCIRT has been in existence since September 2011, for much of its life SCIRT has been working on projects started under IRMO. For example, more than half of the projects in construction during March 2013 were likely to have originated under IRMO. These projects are generally much smaller than SCIRT-defined projects and are lacking some of the features produced for SCIRT projects, such as a target cost.

Once SCIRT had been established, a transition plan governed the transition of existing projects from the IRMO mode of operation to the SCIRT mode of operation. SCIRT took over 148 projects from IRMO that were advanced enough to be defined as IRMO projects, and another 125 projects that were redefined as standard SCIRT projects. By April 2013, construction of all pure IRMO projects had been completed (see Figure 13).

20 The McConnell Dowell and Fletcher joint venture separated for the purposes of the Alliance.

Figure 13
Number of IRMO projects in various stages of construction



Source: SCIRT.

Most of the projects redefined as SCIRT projects had been carried over from IRMO in the design phase. By April 2013, a small number of these had completed construction. New projects since September 2011 are following the SCIRT delivery model from conception to completion. By April 2013, a small number of these were reaching completion and were being handed over.

As time passes, the number of IRMO residual projects will decrease to nothing, and the proportion of work carried out on pure SCIRT projects will increase.

Appendix 2
The non-owner participants

Downer New Zealand Limited

Downer New Zealand Limited is a large engineering and construction company. It traces its origins back to the formation of the Public Works Department in 1870. Downer is a major provider of engineering and infrastructure management services to central and local government.

Fulton Hogan Limited

Fulton Hogan Limited was founded in Dunedin in 1933 by Julius Fulton and Robert Hogan. It has grown from a small civil contractor to a major construction company, operating throughout New Zealand, Australia, and the South Pacific.

McConnell Dowell Constructors Limited

McConnell Dowell Constructors Limited was founded in New Zealand in 1961 by New Zealand engineers Malcolm McConnell and Jim Dowell, and expanded to overseas offices from 1971. The company delivers projects worldwide in building, infrastructure, and resource extraction industries.

Fletcher Construction Company Limited

Fletcher Construction Company Limited was originally formed in 1909 in Dunedin by James Fletcher. The company expanded throughout New Zealand and now operates internationally. It is a major contributor to infrastructure construction.

City Care Limited

City Care Limited is a council-controlled trading organisation, fully owned by Christchurch City Holdings Limited.[21] Established in 1999, City Care provides infrastructure services to about 15 other councils as well as Christchurch City Council. It is a major provider of infrastructure maintenance.

21 Christchurch City Holdings Limited is the commercial and investment arm of Christchurch City Council.

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Other publications issued by the Auditor-General recently have been:

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- Using the United Nations' Madrid indicators to better understand our ageing population
- Annual Report 2012/13
- Using development contributions and financial contributions to fund local authorities' growth-related assets
- Commentary on *Affording Our Future: Statement on New Zealand's Long-term Fiscal Position*
- Annual Plan 2013/14
- Learning from public entities' use of social media
- Inquiry into Mayor Aldo Miccio's management of his role as mayor and his private business interests
- Managing public assets
- Insuring public assets
- Evolving approach to combating child obesity
- Public sector financial sustainability
- Education for Māori: Implementing *Ka Hikitia – Managing for Success*
- Statement of Intent 2013–2016
- Central government: Results of the 2011/12 audits
- Health sector: Results of the 2011/12 audits
- Transport sector: Results of the 2011/12 audits
- Local government: Results of the 2011/12 audits
- Crown Research Institutes: Results of the 2011/12 audits

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