Christchurch City Council

Facilities and Infrastructure Rebuild Group

Land Drainage Recovery Programme

Summary Report

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Contents

Section 1. Introduction

The Canterbury earthquakes increased flood risk in some parts of the city by changing the topography and damaging land drainage infrastructure. The Land Drainage Recovery Programme (LDRP) was established by Council in 2012 to understand the consequences of the earthquakes on the land drainage network within the city limits. In addition to the immense physical damage, the health and social impacts on communities has been severe. Therefore, the LDRP will also help to restore community resiliency and wellbeing.

1.1 Land Drainage Network

The land drainage system in Christchurch consists of rivers and tributaries, utility waterways (lined and unlined drains), and stormwater pipe networks (Table 1).

Table 1 Summary of land drainage network

Feature	Approximate length (km)
Rivers	79 km
Tributaries	160 km
Utilities waterways (lined and unlined drains)	130 km
Stormwater pipe network	790 km

1.2 Damage to the Network

The LDRP sets out to deliver projects to:

- Repair damage to waterways and land drainage infrastructure; and
- Reinstate pre-quake levels of flood risk.

Damage to the network has taken a number of different forms:

- *Direct damage to waterways:* bed heave, bank slumping, subsidence, silting of bed and vegetation decline.
- *Direct damage to structures:* damaged bridges, retaining structure, concrete lined channel cracking, tilting of outfall structures, and wall failure of timber lined drains. Some of this damage is being addressed by the SCIRT work programme, but not all.
- *Change in flood risk*: land damage, tectonic shift and changing stream bed slopes have increased flood risk to properties and houses. Physical works to address change in flood risk include network capacity upgrades, which are typically far more expensive than direct damage repairs.

Damage is widespread across the city but more extensive in the Eastern suburbs. The land drainage recovery programme includes work packages across many parts of the city (Appendix C).

1.3 Land Drainage Recovery

1.3.1 Goal

The goal of the recovery is to understand the consequences of the earthquakes on the land drainage network of rivers, streams, overland flow paths and major structures. Some of these consequences may mean that repair is needed but equally adaptation and careful management may be a better option.

The network will be recovered when all identified responses are in place and flood risk has been returned to pre-earthquake levels or a new level of risk accepted. Responses range from LDRP physical works (e.g. defence measures such as stopbanks) to non-LDRP policy change, (retreat or adaptation, e.g. modification to building stock or adaptive management practices).

Adaptive management means changing existing management practices to suit the revised environment and reviewing the practices regularly to ensure they are appropriate, efficient and/or accurate. Examples include: revising floor level requirements to address change in flood risk, changing weed harvesting frequency to manage increased low flow water levels or preparing for rainfall events by developing management plans.

1.3.2 Objectives

- To implement a prioritised programme of investigations and physical works to repair damage and restore flood risk; and
- Use a benefit/cost analysis and risk based approach to determine an appropriate response being either: physical works, retreat, adaptation or adaptive management.

1.4 LDRP Working Group

Councillors' objectives for the LDRP are informed and guided by the LDRP Working Group. This is a sub group of the Infrastructure Transport and Environment (ITE) Committee and comprises three Councillors including the Chair of ITE.

This group is not a decision making body but is a forum to update on programme and projects, seek councillor feedback and guidance, provide information and discussion on any land drainage or flood hazard issue from all parts of the business including Strategy and Planning, and Operations.

The Working Group have helped guide and support work with Community Boards and resident and stakeholder engagement.

This group is helping guide and develop plans to respond to flooding, both pre and post quakes and into future climate change and natural hazard environments.

Their aspirations are to return the city to pre-quake levels of flood risk, with priorities given to the Eastern suburbs, and to consider opportunities for 'enhancement' where appropriate. The Working Group wish to be well informed and to ensure that residents are also aware of the

developing programme of works. They are becoming increasingly aware of the complexities and inter-relationships in developing infrastructure and policy responses. They have been very supportive of the programme and projects to date.

1.5 Funding

A three-year programme has been discussed for funding of the LDRP in Council's LTP. The approved budget for first three years of spend in programme currently totals approximately $170 million (Table 2).

Table 2 LTP approved budget

Budget type	FY16	FY17	FY18
Investigations (OPEX)	$7.5M	$7.5M	$7.5M
Physical works (CAPEX)	$43.1M	$53.7M	$49.4M

In the LTP 10-year horizon, approximately $315 million is identified for investigations and physical works. To complete the full LDRP programme (Appendix B – LDRP Physical Works Scenario 4a) would require spend over greater than 30 years and total over $1.2 billion. In either of these situations if funding is not agreed then the Programme Control Group will need to decide whether to seek an increase in the programme budget or extend timeframes

1.6 Purpose of this summary report

The purpose of this summary report is inform key stakeholders of the current status of the LDRP. The projects that form this programme of works are divided into two streams; "investigations" projects, and "physical works" projects. This report will provide in some detail information on the current scope, priorities, programme, budget, and risks of the programme.

The programme has and will continue to operate in part reactively due to the changing nature of the rebuild and recovery effort. The scope of the projects, programme and costs will have to be reviewed regularly. An updated summary report is required on a regular basis to identify and inform on important changes to the programme. The scope of the projects and the budget cost estimates have been based upon the latest understanding of the recovery effort.

Section 2. Business Need

2.1 Social and Health Impacts

Since the earthquakes there have been a number of flood events. These flooding events have impacted on people's health and wellbeing, their ability to cope with uncertainty and change, and their ability to cope financially. The Mayoral Flood Taskforce in 2014 investigated the social and health impacts in the worst affected areas of Christchurch with the most vulnerable people and houses.

The Taskforce identified a number of key social impacts from frequent flooding:

- People are concerned about living in damp, mouldy houses and consider that living in warm, dry, healthy homes is a priority for physical health and for personal wellbeing;
- There is a reported increase in stress, depression, feelings of hopelessness, frustration, anger and powerlessness. These feelings are partly because of a perceived lack of coordination between the agencies, and a perceived lack of urgency and communication from the agencies. These feelings are also because of uncertainty about the future, financial worries, and living in cold, damp, unhealthy homes;
- Wastewater contamination of floodwater can put public health at risk and potentially jeopardise untreated potable water supply especially where wells or pump stations are in flood prone areas. Stress on the wastewater network from flooding can result in uncontrolled overflows, contamination of people's homes and properties (directly from the wastewater network or from contaminated floodwater), risk of illness and disease associated with contact with wastewater and repeated clean up costs;
- Financial concerns including increased insurance excess, loss of equity in homes, insurance money running out, increased financial obligations such as having to service a mortgage and pay rent, increased electricity and heating costs, impacts on businesses (loss of revenue) and forced annual leave or leave without pay;
- People are concerned about the potential loss of community and/or fragmented communities and a loss of amenities;
- Uncertainty with timing of house repairs; and
- The time it may take to remedy or reduce flooding and uncertainty of what to do in the meantime.

In time if flooding issues, particularly regular flooding, are not addressed then social degradation can occur. Houses can lose value, abandonment can occur, crime can increase and this directly impacts on the fabric of the local community and the wider community. Confidence in the Christchurch rebuild could be undermined if this were to occur.

2.2 Economic Impacts

In addition to the social and health impacts there are direct and indirect impacts from the increase in flooding resulting from the earthquakes:

- *Direct impacts:* damage to houses, business and infrastructure, clean up costs and flood management activities; and
- *Indirect impacts:* reduced economic activity, inefficiency in transport network, increased insurance costs, stress on the public health system, delays in access for emergency response vehicles, social degradation from repeated flooding.

Historically land drainage infrastructure projects do not have 'positive' benefit cost ratios due to the intermittent nature of flooding. However they are often progressed based upon significant social impacts.

Building and accessway flooding

Section 3. Guiding Principles

The LDRP uses guiding principles are used to establish which response, if any, is appropriate. These principles are focused on:

- Demonstrating earthquake effect
- Achieving significant social benefit
- Adherence to long term planning ('no regrets') and Council's six values[1] approach
- Levels of service

An engineering risk based approach will be applied to the selection of projects to proceed into the later stages of design and construction.

Capital works will proceed prior to the completion of investigations across the entire city. Decisions on adaptive management and 'do nothing' need to be justified and relate to the guiding principles.

3.1 Earthquake Effect

An earthquake effect must be identified and proposed physical works must clearly demonstrate remediation of earthquake impacts. For example, in-stream works must be located in areas of direct damage or proposed increases in network capacity must be linked to restoration of pre-quake flood risk. Any direct enhancement must be clearly identified as funding of this may require re-prioritisation of other projects or a separate funding source. Indirect enhancement needs to be identified.

Earthquake damage to a pump station and bridges in Christchurch

[1] The six values are: ecology, landscape, recreation, heritage, culture, and drainage. This approach ensures that wider cultural, community and environmental values are taken into account when making decisions about surface water drainage.

3.2 Social Benefit

Any proposed responses need to provide benefit. This could include social and economic benefit, such as: reducing the frequency or severity of flooding, preventing social decline or minimising damages. Any proposal with limited or no benefit should not be progressed.

3.3 'No Regrets'

Proposed responses need to be consistent with long term planning objectives and not compromise any responses to sea level rise (SLR). In general the works will not address SLR, but where they do (e.g. due to cost efficiencies in future-proofing the works) then this portion shall be clearly identified so that a funding path can be determined. The principle is that all projects should be consistent with proposed future works and investment should not impede long term strategies. Responses should also be consistent with Council's six values approach, ensuring that cultural, community and environmental values are taken into account.

3.4 Levels of Service

The LDRP supports the Council's Long Term Plan (2015 - 2025) and underpins levels of service relating to stormwater:

Activity: Flood Protection and Control Works - Flood Protection and Control Works

- Level of Service: 14.1.5: Implement Land Drainage Recovery Programme works to reduce flooding
  - 2016/17 target: Complete construction of Flockton/Dudley Creek scheme
  - 2016/17 target: Start construction of Heathcote scheme
- Level of Service: 14.1.1: Ensure dwellings are safe from flooding during extreme rain events
  - 2016/17 target: Additional 30% reduction on 2014 'above floor' number of dwellings flooded in a 1 in 50 year event

LDRP project options are being developed to achieve suitable repair and remediation to reduce flooding. Enhancement is not a stated objective but is included in investigations to inform Council and possible future work programmes.

Work is being done under the LDRP to better inform future levels of service as there is room for improvement. This may include better definition around above floor, below floor, property flooding, street flooding, residential versus commercial, return interval risk e.g. 1 in 50 years, 1 in 10 years, etc. It is proposed that a report for decision be taken to Council by mid-2016 once the City Wide Stormwater Model etc. has provided better data for consideration.

Section 4. Investigations & early works projects

The investigations / early work sub-programme has two key objectives:

- *To inform the physical works programme:* It provides the necessary information to allow for prioritisation and costing of high priority physical works; and
- *Deliver on high priority physical works:* The programme balances investigations against high priority physical works to minimise any lag in construction between the CAPEX sub-programme and the ongoing programme and to optimise the investigations spend.

The approach to this sub-programme has enabled flexibility between investigations and physical works so that any investigations do not precede physical works by a significant period.

A total of 107 investigation projects have been identified to date (Appendix A - LDRP Investigation Projects). These are organised into eight categories, as summarised in Table 3. Of the projects, 64% have been completed or are underway in 2015. Of the remaining, 36% are scheduled to initiate in 2016. The future of these projects will be reassessed as the programme progresses. There may also be further additions to the programme throughout its lifetime as the recovery progresses.

Table 3 Category summary - investigations as at October 2015

LDRP Programme Category	Complete[1]	Underway	2016[2]	Total
Analysis, Optioneering & Concept Design	2	4	3	**9**
Downstream Rivers	9	5	6	**20**
Lined & Unlined Drains	1	5	5	**11**
Modelling	4	2	1	**7**
Operations	2			**2**
Planning and Policy	2	2	1	**5**
Private Property & Land Drainage	1			**1**
Upstream Rivers and Tributaries	12	17	23	**52**
Total	**33**	**35**	**39**	**107**
Percentage	**64%**		**36%**	**100%**

[1] Projects have also been marked complete if they have been determined to be no longer necessary, or merged with another LDRP Project
[2] Some are on hold and may not progress in 2016

Overall the projects cover:

- A wide geographical area of Christchurch including private, public, residential and commercial areas
- A range of activities (e.g. flood hazard assessment, recreational users' policy, engineering optioneering and groundwater assessment and modelling)
- Only the land drainage network in areas affected by the earthquakes

The programme schedule has been and will continue to be driven by the highest priority projects and their precedents. The need to deliver an efficient programme has required some lower priority projects being delivered in conjunction with high priority projects, and this will continue to be the case across the remainder of the programme.

Many of the projects have been dependent on others for initiation. These have been routinely identified and re-prioritised so that those that inform the highest priority projects are scheduled to begin first. The full programme schedule is attached in Appendix D - Programme Schedule. The total duration for the programme assumes that ‘infinite’ resources are available in the market and Council’s ability to manage concurrent projects.

Section 5. Physical Works Programme

5.1 Prioritisation

Council and community expectations of the programme are high with a strong desire to see the most flood prone areas remediated as soon as possible. As such considerable efforts are going into identifying and prioritising projects and maximising savings and efficiencies at project level to enable the greatest benefits in the shortest time. There are also a number of other considerations at a programme level to factor in:

- The City Wide Stormwater Model, validated by floor level surveys etc., will better define the extent of flood risk and will inform long term sustainable decision making.
- The City Wide Economic Assessment Model will better define cost benefit assessments that do not easily consider differences between above and below floor flood risk, infrastructure versus policy responses (e.g. managed retreat), future climate change effects, etc.
- A review of Levels of Service required is proposed mid-2016.
- Strategy and Planning Group's consideration of Natural Hazards and Three Waters strategies will begin to better inform the LDRP and potentially identify areas for savings or alternative funding.
- Project investigations consider the cost benefits of a number of options and identify cost by damage, remediation, and enhancement. Enhancement would not normally be recommended for funding from LDRP, but this is still to be largely tested as project reports begin to go to Council for consideration.
- Feedback from project investigations will allow a review of the LDRP programme cost estimate assumptions from early 2016.

A prioritised physical works package has been developed based upon an engineering intervention approach of defence (Appendix B – LDRP Physical Works Scenario 4a). The budget estimate for the entire programme totals $1.227 billion (+/-40%). This does not consider affordability of the programme and if a lesser budget were to be available some projects would be left undelivered.

The projects have been categorised and prioritised in groups:

- Dudley Creek and associated works in the Shirley area;
- LDRP high priority;
- Avon River Flood Protection;
- Heathcote River Flood Protection Programme;
- Styx River Flood Protection Programme;
- Estuary and Sumner Flood Protection Programme; and
- LDRP Medium/Low Priority.

The prioritisation of the groups is based upon a range of weighted, qualitative and quantitative criteria:

- Flood risk and effects;
- Cost benefit;
- Alignment with long-term planning objectives, other programmes (SCIRT, CERA, LTP), projects etc; and
- Five values (non-drainage values i.e. ecology, landscape, recreation, heritage, culture).

There are a range of defence measures included in the programme, such as:

- Stopbanks;
- Pump stations;
- Channel modifications, e.g. widening, regarding, bank trimming;
- Storage; and
- Property level defences e.g. house raising.

Dudley Creek and associated works in Shirley

The Dudley Creek project area is one of the areas worst affected by post-earthquake flooding. The Flockton Street area has 70 per cent of the city's homes with repeated flooding above the floor since the quakes. The Council approved works currently underway will reduce the number of homes likely to flood above the floor from 91 to 10. In a one in 10 year storm event the number of floor levels at risk reduces from 55 to three. Overall, the work will reduce flooding depth for at least 585 properties. This option will effectively return most of the catchment to the same level of flood risk, or slightly better, than before the earthquakes. The project group also includes a number of other works requested by Council and necessary to reduce flood risk in peripheral areas and these complement the main scheme.

LDRP High Priority

The LDRP High Priority programme includes those projects which were ranked as very high or high priority based on a qualitative and quantitative assessment of flood risk to residents' homes, alignment with policies and other programmes, and ability to improve non-drainage values (e.g. environmental, community health & wellbeing, etc.). The programme targets the areas outside of Dudley Creek catchment and the main rivers. Over 1,600 properties identified by the Earthquake Commission (EQC) as having Increased Flood Vulnerability (IFV) are included in the extent of the works in this programme.

Avon River Flood Protection Programme

The effect of damage to land and infrastructure alongside the Avon River has been to increase the severity of flooding to existing flood prone land as well as to expose new areas to the risk of inundation. There have also been effects on land zoning, existing flood mitigation infrastructure, stormwater systems, critical roads as well as other services. The Avon River Flood Protection

Programme (FPP) may consist of stopbanks, pumping and other measures to restore flood risk to pre-earthquake levels, although given the interaction with the Residential Red Zone (RRZ) this will be in discussion with CERA.

Over 1,100 properties identified by EQC as having Increased Flood Vulnerability (IFV) are included in the extent of the works in this programme.

Heathcote River Flood Protection Programme

The effect of damage to land and infrastructure alongside the Heathcote River has been to increase the severity of flooding to existing flood prone land, mostly within the flood plain defined by the river terraces. Some new areas are now exposed to the risk of inundation. There have also been effects on existing flood mitigation infrastructure, stormwater systems, critical roads, wastewater overflows, as well as other services. Properties adjacent to the Heathcote River were noted by the Mayoral Flood Taskforce (May 2014) as being the second most significant cluster of post-earthquake flooding after the Dudley Creek catchment, and Councillors and Community Boards frequently express their concerns about this. The Heathcote River FPP may consist of upper catchment storage, stopbanks, pumping stations, house raising, and/or other measures to restore flood risk to pre-earthquake levels. Over 1,300 properties identified by EQC as having Increased Flood Vulnerability (IFV) are included in the extent of the works in this programme.

Styx River Flood Protection Programme

The Styx catchment is largely rural but also includes significant urban areas of Christchurch and Belfast and some commercial and industrial areas. The programme includes the main Styx River and tidal flood protection project and two smaller schemes. The main flood protection works may include stopbanks and flood walls, ring banking of some isolated areas, and backflow prevention. The Styx River FPP area of benefit contains no properties identified by EQC as having IFV outside of the RRZ. It is also noted that this area will be severely affected by future sea level rise.

Estuary and Sumner Flood Protection Programme

The Estuary and Sumner FPP includes Southshore, Redcliffs and parts of Sumner. Flooding of the Estuary is driven by extreme tide events. The options proposed for protection include stopbanks, floodwalls, new pumpstations and new and repaired pipework to restore the

stormwater and drainage network. A tidal barrier pre-feasibility study covered this area but has recently been dismissed from further investigation by Council. Over 100 properties identified by EQC as having Increased Flood Vulnerability (IFV) are included in the extent of the works in this programme.

LDRP Medium/Low Priority

The LDRP Medium and Low Priority Programme includes those projects which were ranked as having medium-low priority based on a qualitative and quantitative assessment of flood risk, alignment with policies and other programmes, and ability to improve non-drainage values (e.g. environmental). These are areas where flood risk is known or suspected to have increased as a result of the earthquakes, but were ranked lower. Medium priority projects areas include over 350 properties identified by EQC as having IFV. Low priority projects areas include over 200 properties identified by EQC as being IFV.

5.2 Next Three Years

A number of projects, identified through the prioritisation process, are budgeted across the next three year period (Table 4).

As more detailed investigations are undertaken then the priority and cost estimates of the projects will change. Some changes are already occurring and an update to the entire programme is planned for circulation and decision making by mid-2016, following the completion of the city wide modelling study and project re-prioritisation. It is likely that some of the projects identified within the list provided below will be re-prioritised and other projects may progress in advance of those currently identified. Balancing physical works programmes also requires changes to the identified capital spend for individual projects and Table 4 below is in the process of being updated.

Table 4 Capital projects for FY16-18

LDRP ID	Project	$Millions			
		2015/16	2016/17	2017/18	Total
54	Dudley Creek	21.1	26.9		48
54	Shirley Stream Culvert	1.5			1.5
54	Dudley Creek Extensions (Francis Ave and St. Albans Creek)		3.5	1	4.5
39	Mairehau Drain, Lower Avon		1		1
54	Thames Street Pipeline Upgrade			1	1
44	Integrated City Wide Modelling	1.3			1.3
504	Stormwater Infrastructure Economic Model	0.4			0.4
501	Knights Drain Desired Profile	5	6	4	15
501	Bells Creek Desired Profile	5	7	8	20
501	City Outfall Drain	4	5	3.3	12.3
501	Britten's Drain, Lower Avon	1.5	1.8		3.3
501	Estuary Drain	2.5	2	1.5	6
502	Matuku Waterway	1.4			1.4
505	Sumner Waterways	1	3	2	6
503	Cranford Basin Active Management	1.3			1.3
506	Dudley Creek Tributaries (Shirley Stream, St. Albans Creek, Bings Drain)	3	2		5
507	Interim Stopbank Strengthening*	5	5	5	15
508	LDRP 508 - Lower Avon Stopbanks Preliminary Design	0.9	1.3		2.2
TBA	Waiarapa and Wai-iti Streams*		0.5	26	23.5
TBA	Wairarapapa Tributaries (Cross and Taylor Streams)			1.7	1.7
TBA	Upper Avon, Ilam Stream and Okeover Stream*			3.7	3.7
TBA	Upper Heathcote Storage		3	5	8
TBA	No. 1 Drain		1	1	2
TBA	PS205 Canal and PS Reinstatement		2	2	4
	TOTAL	**54.9**	**70**	**64.2**	**189.1**

*Budget extends beyond three years

Section 6. Ongoing Programme

Following the three year programme an ongoing programme will be required to deliver on the goal of the LDRP. The current ten year programme (in the draft Long Term Plan (LTP) including the first three years) totals approximately $315 million. If a budget allocation of approximately $20 million per annum was provided for the subsequent 20 years then the total budget is approximately $700 million (Figure 2). This assumes that the lowest priority projects will be delivered after the 30 year programme or remain undelivered.

The physical works current identified in Table are prioritised based upon current understanding. Ongoing funding would enable delivery of the full list of projects in the specified order as per Appendix B – LDRP Physical Works Scenario 4a.

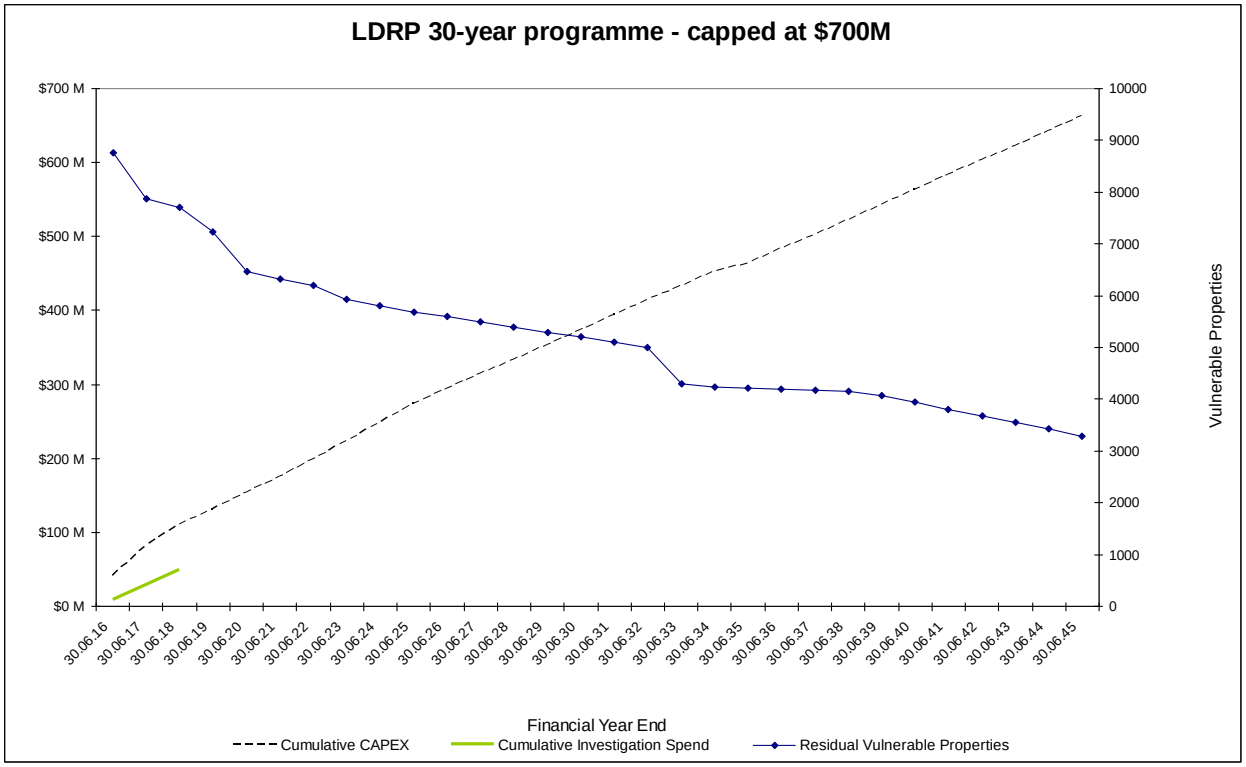


Figure 2 Ongoing Programme

Section 7. Uncertainty and Risks

The programme will operate in part reactively due to the changing nature of the rebuild and recovery effort but in general will have a structured approach as set out in the programme. The scope of the projects, programme and costs will have to be reviewed regularly to adapt to this.

The scope of the projects and the budget cost estimates have been based upon the latest understanding of the recovery effort (assessments based upon EQC IFV, hydraulic modelling of the main river stems, pre-feasibility assessments and catchment investigations). There is a range in confidence in the proposed physical works programme arising from:

- *Variation in investigations progress:* For example, the Dudley Creek investigations have progressed further than Bell's Creek;
- *Alternative responses:* The current physical works programme is based upon an engineering intervention approach (i.e. defend). The other responses (adapt, retreat) could give rise to changes in the proposed work or cost estimates. The policy and investigations work to support the optimal response strategy is ongoing; and
- *Ongoing review:* The proposed physical works programme is currently under review. Preliminary findings will be reported back in mid-2016. This may update the cost estimates and scope of the physical works packages.

7.1 Risk management

The programme risk register is the key management tool for programme-level risks. Risk identification covers all aspects of the programme throughout its lifecycle, including budget, procurement, programme administration, health and safety, and environmental.

Key risks to the programme include:

- *Power to implement:* Timeframes not being achievable, RMA processes cause increased time and cost or existing powers not available
- *Land requirement:* Unable to get agreement with land owners, land acquisitions not viable estimated cost not realistic. May need to forcibly acquire land
- *Resource availability:* Lack of in-house resources, or loss of resources, results in slower than expected programme delivery

7.2 Assumptions

There are some basic assumptions made in the development of the programme budget estimates:

- *Budget:* For the budget it is assumed that the projects will be delivered by external consultants. The project budget estimates have been priced at current market rates.
- *Contingency:* A uniform contingency of 40% has been applied to the budget estimates for projects still to be initiated. This has not been varied according to the individual project risk profiles but will be addressed at the project charter development stage.

- *Programme:* The timing of programme assumes unconstrained resources in the external market. This may be unrealistic as the market is near saturation point.
- *Reactive Projects*: As has happened to date, further new projects may be required and priorities of existing projects may be altered during the course of the remainder of the programme

Section 8. Conclusions

The earthquakes significantly altered the performance of the land drainage network. Direct damage to waterways and structures has combined with land damage to significantly alter flood risk across much of Christchurch. Up to 9,000 properties have been identified as having increased flooding vulnerability due to the earthquake, with many of those at increased risk of floor level flooding.

Remediation of these impacts will be costly and will require an ongoing commitment to funding. The LDRP has developed a physical works remediation programme totalling over $1.2 billion. The programme will continue to develop with time as further investigations are completed, reviews undertaken and policies developed on alternative responses.

This programme will continue to develop alongside the proposed changes to the district plan, the resilient city framework and other policy initiatives to ensure an integrated approach to risk reduction and flood management.

The first three years of the programme currently totals approximately $150 million. Approximately $315 million is identified in total over the ten year LTP timeframe for investigations and physical works. Ongoing funding is required to deliver on the remainder of the programme.

Appendix A - LDRP Investigation Projects

Project Identifier	Project Name	Status
LDRP 1	Modifying Land Drainage Maintenance Contracts for Earthquake Effects	Complete
LDRP 2	Temporary Stopbank Management - Short to Medium Term	Underway
LDRP 3	Downstream Rivers: Bank Treatment	2016
LDRP 4	Accommodating Recreational Needs	2016
LDRP 5	Detailed Design of the Desired Profile for Major Rivers (not undertaken)	Complete
LDRP 6	Stopbank Detailed Design and Construction (not undertaken)	Complete
LDRP 7	Options and Guidelines for Outfall Structures and Open Channels	Complete
LDRP 8	Horseshoe Lake Stormwater Recovery Plan	Underway
LDRP 9	Styx River Operational Water Levels	Underway
LDRP 10	Pages Road Bridge Realignment Options	Complete
LDRP 11	Jacksons Creek Desired Profile - Lower Heathcote	Underway
LDRP 12	Steamwharf Drain - Lower Heathcote	Underway
LDRP 13	Avoca Valley Stream - Lower Heathcote	2016
LDRP 14	Couling Creek - Lower Heathcote	2016
LDRP 15	Upper Heathcote - Above Colombo Street	Underway
LDRP 16	Hayton Stream - Upper Heathcote	2016
LDRP 17	Curletts Stream - Upper Heathcote	2016
LDRP 18	Cashmere Stream and Hendersons Basin - Upper Heathcote	Underway
LDRP 19	Travis Swamp Outfalls (Late Kate Sheppard Stream and Corsers Drain)	2016
LDRP 20	Horseshoe Lake Tributaries (Snellings Drain, No. 1 Drain, No.2 Drain)	2016
LDRP 21	Shirley Stream - Lower Avon/Dudley Creek	Underway
LDRP 22	St. Albans Creek - Lower Avon/Dudley Creek	Underway
LDRP 23	Upper Avon, Ilam Stream And Okeover Stream	Underway
LDRP 24	Waimairi Stream - Upper Avon	Underway
LDRP 25	Wairarapa Tributaries (Cross And Taylor Streams)	Underway
LDRP 26	Kaputone Stream - Upper Styx	2016
LDRP 27	Upper Styx River	2016
LDRP 28	Sumner Stream & Richmond Hill Stream	Underway
LDRP 29	Bells Creek Desired Profile - Lower Heathcote	Underway
LDRP 30	Bank Stability Impacts (merged into LDRP 97)	Complete
LDRP 31	Reinstatement of Ecologically Sensitive Areas	2016
LDRP 32	Detailed Design of the Desired River Profile (not undertaken)	Complete
LDRP 33	Condition and Damage Assessment	Underway
LDRP 34	Silt Removal	2016
LDRP 35	City Outfall Drain	Underway
LDRP 36	Bings Drain - Lower Avon/Dudley Creek	Underway
LDRP 37	Knights Drain - Lower Avon	Underway
LDRP 38	Brittans Drain - Lower Avon	Underway
LDRP 39	Mairehau Drain - Lower Avon/Dudley Creek (merged into LDRP 65)	Complete
LDRP 40	Kruses Drain - Upper Styx	2016
LDRP 41	Sheppards Drain - Lower Styx	2016
LDRP 42	Wilsons Drain - Otukaikino	2016
LDRP 43	Riccarton Main Drain - Upper Avon	2016

LDRP 44	Integrated City Wide Flood and Floor Level Modelling	Underway
LDRP 45	Effects of Earthquakes on Groundwater Levels	2016
LDRP 46	Flockton Basin Rainfall Response Plan	Complete
LDRP 47	Halswell River Catchment Modelling	Underway
LDRP 48	Overland Flow Path Modifications	2016
LDRP 49	SCIRT Modelling Integration (merged LDRP 44)	Complete
LDRP 50	Post-earthquake Filling of Land	Underway
LDRP 51	Network Performance Against City Plan/By-Law Rules	2016
LDRP 52	Floor Levels and Building Platform Filling Policy	Complete
LDRP 53	Cashmere Brook - Upper Heathcote (merged into LDRP 15)	Complete
LDRP 54	Dudley Creek Value Engineering	Complete
LDRP 55	Private Property & Land Drainage	Complete
LDRP 56	Assessment of Filling Building Platforms	Complete
LDRP 57	Port Hills	Complete
LDRP 58	Bank Stability	Complete
LDRP 59	Insurers' Responses	Complete
LDRP 60	EQC Responses	Complete
LDRP 61	Stormwater Modelling	Complete
LDRP 62	Pre-Feasibility Estuary Barrage	Complete
LDRP 63	Investigation River & Tidal Flood Protection	Complete
LDRP 64	Wairarapa & Wai-Iti Streams	Underway
LDRP 65	Dudley Creek	Complete
LDRP 66	Cranford Basin Active Management	Underway
LDRP 67	LDRP Planning Review	Underway
LDRP 68	Owles Terrace - Lower Avon	2016
LDRP 69	Blake Street	2016
LDRP 70	Avondale PS's & Outfalls- Lower Avon	2016
LDRP 71	Mckenzie Ave and Tabart Street (merged into LDRP 29)	Complete
LDRP 72	Rawson Street	2016
LDRP 73	No 1 Drain (merged into LDRP 33)	Complete
LDRP 74	Estuary Drain (previously known as LDRP 55)	Underway
LDRP 75	Wainoni Road	2016
LDRP 76	Railway Drain (merged Styx Lined Drains bundled project)	Complete
LDRP 77	Grafton Street (merged into LDRP 29 Bells Creek)	Complete
LDRP 78	Thames St Pipeline Upgrade (merged into LDRP 54 Dudley Creek)	Complete
LDRP 79	Knights/Nottingham	Complete
LDRP 80	Earlham Street	2016
LDRP 81	Lower Styx Road	2016
LDRP 82	Cooks/Lodges Drain	2016
LDRP 83	Woodpeckers On Mairehau Road	2016
LDRP 84	Queenspark Drive	2016
LDRP 85	Pegasus Avenue	2016
LDRP 86	Palmers Road	2016
LDRP 87	Avon Gayhurst-Barbadoes (merged into LDRP 97)	Complete
LDRP 88	Upper Heathcote Storage Options	Underway
LDRP 89	House Raising Feasibility Study	Underway

LDRP 90	Estuary Investigation River & Tidal Flood Protection	2016
LDRP 91	Sumner Near Cave Rock	Complete
LDRP 92	Styx River & Tidal Flood Protection	2016
LDRP 93	Heathcote US & DS Ensors Road (merged into LDRP 97)	Complete
LDRP 94	Tidal Barrier Impacts on Flood Defence Options - Stage 1	Complete
LDRP 95	Wet Weather Event Recording	Underway
LDRP 96	Upper Dudley Creek	Underway
LDRP 97	Downstream River & Tidal Flood Management Scenarios	2016
LDRP 98	Open Waterways Condition & Damage Assessment	Underway
LDRP 99	Avon-CBD U/S Barbadoes	Underway
LDRP 100	Matuku Waterway	Underway
LDRP 101	Heathcote Summary	2016
LDRP 102	Stormwater Pump Station Design Specification	2016
LDRP103	Floor Level Surveys	2016
LDRP 104	PS210 Catchment	2016
LDRP 105	Linwood Canal	2016
LDRP 106	Cost Models	Underway
LDRP 107	Citywide Modelling Analysis	2016

Appendix B – LDRP Physical Works Scenario 4a

Project	Cost estimate ($)~	Flooded properties benefiting***	EQC Increased Flooding Vulnerability (IFV) properties	Qualitative priority Score /100	Quantitative flood priority Score /100 ^^	Weighted priority score /100 **	Design Stage#	Cumulative Cost	Cumulative properties benefited***
1 - Dudley									
LDRP_b - Dudley Creek - Dudley Creek Option 2	$48 M	532	316	85	97	91	F	$48 M	532
2 - Temp Stopbank Management									
③*LDRP_2 - Interim stopbank strengthening ++ - Short-medium term stopbank management	$17 M	0	0	73	95	84	P	$65 M	532
3 - LDRP High Priority									
LDRP_22 - St. Albans Creek - Lower Avon/Dudley Creek - Restore pre-EQ channel capacity	$3 M	246	100	86	85	86	P	$68 M	778
①LDRP_29 - Bells Creek Desired Profile - Lower Heathcote - PS with stream and pipe upgrades	$20 M	927	592	78	90	84	IFV	$87 M	1705
LDRP_IFV_14 - Cranford Basin Active Management and Upper Dudley Creek - Maximise benefit of ponding area	$2 M	119	57	84	72	78	IFV	$89 M	1824
⑥LDRP_c - Waiarapa & Wai-iti Streams - Channel capacity upgrades and diversions	$33 M	259	198	71	84	77	IFV	$122 M	2083
LDRP_21 - Shirley Stream - Lower Avon/Dudley Creek - Restore pre-EQ channel capacity	$1 M	78	78	78	74	76	P	$123 M	2161
② LDRP_a2_sumner - Sumner (residual with barrage) - Floodwalls and stopbanks	$5 M	168	5	78	67	73	C	$129 M	2329
①LDRP_35 - City Outfall Drain - Stream widening or bypass	$12 M	325	314	63	82	72	IFV	$141 M	2654
② LDRP_28 - Sumner Main Drain - Mixture of pipe and channel upgrades	$6 M	112	5	52	56	72	P	$146 M	2766
LDRP_38 - Brittans Drain - Lower Avon - Pipe and stream drainage upgrades with PS or storage	$3 M	118	76	73	70	72	IFV	$150 M	2884
⑥LDRP_25 - Wairarapa Tributaries (Cross and Taylor Streams) - Restore pre-EQ channel capacity	$2 M	91	66	63	75	69	P	$152 M	2975
⑥LDRP_23 - Upper Avon, Ilam Stream and Okeover Stream - Floodwalls or stopbanks with PS	$6 M	251	158	54	80	67	IFV	$157 M	3226
LDRP_37 - Knights Drain - Lower Avon - Stopbank and pump to river	$7 M	66	66	71	62	67	IFV	$164 M	3292
⑤LDRP_15 - Upper Heathcote - Above Colombo Street - Localised stopbanks and PS or storage	$44 M	243	74	46	87	67	IFV	$208 M	3535
LDRP_24 - Waimairi Stream - Upper Avon - Restore pre-EQ channel capacity	$3 M	122	47	58	69	63	P	$211 M	3657
LDRP_36 - Bings Drain - Lower Avon/Dudley Creek - Restore pre-EQ channel capacity	$2 M	30	29	61	64	62	P	$213 M	3687
4 - Avon FPP									
③④*LDRP_a1a - Avon D/S Gayhurst - New stopbanks, new alignment	$210 M	1030	641	83	97	90	C	$423 M	4717
*LDRP_IFV_19 - Avondale - Stopbank and 2 PS to river	$8 M	288	288	67	79	73	IFV	$431 M	5005
④*LDRP_IFV_11 - Owles Terrace - Stopbanks and pumping	$2 M	144	48	65	59	62	IFV	$433 M	5149
④*LDRP_IFV_12 - Blake Street - PS and stormwater upgrades	$3 M	161	36	60	61	60	IFV	$436 M	5310
*LDRP_IFV_18 - Wainoni Road - New stormwater pipe network discharging to golf course	$1 M	56	24	49	44	47	IFV	$437 M	5366
④*LDRP_IFV_10 - Rawson Street - Stopbanks and pumping	$2 M	33	19	60	31	46	IFV	$439 M	5399
LDRP_a1b - Avon Gayhurst-Barbadoes - Section not protected by barrage	$31 M	86	12	49	34	42	C	$470 M	5485
LDRP_a1_CBD - Avon-CBD U/S Barbadoes - Flood walls through CBD	$66 M	62	62	32	51	41	C	$536 M	5547
④LDRP_IFV_9 - Palmers Road - Bunding and PS	$4 M	14	14	28	11	20	IFV	$540 M	5561
5 - Heathcote FPP									
*LDRP_a4L_no barrage - Lower Heathcote D/S Ensors Rd - no barrage - Stopbanks and floodwalls	$162 M	1053	798	81	93	87	C	$702 M	6614
LDRP_IFV_4 - McKenzie Ave and Tabart St - Bunding and PS	$10 M	339	339	64	77	70	IFV	$712 M	6953
*LDRP_a4U_no barrage - Heathcote U/S Ensors Rd - no barrage - Stopbanks and floodwalls	$206 M	291	210	48	92	70	C	$918 M	7244
6 - Estuary FPP									
*LDRP_a2 - Estuary Investigation River & Tidal Flood Protection - Stopbanks and floodwalls	$177 M	1264	116	78	89	83	C	$1095 M	8508
7 - LDRP Medium/Low Priority									
LDRP_18 - Cashmere Stream and Hendersons Basin - Utilise storage to maximum potential	$12 M	136	20	55	66	60	IFV	$1107 M	8644
LDRP_11 - Jacksons Creek Desired Profile - Lower Heathcote - Restore pre-EQ channel capacity	$4 M	114	114	63	54	58	P	$1110 M	8758
LDRP_IFV_15 - No 1 Drain - Widen channel through golf course	$3 M	59	59	62	46	54	P	$1113 M	8817
LDRP_IFV_17 - Rowses Road / Estuary Drain - PS with rising main at or near ground level	$6 M	101	101	52	52	52	IFV	$1119 M	8918
LDRP_IFV_3 - Railway Drain - Restore pre-EQ channel capacity	$3 M	73	7	45	49	47	IFV	$1122 M	8991
LDRP_12 - Steamwharf Drain - Lower Heathcote - Increase channel capacity to get flow to river	$1 M	21	17	57	36	47	P	$1123 M	9012
LDRP_IFV_5 - Grafton Street - PS and pipleline to Jackson Creek	$3 M	71	49	45	48	46	IFV	$1126 M	9083
LDRP_40 - Kruses Drain - Upper Styx - Restore pre-EQ channel capacity	$1 M	49	13	50	41	45	P	$1127 M	9132
⑤LDRP_53 - Cashmere Brook - Upper Heathcote - Restore pre-EQ channel capacity	$6 M	19	14	53	33	43	P	$1133 M	9151
LDRP_X1 - Thames St Pipeline Upgrade - Upgrade pipeline to maximise use of Tay St	$1 M	29	11	60	26	43	P	$1134 M	9180

Drain PS										
LDRP_13 - Avoca Valley Stream and Heathcote Valley - Lower Heathcote - Restore capacity of hill waterways	$2 M	14	7	53	30	41	P	$1136 M	9194
LDRP_19 - Travis Swamp Outfalls - Restore pre-EQ channel capacity	$1 M	26	26	38	43	40	P	$1137 M	9220
⑤LDRP_14 - Couling Creek - Lower Heathcote - Restore pre-EQ channel capacity	$1 M	17	17	52	28	40	P	$1137 M	9237
LDRP_27 - Upper Styx River - Restore pre-EQ channel capacity	$4 M	31	0	38	39	38	P	$1141 M	9268
LDRP_IFV_16 - Cooks/Lodges Drain - Upgrade pump station capacity	$4 M	41	41	50	23	36	IFV	$1145 M	9309
LDRP_IFV_7 - Queenspark Drive - Soakage and storage or local upgrades	$2 M	39	39	43	25	34	IFV	$1147 M	9348
LDRP_8 - Horseshoe Lake stormwater recovery plan - PS or outlet capacity upgrade	$1 M	63	0	51	16	34	P	$1147 M	9411
LDRP_42 - Wilsons Drain - Otukaikino - Restore pre-EQ channel capacity	$1 M	99	0	29	38	33	P	$1148 M	9510
LDRP_43 - Riccarton Main Drain - Upper Avon - Upgrade pipes and open channel	$5 M	16	16	43	20	32	P	$1153 M	9526
LDRP_26 - Kaputone Stream - Upper Styx - Restore pre-EQ channel capacity	$2 M	11	0	36	26	31	P	$1155 M	9537
LDRP_d - Knights/Nottingham - Restore pre-EQ channel capacity	$1 M	2	2	60	2	31	C	$1156 M	9539
LDRP_39 - Mairehau Drain - Lower Avon/Dudley Creek - Restore pre-EQ channel capacity	$1 M	16	1	55	5	30	P	$1157 M	9555
LDRP_20 - Horseshoe Lake Tributaries No.2 Drain - Restore pre-EQ channel capacity	$2 M	8	4	42	18	30	P	$1159 M	9563
LDRP_IFV_6 - Woodpeckers on Mairehau Road - Soakage and storage or local upgrades	$1 M	19	19	43	10	27	IFV	$1160 M	9582
LDRP_IFV_8 - Pegasus Avenue - Raising of ground levels or PS	$4 M	25	25	36	15	26	IFV	$1163 M	9607
LDRP_41 - Sheppards Drain - Lower Styx - Restore pre-EQ channel capacity	$1 M	6	0	38	8	23	P	$1164 M	9613
LDRP_17 - Curletts Stream - Upper Heathcote - Restore pre-EQ channel capacity	$1 M	20	20	30	13	22	P	$1165 M	9633
LDRP_31 - Reinstatement of ecologically sensitive areas - Allowance to improve damaged ecosystem health	$2 M	0	0	31	0	15	P	$1167 M	9633
LDRP_16 - Hayton Stream - Upper Heathcote - Restore pre-EQ channel capacity	$1 M	0	0	30	0	15	P	$1168 M	9633
8 - Styx FPP									
⑦LDRP_a3 - Styx River & Tidal Flood Protection - Protection of non-Red Zone land	$55 M	47	0	63	21	42	C	$1223 M	9680
⑦LDRP_IFV_1 - Earlham Street - Low lying area may require PS	$1 M	14	0	49	7	28	IFV	$1223 M	9694
⑦LDRP_IFV_2 - Lower Styx Road - PS to drain low lying area	$4 M	9	0	42	3	22	IFV	$1227 M	9703
Grand Total	**$1227 M**								
Lower bound of cost estimate[#]	**$744 M**								
Upper bound of cost estimate[#]	**$1721 M**								

Notes:

① Synergies exist which mean that Bells Creek and City Outfall Drain should be considered together.

② These projects should be constructed together to provide full protection

③ These projects cover the same area. LDRP 2 is to keep the temporary stopbanks functioning for the medium term (10-15 years). LDRp a1a is for permanent stopbanks covering the same area

④ Smaller projects not needed if LDRP a1a (permanent stopbanks) constructed. However, may be needed in the short term

⑤ Smaller projects on Upper Heathcote may not be needed if larger scheme implemented (LDRP 15, eg upstream storage basins)

⑥ If Wairarapa/Wai-Iti convey more flow then potential to increase flooding through Mona Vale - LDRP 23 may need to be partially implemented

⑦ If Styx river and tidal protection (LDRP a3) installed then smaller LDRP IFV 1 and 2 not needed.

*Not needed with barrage

**The weighted priority score is the average of the qualitative and quantitative priority scores

*** The 'properties benefitting' is approximate only, and relates to the property and not floor levels. In the cumulative count there is some double counting. It is intended to provide an indication of comparative flooding severity rather than a precise measure of flooded properties.

+The flooded property benefit for these projects is included in the barrage count

++ Temporary stopbank management has same benefit as LDRP_a1a (permanent stopbanks)

^^ The quantitative flood priority score is based on weightings of property counts within the areas of benefit using the following weightings: IFV-25%; 50 yr flood extent-25%; June 2013-15%; March 2014-15%; Taskforce-20%.

˜ The costs provided include investigations for each project

Abbreviations:

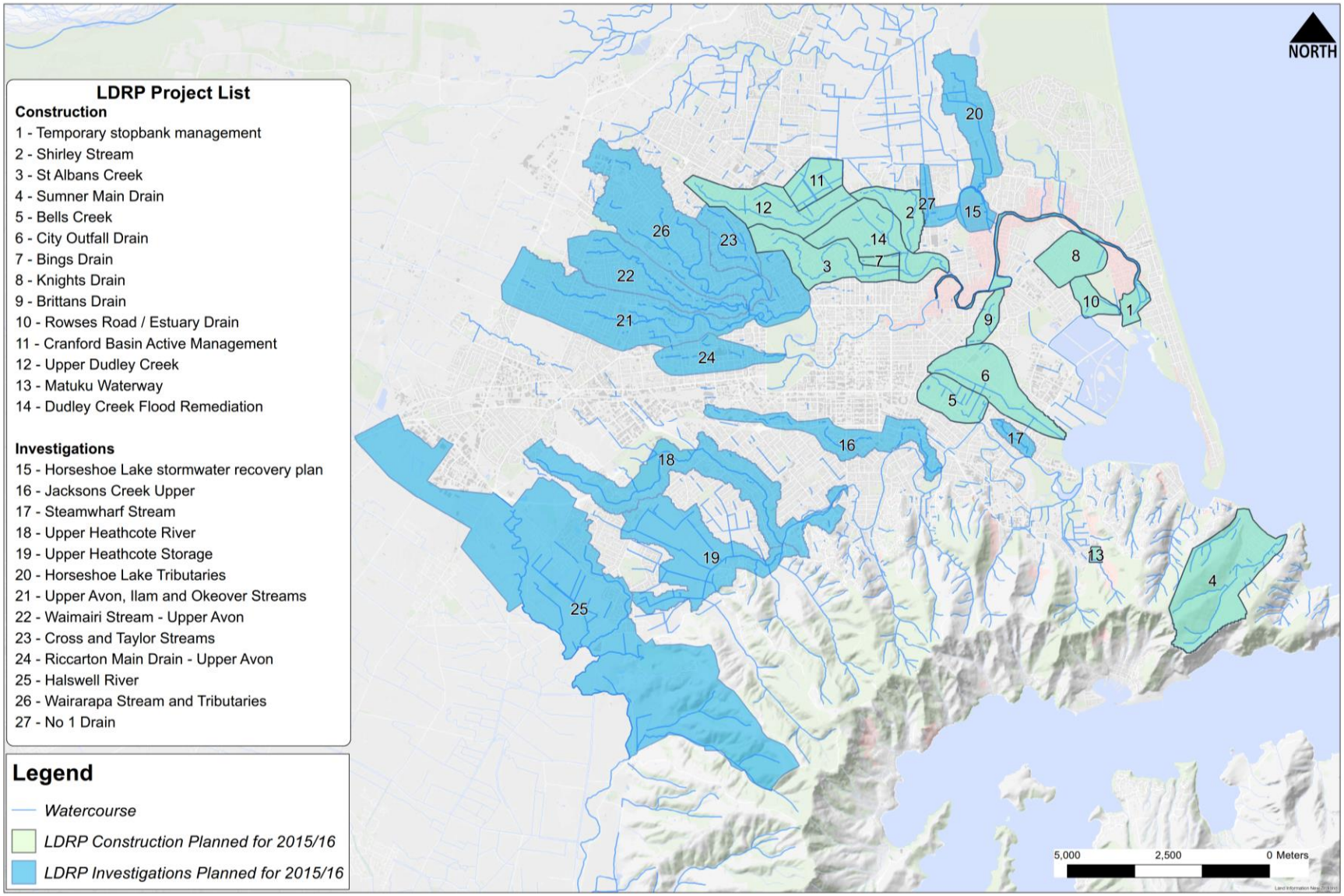
LDRP = Land Drainage Recovery Programme

FPP = Flood Protection Programme

PS = pump station

[#]**Design stage upper and lower cost certainty limits:**	**Symbol**	**Lower**	**Upper**
Concept - Locations identified, quantities calculated, costs independently reviewed. Moderate level of confidence.	C	-40%	40%
Feasibility - Concept design advanced, costs independently reviewed. High level of confidence.	F	-10%	30%
IFV workshop estimates - Workshop to identify likely scheme components. Estimates based on similar schemes. Low level of confidence.	IFV	-40%	40%
Pre-investigation - Costs based on extrapolation of similar projects. No identification of scheme components. Lowest level of confidence.	P	-50%	50%

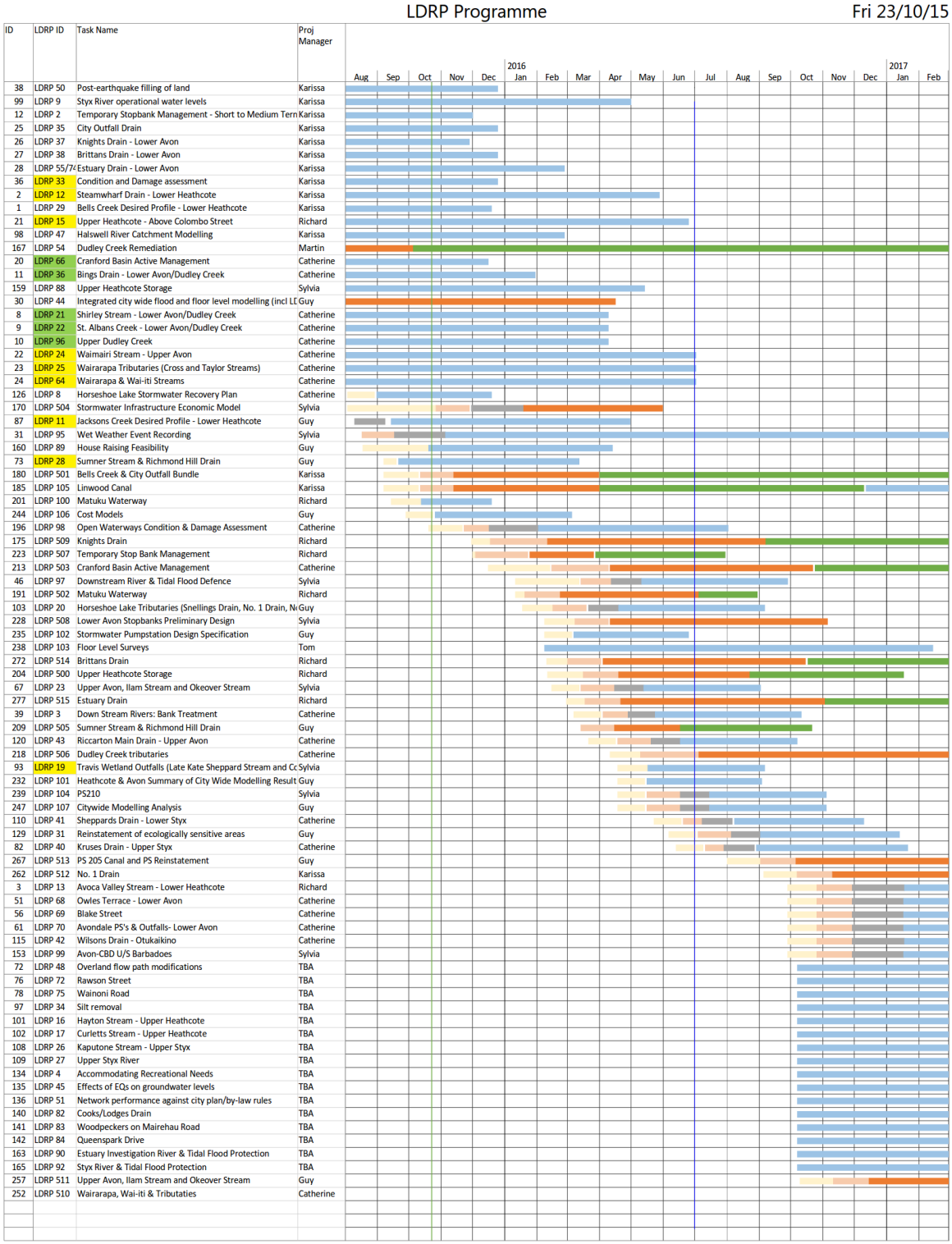
Appendix C - Map of 2015/16 Project Locations



Appendix D - Programme Schedule

LDRP Programme — Fri 23/10/15

ID	LDRP ID	Task Name	Proj Manager
38	LDRP 50	Post-earthquake filling of land	Karissa
99	LDRP 9	Styx River operational water levels	Karissa
12	LDRP 2	Temporary Stopbank Management - Short to Medium Tern	Karissa
25	LDRP 35	City Outfall Drain	Karissa
26	LDRP 37	Knights Drain - Lower Avon	Karissa
27	LDRP 38	Brittans Drain - Lower Avon	Karissa
28	LDRP 55/7	Estuary Drain - Lower Avon	Karissa
36	LDRP 33	Condition and Damage assessment	Karissa
2	LDRP 12	Steamwharf Drain - Lower Heathcote	Karissa
1	LDRP 29	Bells Creek Desired Profile - Lower Heathcote	Karissa
21	LDRP 15	Upper Heathcote - Above Colombo Street	Richard
98	LDRP 47	Halswell River Catchment Modelling	Karissa
167	LDRP 54	Dudley Creek Remediation	Martin
20	LDRP 66	Cranford Basin Active Management	Catherine
11	LDRP 36	Bings Drain - Lower Avon/Dudley Creek	Catherine
159	LDRP 88	Upper Heathcote Storage	Sylvia
30	LDRP 44	Integrated city wide flood and floor level modelling (incl LE	Guy
8	LDRP 21	Shirley Stream - Lower Avon/Dudley Creek	Catherine
9	LDRP 22	St. Albans Creek - Lower Avon/Dudley Creek	Catherine
10	LDRP 96	Upper Dudley Creek	Catherine
22	LDRP 24	Waimairi Stream - Upper Avon	Catherine
23	LDRP 25	Wairarapa Tributaries (Cross and Taylor Streams)	Catherine
24	LDRP 64	Wairarapa & Wai-iti Streams	Catherine
126	LDRP 8	Horseshoe Lake Stormwater Recovery Plan	Catherine
170	LDRP 504	Stormwater Infrastructure Economic Model	Sylvia
87	LDRP 11	Jacksons Creek Desired Profile - Lower Heathcote	Guy
31	LDRP 95	Wet Weather Event Recording	Sylvia
160	LDRP 89	House Raising Feasibility	Guy
73	LDRP 28	Sumner Stream & Richmond Hill Drain	Guy
180	LDRP 501	Bells Creek & City Outfall Bundle	Karissa
185	LDRP 105	Linwood Canal	Karissa
201	LDRP 100	Matuku Waterway	Richard
244	LDRP 106	Cost Models	Guy
196	LDRP 98	Open Waterways Condition & Damage Assessment	Catherine
175	LDRP 509	Knights Drain	Richard
223	LDRP 507	Temporary Stop Bank Management	Richard
213	LDRP 503	Cranford Basin Active Management	Catherine
46	LDRP 97	Downstream River & Tidal Flood Defence	Sylvia
191	LDRP 502	Matuku Waterway	Richard
103	LDRP 20	Horseshoe Lake Tributaries (Snellings Drain, No. 1 Drain, N	Guy
228	LDRP 508	Lower Avon Stopbanks Preliminary Design	Sylvia
235	LDRP 102	Stormwater Pumpstation Design Specification	Guy
238	LDRP 103	Floor Level Surveys	Tom
272	LDRP 514	Brittans Drain	Richard
204	LDRP 500	Upper Heathcote Storage	Richard
67	LDRP 23	Upper Avon, Ilam Stream and Okeover Stream	Sylvia
277	LDRP 515	Estuary Drain	Richard
39	LDRP 3	Down Stream Rivers: Bank Treatment	Catherine
209	LDRP 505	Sumner Stream & Richmond Hill Drain	Guy
120	LDRP 43	Riccarton Main Drain - Upper Avon	Catherine
218	LDRP 506	Dudley Creek tributaries	Catherine
93	LDRP 19	Travis Wetland Outfalls (Late Kate Sheppard Stream and Cc	Sylvia
232	LDRP 101	Heathcote & Avon Summary of City Wide Modelling Result	Guy
239	LDRP 104	PS210	Sylvia
247	LDRP 107	Citywide Modelling Analysis	Guy
110	LDRP 41	Sheppards Drain - Lower Styx	Catherine
129	LDRP 31	Reinstatement of ecologically sensitive areas	Guy
82	LDRP 40	Kruses Drain - Upper Styx	Catherine
267	LDRP 513	PS 205 Canal and PS Reinstatement	Guy
262	LDRP 512	No. 1 Drain	Karissa
3	LDRP 13	Avoca Valley Stream - Lower Heathcote	Richard
51	LDRP 68	Owles Terrace - Lower Avon	Catherine
56	LDRP 69	Blake Street	Catherine
61	LDRP 70	Avondale PS's & Outfalls- Lower Avon	Catherine
115	LDRP 42	Wilsons Drain - Otukaikino	Catherine
153	LDRP 99	Avon-CBD U/S Barbadoes	Sylvia
72	LDRP 48	Overland flow path modifications	TBA
76	LDRP 72	Rawson Street	TBA
78	LDRP 75	Wainoni Road	TBA
97	LDRP 34	Silt removal	TBA
101	LDRP 16	Hayton Stream - Upper Heathcote	TBA
102	LDRP 17	Curletts Stream - Upper Heathcote	TBA
108	LDRP 26	Kaputone Stream - Upper Styx	TBA
109	LDRP 27	Upper Styx River	TBA
134	LDRP 4	Accommodating Recreational Needs	TBA
135	LDRP 45	Effects of EQs on groundwater levels	TBA
136	LDRP 51	Network performance against city plan/by-law rules	TBA
140	LDRP 82	Cooks/Lodges Drain	TBA
141	LDRP 83	Woodpeckers on Mairehau Road	TBA
142	LDRP 84	Queenspark Drive	TBA
163	LDRP 90	Estuary Investigation River & Tidal Flood Protection	TBA
165	LDRP 92	Styx River & Tidal Flood Protection	TBA
257	LDRP 511	Upper Avon, Ilam Stream and Okeover Stream	Guy
252	LDRP 510	Wairarapa, Wai-iti & Tributaties	Catherine



FOR INTERNAL USE ONLY

Pre-tender | Tender | Evaluate/Award | Investigate | Detailed Design | Construction

Green = LDRP44 workaround in place
Yellow = No LDRP44 workaround in place

TRIM Ref: 15/598053