

CHRISTCHURCH MAYORAL FLOOD TASKFORCE

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ABSTRACT

In early 2014 Christchurch had the heaviest sequence of rainfall since the 1970s. Several large rainstorms fell in the city, saturating the ground, raising river and stream levels, and flooding homes, properties and streets. In many areas flooding was made worse by damage from the 2010-11 Canterbury earthquake sequence.

Many residents trying to recover from the earthquakes were faced with flooded and unhealthy homes. They reported increasing health problems, stress and financial challenges. Christchurch City Council set up a Mayoral Flood Taskforce with urgency on 29 April 2014 to deliver urgent, practical help with short-term flood defence measures until existing programmes to repair earthquake-damaged infrastructure, waterways and land were completed. The majority of these programmes will take several years, or longer, to implement.

The Taskforce was required to develop an assessment framework, carry out field assessments, develop solutions, and consult with the community within an extremely tight timeframe of 10 days for the initial report. The Taskforce adopted a multi-discipline, multi-consultancy/client partnership in order to achieve this.

Key lessons learnt from the Taskforce are presented in this paper. These lessons include: the importance of a clear scope for engagement; the development of rapid field data collection and survey tools through the use of mobile and web-GIS technology; the development of flood vulnerability categories; how a flexible 'toolbox' of response measures contributed to efficiencies; the importance of providing a clear decision making structure; the role of community meetings in collecting flood data and focusing on those affected; the benefits of widely collaborating with other agencies; and the transition of the Taskforce measures back into the normal mode of operation.

KEYWORDS

Flooding, stormwater management, taskforce, community engagement, flood mitigation, earthquake

PRESENTER PROFILE

Sylvia Maclaren is a Project Manager and Senior Water Resources Scientist. She was Project Manager of the Mayoral Flood Taskforce, during which time she was also Christchurch Water Section Leader at Jacobs New Zealand. After graduating from the University of Canterbury with a First Class Honours in Ecology, Sylvia has spent 9 years in the environmental science and stormwater sector.

1 INTRODUCTION

In early 2014 Christchurch had the heaviest sequence of rainfall since the 1970s. Several intense storms saturated the ground, raising river and stream levels, and flooding homes, properties and streets. In many areas flooding was made worse by damage from the 2010-11 Canterbury Earthquake Sequence. Many residents trying to recover from the earthquakes were faced with flooded and unhealthy homes. They reported increasing health problems, stress and financial challenges. They needed urgent, practical help with short-term flood defence measures.

In response to community need, Christchurch City Council Mayor Lianne Dalziel directed the establishment of a Mayoral Flood Taskforce on the 29 April 2014. The concept was based on the advice of the Transport and Greenspace Unit Manager John Mackie, whose vision was to rapidly identify the causes and find possible short-term solutions for the repeated flooding. This was to start immediately and deliver a comprehensive report to a Special Meeting of the Full Council on 12 May 2014.

Mike Gillooly, of Christchurch City Council (Council), was appointed to lead the Taskforce. He was supported by Tom Parsons (Innovate Consulting) and Sylvia Maclaren (Jacobs) in defining the Taskforce objectives, developing the approach, and engaging and managing a collaborative team of multi-discipline, multi-consultancy/client partnerships. They cherry-picked specialists from around the city, resulting in 67 contributors from 12 different organisations. Remarkably, the core members all committed to dropping existing workload to commit to the more than full-time intense turnaround.

It was quickly decided that collaboration was going to work most effectively in shared office facilities. Therefore, the team approached the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) and was granted the use of a spare portacabin for the duration. With less than 24 hours' notice the team had office space and equipment to begin work.

The Taskforce included staff from Council, SCIRT, Jacobs, Aurecon, GHD, Aecom, Opus, Innovate Consulting, MWH, Octa, Bond Construction Management, LG Consulting, City Care, and Environment Canterbury (ECan).

Upon completion of Phase 1 of the Taskforce on 12 May it was recognised that a Phase 2 team would need to continue developing and implementing the proposed measures, and to continue to report to the Council on progress. This work began on 21 May and was completed on 30 June 2014.

Table 1 summarises the key statistics from the operations of the Taskforce. Note that the many additional contributors from agencies who provided input freely are not included.

Table 1: Summary statistics from the Christchurch Mayoral Flood Taskforce

	Taskforce Phase 1	Taskforce Phase 2
Timeframes	1 May – 10 May 2014 (8 working days, including a weekend)	21 May – 30 June 2014 (29 working days)
Number of staff	15 Council, 32 consultants, six contractors, two advisors	10 Council, 55 consultants, two contractors
Effort (hours)	2,850	4,277

2 DISCUSSION

2.1 SCOPE OF ENGAGEMENT

Great care was taken to clearly articulate the Taskforce goals and objectives into a project charter so that clarity of purpose was maintained in an environment where speed was essential. The scope of the Taskforce was confirmed by a Council project governance group and progress was monitored closely to ensure that the Taskforce was meeting the intended objectives. Part of the project definition phase was to identify key priority areas.

The priority areas were based on recent observed flooding from the March 2014 event (which had been surveyed and mapped by Jacobs engineers). From this, nine priority areas were identified (Figure 1). In less urgent times, without the confounding effects of earthquakes, detailed hydraulic modelling would identify flood extents caused by design rainfall events. However this option was not available to the Taskforce.

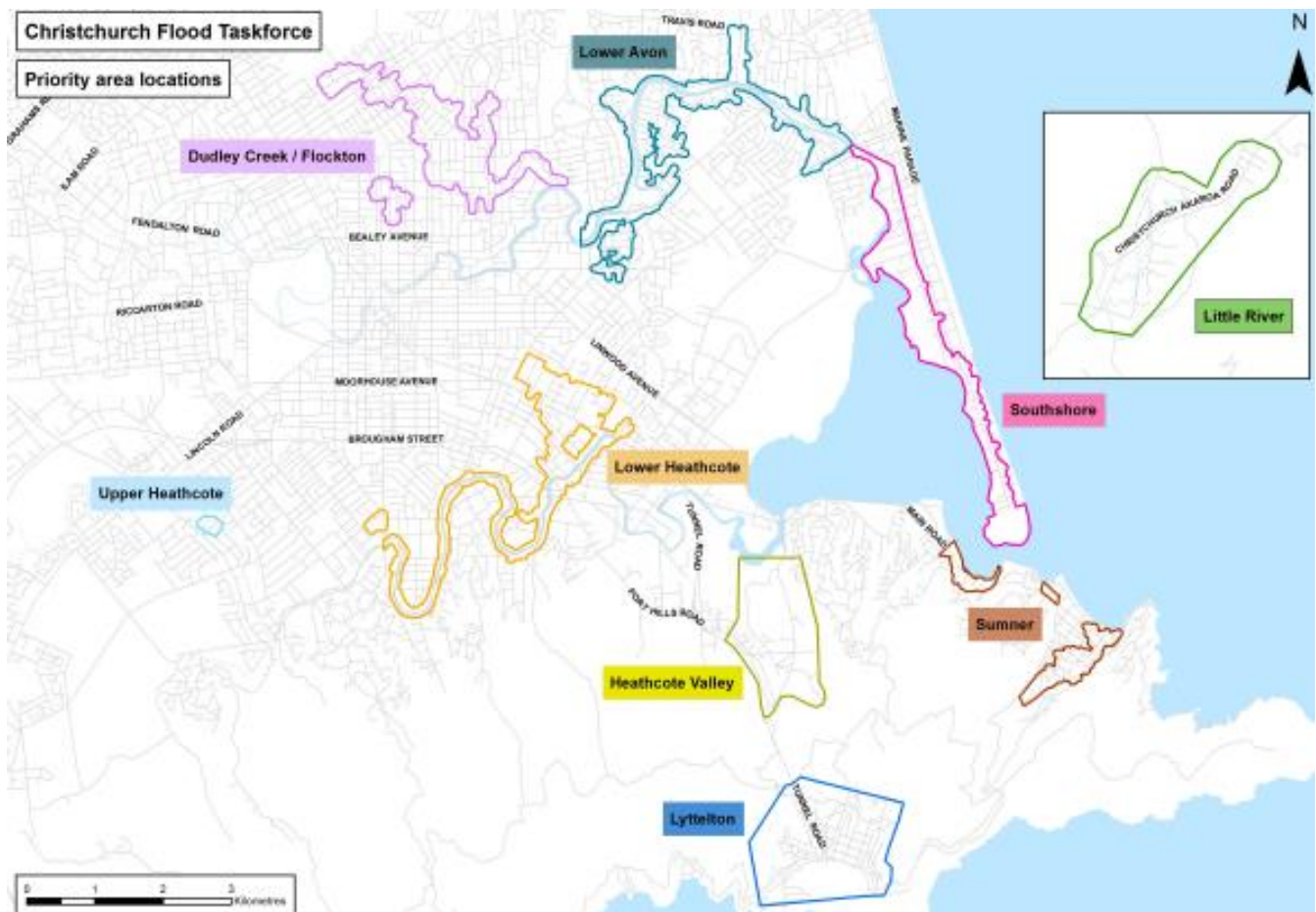


Figure 1. Priority Area Locations for Community Consultation

These priority areas were the basis for investigation and required substantial verification, during which time their boundaries changed. However, this first step was essential in providing focus and boundaries for investigations.

2.2 RAPID FIELD DATA COLLECTION

In less than a day the Opus members of the Taskforce had developed a smartphone application, so that field teams of two engineers could consistently log flood record data from across the city. The field teams were each assigned a priority area, and identified vulnerable households, quantified the effects of earthquake damage where possible,

assessed frequency of inundation above or below floor level, and designed appropriate house defence or local area schemes. Over 2,500 reports of regular post-earthquake flooding were assessed against the criteria for identifying vulnerable households.

The field teams had limited time in which to carry out the work, so engineering judgment and interpolation was necessary. This was managed by constant discussion among the Taskforce members (including Council staff) about the conclusions being drawn. Formal 'challenge sessions' were held to question and help improve all the recommended solutions.

Once collected, data was collated into a bespoke web-GIS service. This was accessible to all Taskforce members, allowing access to up-to-date information, easy sharing of spatial layers and figure production for field surveys. The knowledge gained from experienced engineers who visited a large number of areas shortly after flooding was also recorded in report format and will be invaluable when assessing long-term schemes.

One immediate problem was outliers from the priority area locations. Generally, these were caused by differential settlement between road and individual properties, or by broken private stormwater laterals. The Taskforce decided to identify these properties only, and did not propose specific remediation for them in its recommendations. The 24 properties in this category were handed back to Council to be dealt with through existing delivery mechanisms.

2.3 DEVELOPMENT OF FLOOD VULNERABILITY CATEGORIES

Vulnerability is defined in two complementary ways; the vulnerability of the house to flooding and the vulnerability of the occupants of the house. The first dimension is those houses and their properties that are prone to flood risk, while the second is determined by the occupants' ability to cope with flooding.

To identify vulnerability the Taskforce utilised the Council Call Centre to conduct a survey of residents who had been flooded. This survey was replicated by the field teams and at all community meetings and community hubs to collect as many respondents as possible. The key was the number of times an address and its access had been flooded since the earthquakes.

The reason for collecting the number of times flooded was that rainfall records indicated that one of the post-earthquake storms (that of 4-5 April 2014) was significantly larger than the Council could be reasonably expected to protect against. Therefore, if houses were flooded only in this single event, they were not counted.

The survey and field data allowed the Taskforce to assign vulnerability levels to each household as shown in Figure 2. Level One was defined as any property that had two or more instances of flooding house floors since the earthquakes. Levels Two and Three also required two or more instances of post-earthquake flooding, except that Level Two counted flooding under houses (or once above floor and one or more below floor) and Level Three flooding of access to the property. These categories were developed after initial community consultation through focus groups, which asked residents about the nature, degree and impact of flooding. The Taskforce continued this 'people focus' throughout.

The Taskforce assessed and validated a total of 2,578 properties for flooding vulnerability to arrive at the numbers in Figure 2. Because of the very short timeframes involved, at the end of the Taskforce there remained 49 properties that were not included as the results arrived too late to be fully assessed.



Figure 2. Vulnerability Level Definitions and Affected Properties

These icons were used at community meetings, and because of their ease of interpretation, Level One, Level Two and Level Three Flood Vulnerability became commonly used by Christchurch residents. Other agencies adopted them also; for instance Red Cross gave grants based on the Flood Vulnerability Category.

Although this was a communications success it also caused subsequent challenges. Data was as accurate as possible, but given the timeframes was never going to be precise. Therefore, the numbers in each vulnerability category changed on a daily basis throughout the Taskforce phases as data was collected and validated. Early releases to media and city councilors were then contradicted by subsequent verifications, causing some confusion.

Requests were also made to determine how the vulnerability levels compared with traditional means of determining flood risk, such as a percent annual exceedance probability event. This was not possible within the timeframe of the Taskforce, or with the data available at the time. Nearly one year later the return period of the March 2014 event is still being assessed and debated by experts, partly hampered by the spatial variability of the event, but also by the incomplete data available.

In addition, some residents were concerned about how being categorised could affect the capital value and future sale of their properties. In some instances, residents may have deliberately under-reported flooding, to avoid entry into a more serious flood vulnerability category or to avoid a note placed on Council property files. This would have also been compounded by any residents who were unaware of the Taskforce and the importance of reporting flooding. It is very difficult to judge the magnitude of under-reporting, and it is likely that there is a greater vulnerability within the community than the Taskforce identified. Natural variability in the spatial distribution of rain during post-earthquake storm events also meant that some areas of the city, while potentially being made more vulnerable due to earthquake effects, did not experience flooding during those events. The Taskforce did not attempt to scale or adjust the vulnerability numbers in any way for those outside the priority areas, for under-reporting or for the spatial distribution of post-earthquake storm events.

In addition, being categorised raised a certain level of expectation with residents. In some places this was justified; for instance the Red Cross grants were higher for those in Level One than Level Two. However, the categorisation was not based on Council's levels of service for flood risk. For instance, the Council does not generally protect against access

level flooding in moderate events, therefore some in Level Three expected action whereas that was not necessarily the intention.

2.4 DEVELOPMENT OF A TOOLBOX OF SOLUTIONS

The Taskforce wanted to examine as wide a range of innovative short-term flood defence solutions as possible. Any proposed solution also had to be readily available and/or constructed/delivered in a timely fashion, be cost effective and meet the community need. This involved many discussions with suppliers of products ranging from inflatable bunds to pumps to hire of temporary bridges.

Solutions were separated into three categories: house defence; local area schemes; or maintenance. These are illustrated in Figures 3 and 4 and described below.

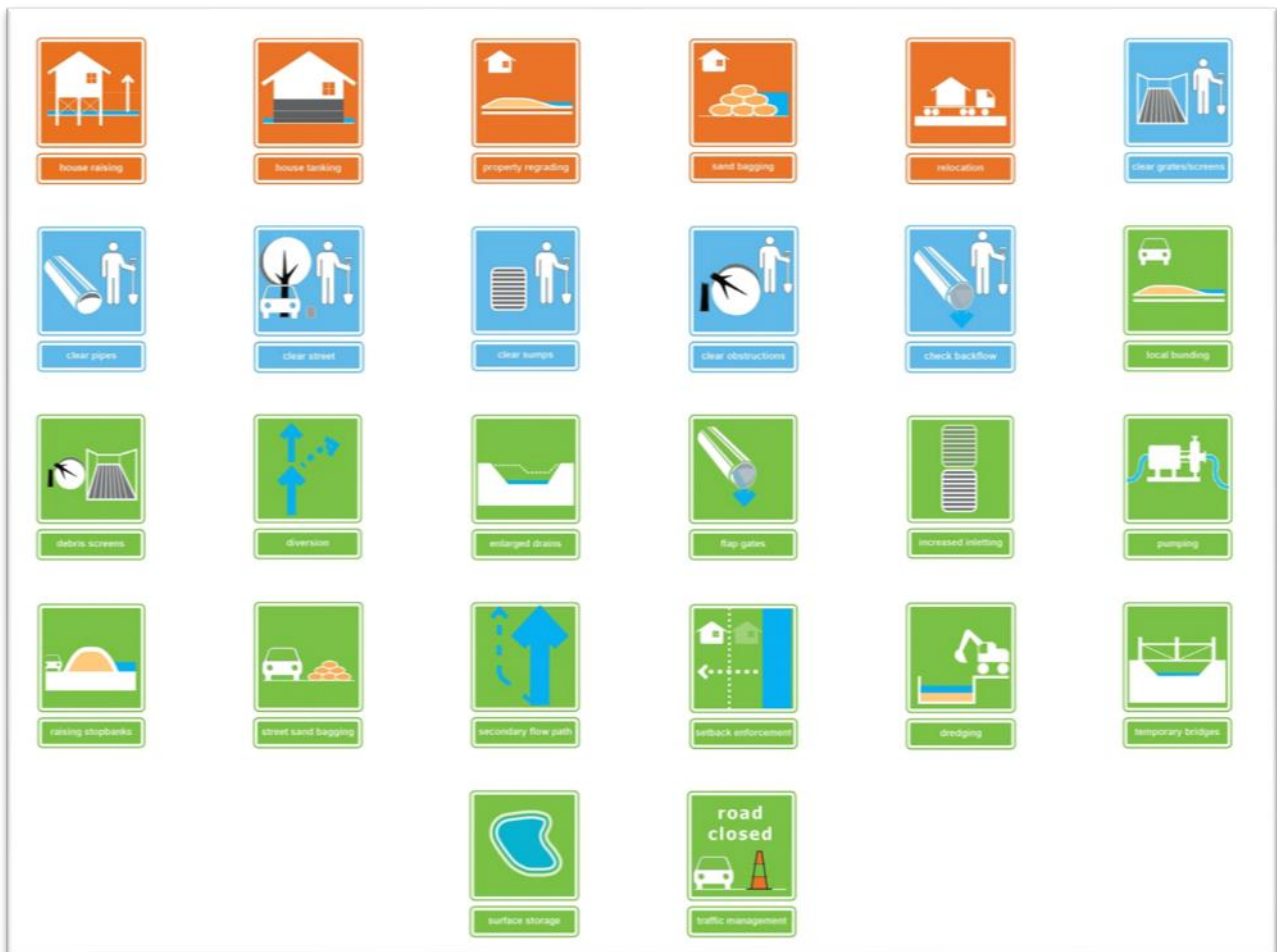


Figure 3. Icons illustrating each of the possible Local Area Schemes. Using iconography allowed visual communication as to the proposed solution for each area, assisting the understanding of the options by local residents

2.4.1 HOUSE DEFENCE

These are works constructed to protect the floor levels of individual homes. These defences could be temporary or permanent, and included raising the house (a permanent solution), tanking the house (waterproofing just above the level of frequent flooding), bunding (either raised mounds or sandbags) or property re-grading to improve drainage of floodwaters away from the house.

2.4.2 LOCAL AREA SCHEMES

These schemes provided wider benefits in terms of addressing the issues experienced by the most vulnerable houses, as well as those considered less vulnerable in the surrounding areas. These offered wider benefits through reducing the severity and frequency of flooding in surrounding areas. This would help maintain occupancy within affected areas, which is an important component of strengthening these communities and improving quality of life. Local area schemes were designed to be approximately equivalent to a 10% AEP flood protection standard. These schemes were implemented over an area to reduce the effects of flooding rather than preventing it completely. They were generally located on the street or within drainage easements to reduce land take. Actions included but were not limited to:

- Local bunding
- Diversions
- Enlarged Drains
- Dredging
- Pumping
- Raising Stopbanks
- Temporary bridges
- Traffic management

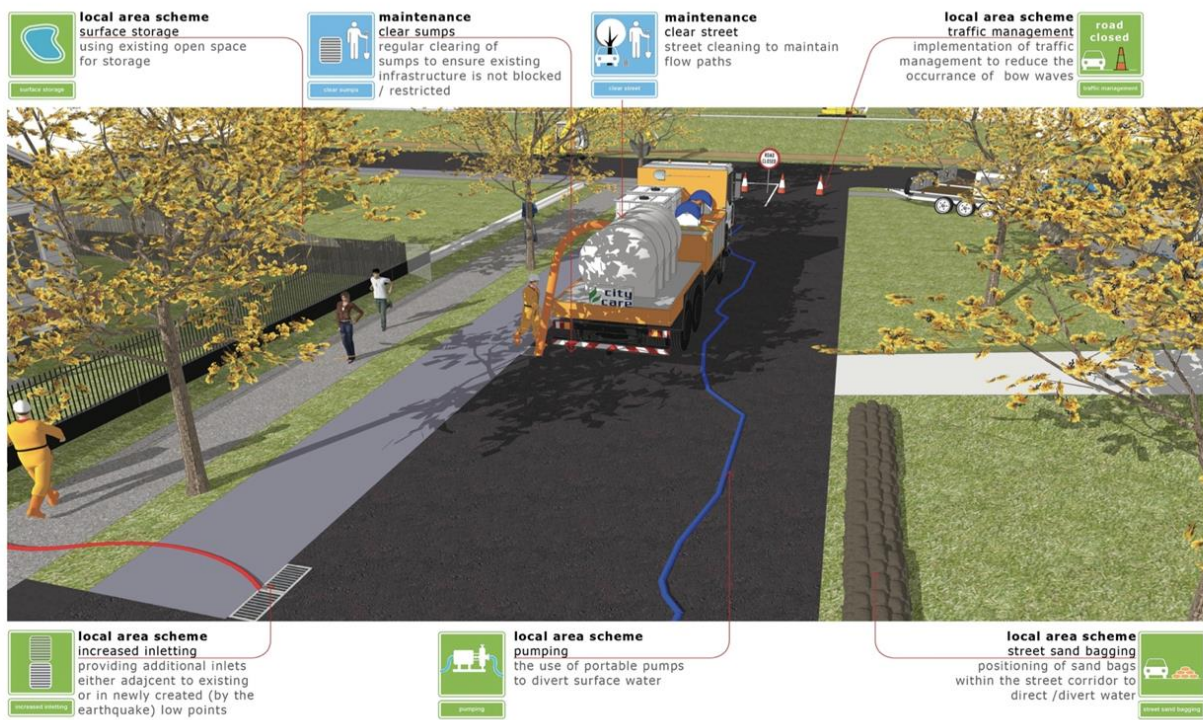


Figure 4. Illustration of various Local Area Schemes initiatives, designed to clarify these options in the public's mind. Several of these were produced for Taskforce community meetings and technical reports

2.4.3 MAINTENANCE

The Taskforce also identified where the Council's maintenance contractor could target efforts to rapidly increase stormwater network capacity. This included targeted maintenance on grates/screens, sumps, streets, pipes, removing obstructions and checking backflow. Although this was obviously already occurring prior to the Taskforce, the earthquakes had caused changes in the operational regime that had not necessarily

yet been identified and addressed. This was primarily because there had not been significant rain events since the earthquakes.

2.5 DECISION MATRIX

Having possible solutions was not the same as the policy or funds to implement them. The Taskforce was well aware of planning and fiscal constraints and the precedent that could easily be set if all affected residents were assisted. Therefore a decision matrix was developed (Figure 5) to identify the best practicable method for addressing each flooded property.

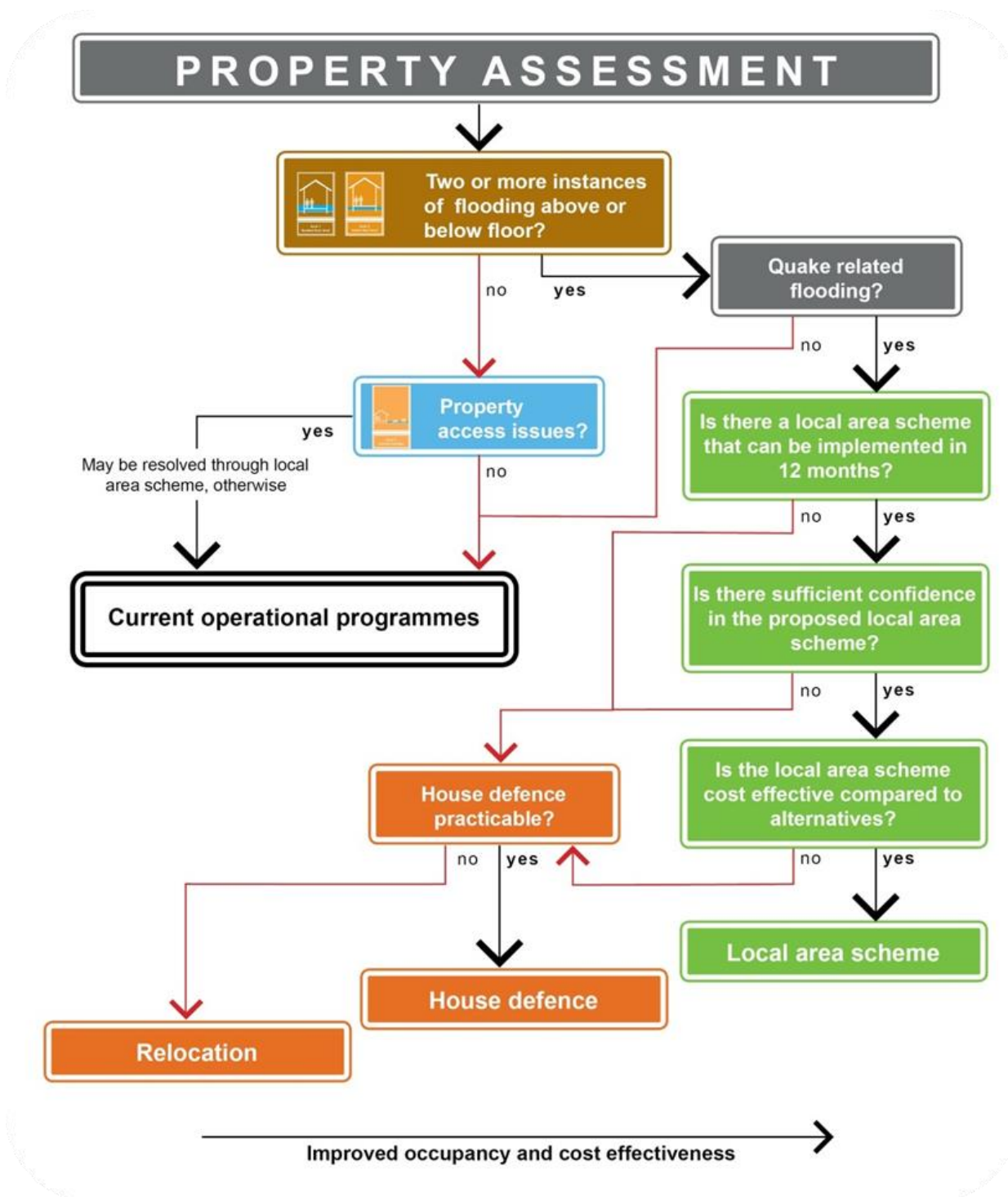


Figure 6: Decision making matrix, developed to determine which of the toolbox of solutions was the most appropriate

The decision matrix is hierarchical. Firstly, it identifies if the property is considered one of the 'most vulnerable' as per the Taskforce's charter. For this, it was determined only those vulnerability Level One and Level Two were to be addressed. Some Level Three properties would gain benefit from wider schemes, but this would be co-incidental.

Initially, the Taskforce focussed attention on Level One vulnerability properties – where flooding had been inside houses above floor level on multiple occasions. These owners were obviously vulnerable, as they had generally had to evacuate and their carpets, furnishings and walls in many cases were irreparably damaged. Many were living elsewhere as a result.

However, subsequent analysis discovered that those who had flooding under their houses on multiple occasions were in some cases no better off. In damp Christchurch conditions floodwater could remain underfloor for months, causing mildew, rot and unhealthy living conditions. Floodwaters were generally contaminated with raw sewage, so bacterial contamination of properties could cause an increase in disease. Also, combined with earthquake-caused differential settlement, some properties no longer drain so houses are now constantly damp underfloor.

The decision matrix also required that the flooding had to be earthquake related, i.e. caused or increased by the earthquakes. This was primarily to do with funding mechanisms, as there are existing planning, operations and capital programmes to manage routine (non-earthquake) land drainage issues.

The first option proposed for any Level One or Level Two properties was a local area solution. Analysis showed these were generally cheaper and easier to implement, plus benefited not just individual properties but also shared assets such as roads. However, the decision matrix also involves a review of an available local area scheme, checking that it: is achievable in what the Taskforce considered to be a reasonable timeframe of 12 months; provides reasonable confidence in successful operation; and is cost effective compared to the alternatives.

Should the answer to any of the above be no, then house defence is considered as an alternative, using the options presented above in Section 2.4.

Where none of the short-term options discussed above were practicable then short-term relocation of the household was proposed as an option. The Council's Strengthening Communities Team assessed the impacts, challenges and costs of this as part of a Social Impact Assessment.

It was recognised that a separate methodology and decision matrix for assessing vulnerability in Lyttelton (which includes slope stability issues) was required and this was developed by the second stage of the Taskforce (but is not discussed in this paper).

2.6 COMMUNITY CONSULTATION

As has been briefly mentioned above, extensive community engagement was undertaken in the areas most affected by regular post-earthquake flooding, as identified by the Taskforce (Figure 2). Community consultation involved community meetings, a survey on flooding including social effects, and door knocking in affected areas. For the most affected residents, a one-on-one meeting to discuss their situation was the preferred method of contact, and many one-on-one meetings were organised

Community meetings were run in a series around the city beginning on May 2014. There was generally one meeting held in each of the priority areas. These meetings were advertised on the Council website and there was a letter drop in the affected area. The

meetings were attended by key Council staff, engineers from the Taskforce, Council and representatives from other relevant agencies. The purpose of the meetings was to present information and answer questions about the recent flooding events, provide interim Taskforce findings and the proposed flood mitigation work. Questions and answers were recorded at each meeting and then published to the Council's website.

In addition, the Council assigned three Call Centre staff to phone residents and obtain survey information. From this combined with the above consultation, over 600 residents were talked through the survey either at the first point of contact or through a call back.

Initial findings from analysis of all community communication indicate that many of the same issues, concerns, preferences and social impacts reoccurred across the city. There were some unique geographies, community contexts or particular solutions that resulted in specific concerns. Some of the common recurring themes relating to the flooding included:

- Falling property values
- Health concerns with damp, mouldy houses
- The time it may take to remedy or reduce flooding and uncertainty of what to do in the meantime (especially with houses due to earthquake repair work)
- House and/or contents insurance money running out and financial worries

There was general agreement that a suite of measures would be needed to provide confidence in the flood mitigation solutions and the future of each area.

Overall, people's willingness to repair their homes and replace their belongings was dependent on their level of confidence that the Council and other agencies would remedy the flooding issues in their area. Further, prolonged periods of uncertainty were stressful both financially and psychologically for people.

This analysis work is ongoing and will further inform Council's and other agencies' psychosocial response to flood-affected households and prioritising the most affected areas and people.

The consultation exercise formed two-way communication with the Taskforce team and the public. Ongoing communication with residents, understanding vulnerability and focusing on the residents' needs and wellbeing was a key aspect for the entire Taskforce team.

2.7 CONSULTATION WITH OTHER AGENCIES

One of the many successes of the Taskforce was engaging with so many other agencies in the short period of operation. This was both a success in terms of general goodwill and collaboration, but also in that the Taskforce was able to build upon a vast background of established work. This meant the Taskforce was able to concentrate on finding solutions, rather than extensive research.

The information gathered by the Taskforce also assisted other parts of Council and other agencies to act. Rates relief was offered by Council to property owners whose houses have been affected by flooding. The Council also worked with the Ministry of Social Development (specifically the Earthquake Support Coordination Service), the Canterbury District Health Board, the Ministry of Education, CERA and other non-government organisations who are members of the Psychosocial Subcommittee.

One outcome of this was that the Honourable Gerry Brownlee, the Minister for Canterbury Earthquake Recovery, and Honourable Paula Bennett, Minister for Social Development announced on 25 June 2014 that Canterbury residents impacted by recent flooding will now be eligible to apply for funding through the Government's Temporary Accommodation Assistance (TAA) programme which is administered by CETAS. This was considered a significant outcome of the Taskforce's work.

2.8 TRANSITION BACK TO NORMAL OPERATIONS

The recommendation of the second phase of the Taskforce was approximately \$12.2M in maintenance and construction works. None of this had previously been included in Council budgets.

The immediate need was most strongly felt in the Dudley Creek catchment, where there were the highest number of vulnerability Level One houses. Here, a \$6.1M pump station was recommended (henceforth named PS202), and design and construction commenced immediately, with final commissioning scheduled in April 2015. Other works in the Dudley catchment included a period of aggressive channel maintenance to increase channel capacity, and the removal of two major culvert constraints. One of these was a road providing thoroughfare, so required significant individual consultation with local residents.

Other immediate works included a range of different activities:

- Stopbanking: A section of stopbank was replaced at Ebbtide Street along Southshore in the Avon-Heathcote Estuary
- Dredging: Silt removal in Trustcotts Drain in the Heathcote Valley
- Vegetation clearance: Removal of Raupo from the Heathcote River

Some projects conceived in the Taskforce were passed back into Council to go through a full planning assessment and evaluation. For instance, while temporary stopbanks along the Heathcote River would fulfill an immediate role it was considered that this had long-term implications that needed to be considered in greater depth.

Conducting work in haste did have inevitable drawbacks. In some areas, such as the lower Dudley Creek, residents did not feel they had sufficient consultation prior to commencement of works. Some departments of Council felt that in some instances (for instance the installation of the stop bank) measures had not been rigorously tested against the Council adopted 'six values' approach, which assesses drainage values alongside the other five values of ecology, heritage, recreation, landscape and culture. The new pumpstation (PS202) also took longer and final costs will exceed preliminary estimates.

However, these are the realities of working in an emergency operations environment. During the six months since the conclusion of the Taskforce, work on the vast majority of the recommendations has been completed or commenced.

3 CONCLUSIONS

The Christchurch Mayoral Flood Taskforce, established with urgency, had the goal of addressing the aftermath of not one but two natural disaster events: earthquakes and flooding. This was not a straightforward task. However, the end result was a successful inquiry into the problem, identification of solutions, and a strong community outcome focus.

The legacy of the Taskforce is ongoing. The recommendations have had tangible outcomes with new maintenance regimes adopted and local area schemes either completed or commenced. If a storm event were to occur today, greater understanding of the post-earthquake flood risk environment would result in reduction in flooded houses and properties.

Less tangible is the impact on the psychosocial aspects of the residents of Christchurch. The establishment and community focus of the Taskforce responded to the needs of residents facing unhealthy homes, financial worries and stress, and these residents were a continuous focus of the Taskforce. The consultation and feedback followed by the implementation of the recommendations illustrated the commitment of the Council to supporting those residents most in need.

Key lessons from the Taskforce were:

- Clear scoping through a well-defined charter and engaged governance enabled and focused Taskforce actions
- Utilisation of a unified technological platform enabled multidisciplinary teams to deliver efficiently
- Development of vulnerability categories allowed the Taskforce to focus on the most vulnerable and also provided a clear communication tool
- Having a defined toolbox of solutions drove uniformity in approach and enabled the team to rapidly apply conceptual solutions without getting too involved in into detailed design considerations
- Continued community consultation and communication was essential and drove outcomes on a local and individual level
- Collaboration with many other agencies allowed a much wider consideration of issues
- Transition back to normal operations was not straightforward in all instances due to the nature of emergency works versus routine procedures

Overall, the Taskforce, whilst consumptive in resources over a short period of time, was an effective mechanism for addressing an immediate problem.

ACKNOWLEDGEMENTS

We would like to thank everybody who helped contribute to this report and its findings. Notably, those named in a list of contributors in both the Mayoral Task Force Report Part A and Part B reports (Christchurch City Council, 2014a&b).

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