

# GR4CM

GYPSUM RECYCLING FOR CEMENT MANUFACTURE

WASTE MINIMISATION FUND FEASIBILITY STUDY

MILESTONE FOUR REPORT

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## 1.0 Introduction

The Gypsum Recycling for Cement Manufacture (GR4CM) feasibility study was launched on August 1, 2011 with an overall objective of “reducing the amount of waste plasterboard entering the waste stream by 32% per annum through improved design and onsite management practices and increasing the amount of plasterboard being collected and recycled in the Canterbury region by 3,000-6,000 tonnes per annum”.

Funding of \$90,000 (plus GST) has been obtained from the Ministry for the Environment’s Waste Minimisation Fund to cover the majority of the project’s budgeted cost of \$140,000 (plus GST).

The project has also received \$50,000 funding from the project stakeholders, namely:

- Winstone Wallboards Ltd (WWB)
- Holcim Cement Limited (HCL)
- Christchurch City Council (CCC)
- BRANZ
- 5R Solutions Limited (5R)

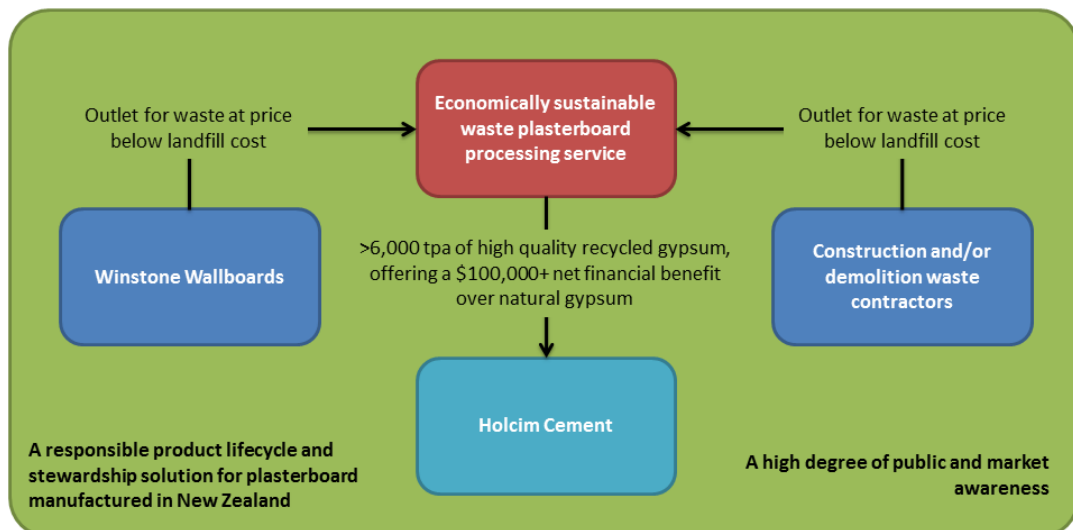
The feasibility study has four overriding goals:

- Identify (by 31 March, 2012) a financially viable waste reduction, collection and recycling scenario that can then be implemented, promoted and scaled up over time
- Achieve a 10% reduction in plasterboard waste generated on new building projects by 31 December 2012
- Achieve an additional 200% (3,000-6,000 tonnes) of plasterboard collection in the Canterbury region per annum by 31 December 2013
- Achieve an additional 200% (3,000-6,000 tonnes) of plasterboard recycling in the Canterbury region per annum by 31 December 2013

Based on the information gained to date the high level vision for this project may be expressed as:

- A waste plasterboard processing service that is **economically sustainable** in the long term, and;
- Provides a **high quality recycled gypsum product** to Holcim Cement Limited at a delivered price that is materially below that of substitute products and at volumes in excess of 6,000 tonnes per year, and;
- Offers Winstone Wallboards an outlet for all of its **manufacturing waste** at a price that is materially below that of landfill disposal, and;

- Captures a significant portion of **construction waste and demolition waste** plasterboard by offering a **collection process that is acceptable and convenient** for waste owners at a price materially below that of landfill disposal, and therefore;
- Offers a **responsible product lifecycle and stewardship solution** for plasterboard manufactured in New Zealand with a **high degree of market and public awareness**.



The project is split into five key milestones:

- Milestone 1 (completed 16 September, 2011): *Industry overview* (key deliverable is a report detailing a situation analysis and map of the current industry)
- Milestone 2 (completed 14 October, 2011): *International Industry Trends* (key deliverable is a report providing an overview of key international trends and technological developments in the industry internationally, and how the selective application of these might improve the industry in New Zealand)
- Milestone 3 (completed 2 December, 2011): *Potential Scenarios* (key deliverable is a report detailing potential new waste plasterboard collection and recycling systems, and the risks, financial implications and potential benefits of each scenario)
- Milestone 4 (due 3 February, 2012): *Stakeholder Collaboration* (key deliverable is detailed business cases for scenarios, including pilot trial plans)
- Milestone 5 (due 30 March, 2012): *Scenario Pilot Trials* (key deliverable is a final report detailing pilot processes and outcomes, and scenario details and implementation plan)

This report addresses the requirements of the fourth milestone, 'Stakeholder Collaboration', which are to:

- Work with individual stakeholders to develop detailed business cases, supply chain models and financial models around scenarios.

- Undertake a presentation and workshop with stakeholders around scenarios to test and enhance models and ensure base level of feasibility for pilot trials before commencing.
- Integrate and synthesise stakeholder feedback into scenarios to prepare for pilot trials.

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## 2.0 The Business Model

The work undertaken in the GR4CM project to date has identified that a number of the components and supply chain elements are now considered to be reliable and 'proven' as far as is practicable within the context of this project. Specifically, these comprise:

- Waste processing
- Gypsum transportation
- Gypsum end use at Holcim Cement

### 2.1 Waste Processing

As the GR4CM project has progressed, numerous potential issues relating to 5R's ability to handle new and increased sources of waste plasterboard have been raised, notably in relation to a suitable available facility. While each of these issues has been duly considered, and a scalable facility has been secured, the ability to handle significantly increased volumes is currently theoretical and subject to testing via pilot activities. Despite this lack of absolute certainty, 5R has satisfied the project stakeholders that the logistical and infrastructural elements are in place to increase scale and receive waste plasterboard from new sources.

### 2.2 Gypsum Transportation

Transportation of recycled gypsum from Christchurch to Westport is undertaken by TNL Freight using backloading capacity from the delivery of coal to Fonterra in Christchurch. Services are contracted and paid for by HCL. Initial concerns about TNL's freight capacity have been allayed by the confirmation that TNL is undertaking daily deliveries to Fonterra, providing ample backloading capacity to cover increased volumes between 5R and HCL.

### 2.3 Gypsum End Use at Holcim Cement

HCL have confirmed their willingness to utilise recycled gypsum to at least 50% of total gypsum volume in cement manufacture, equating to 12,500 tonnes per annum. In addition, given the large potential volumes of recycled gypsum available, HCL has agreed to undertake additional testing to determine the practicality of utilising even higher proportions of recycled gypsum. HCL have also secured additional storage for waste plasterboard in Christchurch and have begun construction of a covered recycled gypsum storage facility at the Westport site. Having this storage facility in place allows for larger volumes of recycled gypsum to be stored and utilised on site, and also ensures that it is protected from weather contamination. Furthermore, this capital investment at a time when HCL's capital spending criteria is particularly restrictive given its proposed relocation to Weston near Oamaru, demonstrates a strong commitment by HCL to receiving increased volumes of recycled gypsum.

### 2.4 Pilot Requirements

The key elements of the business model that require testing via pilot activities are the various potential sources of waste plasterboard and the respective sorting and collection mechanisms to be deployed.

Specifically, these are:

- Residential construction waste
- Residential demolition waste
- Commercial demolition waste

As mentioned in the Milestone Three Report, commercial construction also presents large potential volumes, but will not be initiated within the timeframes of this project. It is hoped that residential demolition will commence within the project timeframes, but as contractor tendering has not yet been finalised, pilot planning has not yet commenced. If this is able to be undertaken in time, a supplementary report will be prepared including relevant planning details.

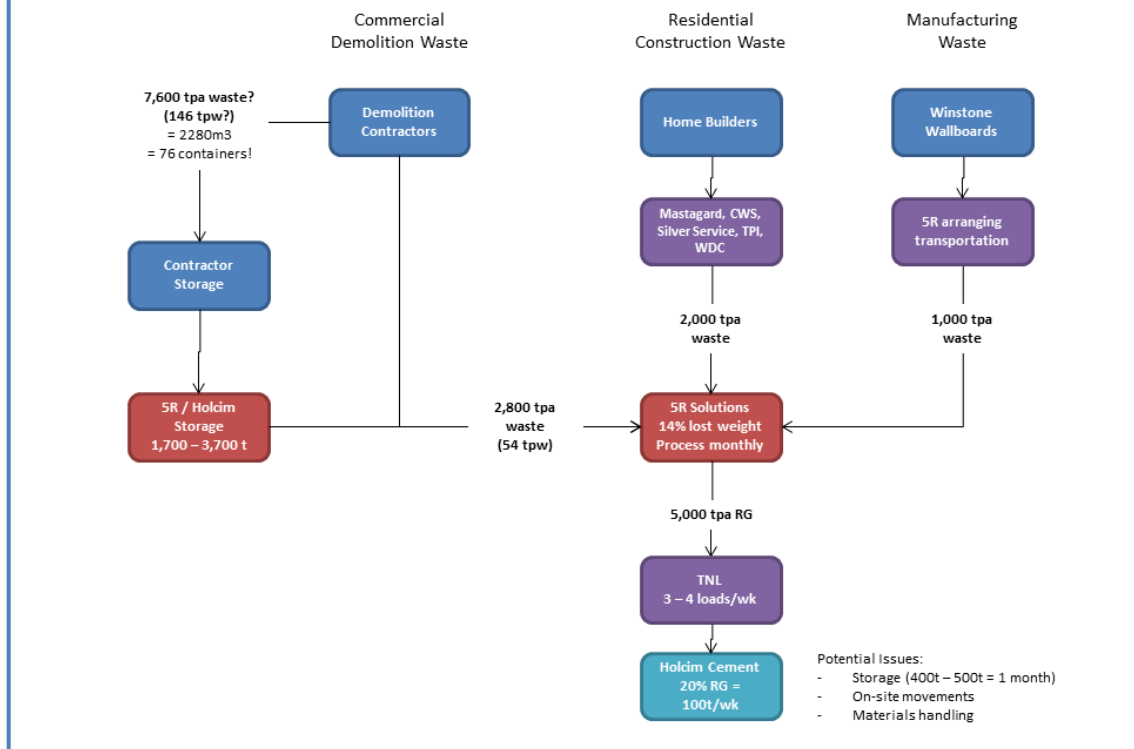
The key pilot objectives and processes are considered in the following sections.

## 2.5 *Capacity Management Options*

As the GR4CM project has progressed, the key challenge has moved from being one of supply shortage to one of supply excess and capacity management. Moving from the current raw material supply volume of approximately 1,500 – 2,000 tonnes per annum up to 10,000 tonnes per annum or more clearly presents challenges in terms of managing capacity and the flow of both inwards waste plasterboard and outwards recycled gypsum.

It is intended that capacity and throughput increase steadily so as not to cause intolerable stress to the overall business model components. Capacity management models have been prepared for key touch points at 5,000 and 10,000 tonnes per annum as follows.

## Capacity Management – 5,000 tonnes per annum



At all levels of capacity manufacturing waste and residential construction waste are given priority; the former due to its pristine state and the pivotal role of Winstone Wallboards as a stakeholder, and the latter due to its enduring supply beyond extraordinary earthquake activity.

At 5,000 tonnes of recycled gypsum supply to HCL, 5R will be able to receive all projected manufacturing waste and 2,000 tonnes of residential construction waste. In terms of residential construction waste, 5R has already secured arrangements with TPI, Mastagard, Silver Service, CWS and the Waimakariri District Council that should account for 75% of this target.

In order to produce 5,000 tonnes of recycled gypsum (with 14% of input weight being lost as paper and unrecoverable gypsum) 5R will require approximately 5,800 tonnes of waste plasterboard. The additional 2,800 tonnes (after 1,000 tonnes of manufacturing waste and 2,000 tonnes of residential construction waste) required would be sourced from commercial demolition as the next preferred (in terms of reliability and absence of contamination) source.

It is estimated (although not independently verified) that for at least the next five years commercial demolition will supply 10,400 tonnes of waste plasterboard per year, or approximately 200 tonnes per week. At this level an excess of 7,600 tonnes of waste plasterboard per annum will be available. 5R and HCL have storage capacity available of up to 3,700 tonnes, but this will only provide a short term buffer.

This likely surplus raises the issue of storage solutions, which are considered in the following section.

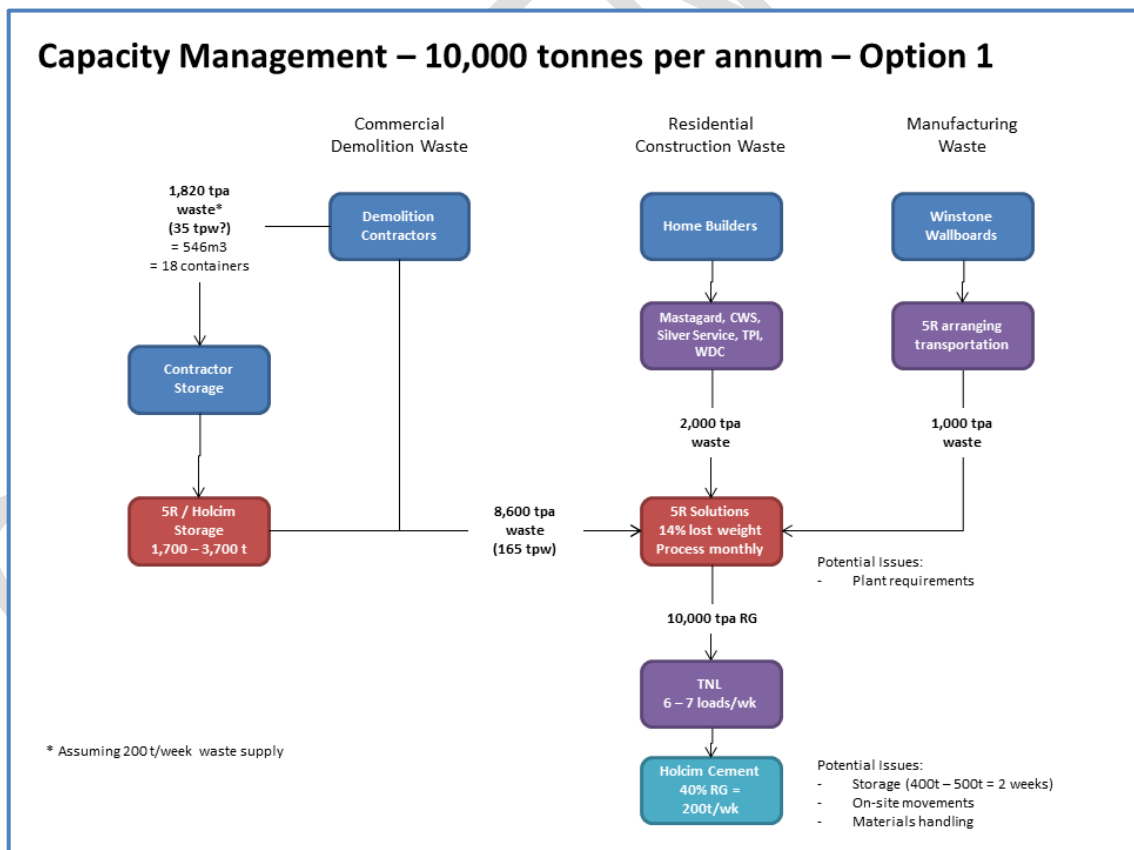
At 5,000 tonnes per annum between three and four loads of recycled gypsum would be transported to Westport each week via TNL Freight, which is well within their capacity limits. HCL would utilise 100 tonnes of recycled gypsum per week which equates to 20% of total gypsum used. This is well below the proven effective maximum proportion of 50%.

The on-site storage facility, which is currently being constructed will house 400 – 500 tonnes of recycled gypsum, providing a four to five week buffer for HCL, which considerably exceeds their minimum buffer requirement of one week.

The three to four-fold increase in deliveries does raise some issues for HCL in terms of additional truck movements and materials handling. These are not considered insurmountable however, and are due for on-site discussion and problem solving in February.

Once capacity reaches 10,000 tonnes per annum, there are two different scenarios available, with the first giving all additional available capacity to commercial demolition waste and the second spreading this capacity between commercial demolition waste and residential demolition waste.

It is likely that the decision as to which model to adopt will be made once the efficiency and effectiveness of stripping waste plasterboard from homes set for demolition is known.

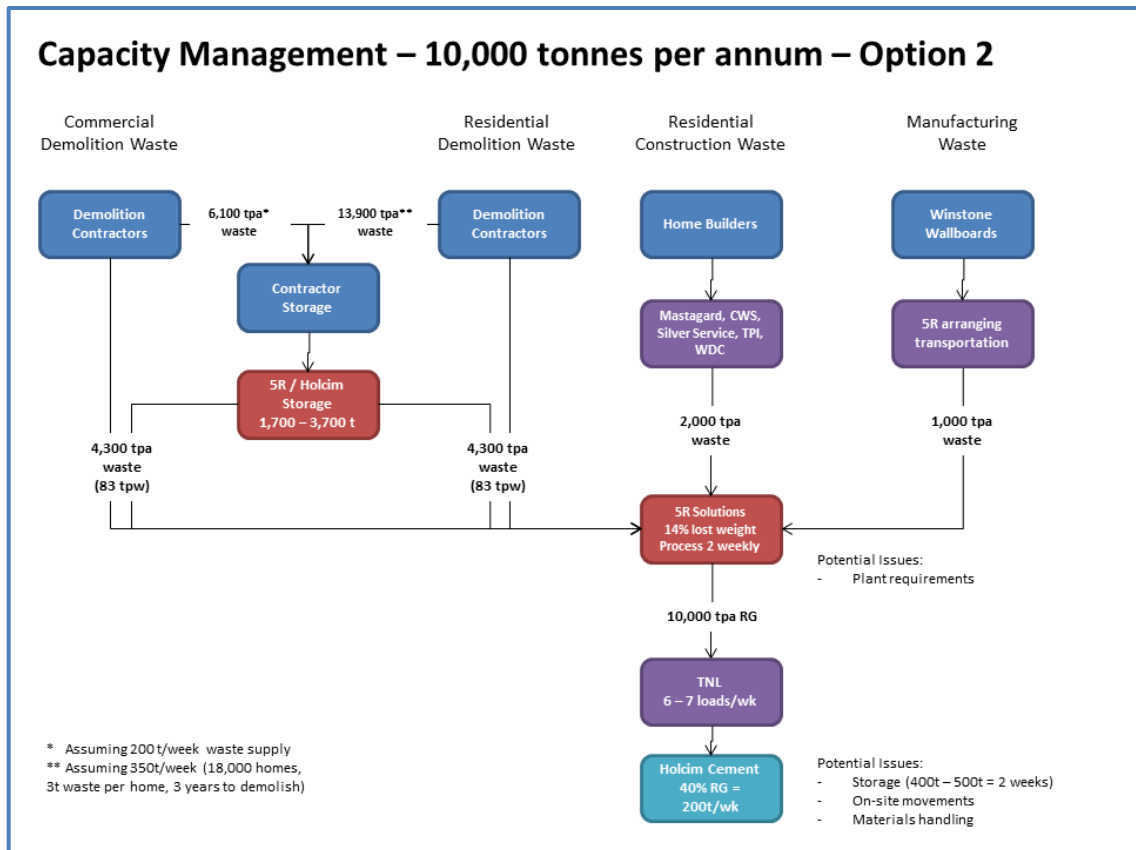


Under Option 1 the total amount of commercial demolition waste received by 5R would increase from 2,800 tonnes per annum to 8,600 tonnes per annum, or 165 tonnes per week. Notably, this still leaves an annual excess equivalent to 18 containers of waste plasterboard for the duration of the earthquake demolition.



At this level deliveries increase to between six and seven a week, HCL increases recycled gypsum proportions to 40% and the on-site storage reduces to two weeks' buffer. Each of these levels is within known constraints.

This level of operation presents a new potential issue in relation to processing capacity and infrastructure. 5R has advised that the additional staffing requirements can be met without unreasonable difficulty, but the ability of the existing plant to handle such drastically increased volumes is unknown. 5R have noted, however, that at these levels they would seek to purchase their own machinery, rather than using leased plant.



Option 2 at the 10,000 tonnes per annum processing level, begins to add in waste plasterboard obtained from residential demolition. Currently residential demolition has not yet begun, but CERA is hopeful such activities will commence in February. It is intended that a pilot be developed for this source of waste if the GR4CM project timeframes can accommodate this.

Under this model the 8,600 tonnes of capacity available per annum would be split equally between commercial demolition waste and residential demolition waste, although these levels may in reality be adjusted as supply demands.

CERA have advised that the residential demolition process will take three years which, with 18,000 houses to be demolished and approximately 3 tonnes of waste plasterboard per home, would indicate an available supply of approximately 350 tonnes per week.

Once the available capacity from 5R is accounted for at this volume, the total excess from demolition activities equates to 20,000 tonnes of waste plasterboard per annum. Once again, this indicates that the GR4CM project must now give due consideration to identifying storage options to avoid this excess supply being sent to landfill.

## 2.6 *Storage Requirements*

The capacity management models demonstrate that, even without including increased residential and commercial building activity, up to 20,000 tonnes of excess waste plasterboard will be produced over the next five years. This figure could increase significantly once rebuilding activity commences and construction waste is included in addition to additional 5R capacity being consumed by additional manufacturing waste from up-scaled production.

At the stakeholder collaboration meeting undertaken in December, this issue was presented and initial discussions undertaken. It was determined that there are various options that may be considered for storing waste plasterboard, and further investigation and development of these options will be undertaken concurrently with the scenario pilots. It was determined that, due to the cashflow requirements of 5R, storage of processed recycled gypsum would not be feasible.

The key objective in storing waste plasterboard is to both provide continuity of high levels of supply for a longer period of time, and the avoidance of waste plasterboard being sent to landfill at higher cost to the waste owner.

The desirability of keeping waste plasterboard dry must be borne in mind in identifying storage solutions, although a large stockpile is likely to absorb water only to a superficial level and most of the waste will remain dry even if exposed to the weather. In addition to this consideration, environmental and safety risks will need to be satisfied and the economics of paying for storage accounted for.

## 3.0 Pilot Plan: Residential Construction

### 3.1 Overview

TPI/Waste Management and Mastagard, the two largest waste management contractors in Canterbury, have agreed to partner with the GR4CM project to develop and trial systems for the effective sorting, collection and transportation of waste plasterboard from residential building sites. Each of these companies has created a 'draft solution' for collection, with TPI pursuing a 'flexibin' container exclusively for plasterboard, and Mastagard proposing a larger skip for gathering wood, steel and plasterboard, ready for basic off-site sorting.

TPI has engaged Enterprise Homes, Jennian Homes and Stonewood Homes as test partners, with the potential addition of Peter Ray Homes. Mastagard has secured Stonewood Homes. It is extremely useful to have Stonewood Homes trialling both solutions to provide direct comparisons between them.

### 3.2 Planning Process

Multiple planning meetings have been undertaken with each of the waste contractors and their building partners to aid in optimising the sorting and collection systems prior to initiating pilots. The format used for this pilot planning is included as **Appendix 1: GR4CM Pilot Briefing Document**.

As a result of completing this process for each individual pilot, it was determined that each builder would provide at least four homes for the pilots. In order to ensure that the objectives of each pilot were clear a Pilot Planning Document for each pilot was prepared jointly with GR4CM, the waste contractor and the builder. The completed documents are included as **Appendices 2 – 5**.

Following stakeholder collaboration and discussion, the specific data to be collected and measured was determined and these requirements formed the basis of Pilot Waste Record requirements which have been supplied to all participants for completion for each home in the pilot. These records (for the builder, the waste contractor and the processor) are included as **Appendices 6 – 8**.

### 3.3 Pilot Implementation

The key issues and the focus of the pilot for the TPI solution are:

- Will installers effectively sort waste into flexibins?
- Will installers find flexibins to be an appropriate, convenient and user-friendly solution?
- Will use of flexibins offer a cost-effective solution based on actual volumes and timings?
- Will storage and collection from inside the garage work?
- Will collection of flexibins be feasible (from an access perspective) and financially viable for WM?
- Will waste be of good quality?
- Will oversight systems work?

The key issues and the focus of the pilot for the Mastagard solution are:

- Will installers effectively sort waste into special skip?
- Will installers find special skip to be an appropriate, convenient and user-friendly solution?
- Will use of special skip offer a cost-effective solution based on actual volumes and timings?
- Will additional skip fit on site?
- Will contamination, rubbish be thrown into skip?
- Will plasterboard become water damaged in skip?
- Will off-site partial sorting be effective?
- Will collection of special skip be financially viable for MG?
- Will oversight systems work?

For each individual participant drivers have been obtained to ensure later pilot evaluations can effectively determine whether expectations have been met.

The following monitoring mechanisms have been determined for the pilots:

- Site visits to be undertaken by GR4CM during plasterboard install for each home
- Flexibins to be inspected and photos taken – noting performance of bins, contamination, volumes etc.
- Installer/supervisor to be briefly interviewed for feedback – benefits, problems and suggestions
- Feedback to be written up and discussed between parties
- Modifications/refinements to be rolled into next home
- Feedback to be sought from collector after each collection in terms of ease of access
- Feedback to be sought from processor after each delivery in terms of waste quality
- More in-depth feedback sought from parties, installers and processor at mid-point and conclusion of pilot, with a focus on viability and economics

Pilots have now commenced, or are due to commence shortly, for each builder/waste contractor combination. These will run until the end of February or shortly thereafter to allow time for evaluation and analysis of results.

## 4.0 Pilot Planning: Commercial Demolition

### 4.1 Overview

CERA has published a list of earthquake-affected commercial buildings that are to be demolished. This list comprises 524 buildings that are to be completely demolished and a further 138 that are to be partly demolished. The volume of plasterboard waste from these demolitions (which are well underway) is likely to be in excess of 10,000 tonnes per annum for the next 12 to 24 months. Currently, much of this plasterboard is being sent to landfill or, in some cases, sent to Auckland for disposal and processing.

CERA, and a number of demolition contractors, have advised that the requirements of commercial demolition are such that plasterboard is typically removed in large sheets as part of the 'deconstruction' approach to demolition that is required in Christchurch's CBD. This approach, combined with the relatively high costs currently being paid by contractors to landfill plasterboard, have generated strong interest in separating and recycling waste plasterboard from these sites.

### 4.2 Planning Process

The provision of waste plasterboard recycling services has been made known to key demolition contractors currently working with CERA. As commercial demolition is currently being undertaken in a somewhat unpredictable fashion it is difficult to identify which contractors are likely to utilise the service, although all those contacted have expressed strong support for it.

One contractor, Ward Demolition, was used as 'test client' in order to determine key drivers and desired process. A Pilot Planning Document was prepared jointly with GR4CM, the waste contractor and Ward Demolition to guide the pilot process. This completed document is included as **Appendices 9**. Further documents will be prepared along these lines as demolition contractors engage, and each of these will be interviewed for evaluation purposes at the end of February. A list of potential contractors has been provided by CERA and contains several hundred approved organisations. Work will begin shortly to communicate the service offering to additional key organisations from this list.

The Pilot Waste Record form contained in Appendix 8 will be used by the processor for the commercial demolition pilots.

### 4.3 Pilot Implementation

The key issues and the focus of the commercial demolition pilot are:

- Can 5R provide sufficient capacity for demolition contractors, and can excess be stored?
- If volumes are high, will contractors accept quotas?
- Will logistics for drop-off operate effectively?
- Will waste be of sufficient quality and dryness, and relatively contamination-free to allow successful processing?

- Will collection and weighing systems operate satisfactorily?
- Will volumes be sufficient and regular?

Monitoring of quality and volumes will be undertaken by 5R continually, and participant demolition contractors will be interviewed to determine the effectiveness of the process from their perspective.

5R has already begun receiving commercial demolition waste. It is intended that additional demolition contractors will engage of the next month.

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## 5.0 Next Steps

The remainder of the GR4CM project is focused on piloting and refining the different scenarios to gain as much information as possible in order to prepare a final business model for implementation. The goal of this process is to identify issues and opportunities for improvement while undertaking small scale implantation so that corrections can be made before launching the service at full commercial scale.

The next phase of the project therefore involves:

- Build detailed evaluation criteria and mechanisms for pilot trials, and gain endorsement from stakeholders.
- Implement pilot trial of feasible scenario options.
- Evaluate pilot trials and market test scenarios that meet key criteria.
- Evaluate market testing.
- Undertake presentation and workshop with stakeholders to analyse and ensure understanding of implications of trials before preparing final report.
- Select and refine preferred scenario for implementation.

The stakeholders will also have to determine, at the end of this process, whether the stakeholder group will continue to exist to guide industry development, and whether any further activity will be undertaken to increase recycling activity and improve the processes for securing and diverting waste plasterboard.

### Introduction

It is estimated that 20,000-40,000 tonnes of plasterboard waste is generated in New Zealand annually. This is primarily from construction, demolition and manufacturing activities. The Canterbury region has the second largest number of building consents granted annually in New Zealand and undertakes approximately 20% of all building related construction in New Zealand. This means 4,000-8,000 tonnes of waste plasterboard is produced in the Canterbury region per annum.

Earthquake damage in the Canterbury region has created a large quantity of waste plasterboard that could potentially be collected and recycled if existing collection and recycling activities were scaled up. An opportunity also exists to reduce the creation of plasterboard waste by changing the way in which building design and onsite management practices are undertaken.

Scaled up recycling, along with improved building and onsite management practices, would lower costs associated with plasterboard, reduce volumes entering the waste stream and be a best practice example of what could be achieved in other regions of New Zealand with plasterboard and with other materials and products.

GR4CM (Gypsum Recycling for Cement Manufacture) is a project aimed at creating a sustainable business model to greatly increase the volume of plasterboard recycled in Canterbury, particularly through capturing construction and/or demolition waste streams. The end use for the recycled plasterboard is for inclusion in cement manufacture by Holcim, based in Westport.

GR4CM is a partnership between Winstone Wallboards, Holcim Cement, BRANZ, Christchurch City Council and 5R Solutions. The project has funded from the Ministry for the Environment's Waste Minimisation Fund.

The overall project objectives are to:

- Identify (by 31 March, 2012) a financially viable waste reduction, collection and recycling scenario that can then be implemented, promoted and scaled up over time.
- Achieve a 10% reduction in plasterboard waste generated on new building projects by 31 December 2012.
- Achieve an additional 200% (3,000-6,000 tonnes) of plasterboard collection in the Canterbury region per annum by 31 December 2013.
- Achieve an additional 200% (3,000-6,000 tonnes) of plasterboard recycling in the Canterbury region per annum by 31 December 2013.

The initial phases of the project have focused on understanding the current situation in New Zealand, and examining international best practice. We are now moving into the creation of different scenarios for increasing collection and recycling, with a view to piloting options in the first quarter of 2012. The project completion date is 31 March, 2012.



## Residential Construction Plasterboard Collection

One of the potential scenarios for increasing plasterboard recycling is collection of construction waste from residential building sites. This is common internationally, but the low volumes and low overall costs of waste disposal make this a challenging area in which to build a sustainable model.

There are several different models for achieving successful residential construction plasterboard waste collection and recycling, and we are keen to consider a number of these and pilot those that have demonstrated merit.

There are two phases in considering these models:

1. Thoroughly considering all aspects of the proposed system/s 'offline' prior to implementation to ensure that, in theory, the system offers all participants sustainable benefits
2. If #1 can be achieved, piloting the system in such a way as to gain an indication as to whether scaling this system up will produce a viable and sustainable model

## Initial Considerations

The following need to be considered before moving forward with a pilot:

- What is the basic design of the system?
  - How will waste be sorted and collected?
  - Are there sufficient incentives/drivers for all involved in the system to participate on an ongoing basis (beyond an initial brand advantage, do the numbers and convenience stack up)? What does everyone want out of the system?
  - What are the cost savings/increases involved for all parties in implementing the system?
  - Who will be responsible for ensuring the quality of the waste sorting and freedom from contamination? Are the drivers aligned so that those responsible for sorting and monitoring are incentivised to do this well? Is it too much hassle?
  - Where will it be stored and will it be safe from the weather? Is there sufficient space on a typical site?
  - How will pick-up be coordinated and actioned?
  - How will waste quality be checked, and what happens if there is contamination? Will waste be rejected or incur additional charges?
  - How and when will waste be transported to 5R?
- How would the pilot be run?
  - Who will have overall oversight?
  - What costs will be incurred, if any?
  - How many homes can we test with and will this give sufficient volume and 'spread' to indicate scalability? What geographical areas will be covered?
  - How will we monitor results, and who will do this? What is our list of measurement criteria?

- Waste quality and volumes
- Timeliness of pick-up
- Costs to parties – benefit versus cost
- Convenience and likelihood of maintaining the system
- How will we undertake evaluations and make ‘course corrections?’
- Do we need contingency plans if something goes wrong?
- What will success look like? What are everyone’s ‘bottom lines’? How would we roll out a successful system and what volumes of waste would be indicated?
- Are the timeframes (Dec – Mar) realistic for getting a sufficient volume of homes?
- What are the risks involved in the pilot e.g. damage to home, bins stolen?
- How will billing work?
- What are the training requirements for participants and who will undertake this? When?
- What will we need to communicate as we go along and to whom? Publicity?
- Is there anyone else we should consider bringing in that could add additional value?

### **Piloting**

Once the initial considerations have been worked through, the intention is to map out the process and create a ‘pilot plan’ including objectives, roles, activities and monitoring and measurement plans. This will form the blueprint for the pilot and will be reported against to the project stakeholders and to pilot participants.

## APPENDIX 2: GR4CM Pilot Planning Document – Waste Management/Enterprise

### Overall Pilot Objectives

- To create a sustainable and economically viable system for the collection of residential construction plasterboard waste
- To ensure that collected waste is high 'quality' – free from contamination and relatively dry
- To ensure that the system is easy to use and at least as attractive as existing options for all parties

### Pilot Information

#### *Pilot Management and Implementation*

Parties	GR4CM Project	Waste Management	Enterprise Homes
<b>Representative</b>	Fraser Scott	Patrick Clancy	Steve Lewis
<b>Pilot role</b>	Overall management, monitoring and reporting	Waste solution provider and transporter	Building company – pilot site manager
<b>Others involved</b>	Plasterboard installers – East Coast fixers		
<b>Pilot description</b>	Trial use of flexibins on site for collection of clean residential plasterboard waste		
<b>Pilot timeframes and milestones</b>	1/12/2011 – 28/2/2012 Enterprise to advise when plasterboard installation commencing for each home to allow site visit.		
<b>Number of homes and addresses and predicted volumes (if known)</b>	Approx 4 homes with 3 – 4 m3 of waste plasterboard per home. Likely to be in Yaldhurst subdivision.		
<b>Key issues to test</b>	<ul style="list-style-type: none"> <li>• Will installers effectively sort waste into flexibins?</li> <li>• Will installers find flexibins to be an appropriate, convenient and user-friendly solution?</li> <li>• Will use of flexibins offer a cost-effective solution based on actual volumes and timings?</li> <li>• Will storage and collection from inside the garage work?</li> <li>• Will collection of flexibins be feasible (from an access perspective) and financially viable for WM?</li> <li>• Will waste be of good quality?</li> <li>• Will oversight systems work?</li> </ul>		
<b>Success criteria (what needs to happen for this to work?)</b>	<ul style="list-style-type: none"> <li>• Scalable, financially viable system</li> <li>• Installer uptake</li> <li>• Clean waste</li> </ul>	<ul style="list-style-type: none"> <li>• Service needs to be financially viable</li> <li>• Flexibin methodology needs to work</li> <li>• Collection/pickup and supply of bag needs to be simple &amp; straightforward</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal resistance from fixers</li> <li>• Minimal difficulty filling the bags</li> </ul>
<b>Drivers (what will each party gain if this works?)</b>	<ul style="list-style-type: none"> <li>• Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing work with a new service &amp; involvement with a sustainable initiative</li> </ul>	<ul style="list-style-type: none"> <li>• Hopefully cost savings</li> </ul>

<b>Cost Implications</b> (will cost savings or increases occur?)	N/A	<ul style="list-style-type: none"> <li>• Dependant on number of collections and distance between them</li> <li>• Currently cost matching with desire to offer discount</li> </ul>	<ul style="list-style-type: none"> <li>• Too early to say if savings will be made</li> </ul>
<b>Key risks</b> (what do we think might go wrong?)	<ul style="list-style-type: none"> <li>• Waste contamination</li> <li>• Installer refusal to participate</li> <li>• House damage from flexibin pick-up</li> </ul>	<ul style="list-style-type: none"> <li>• Methodology not suitable for us or the client</li> <li>• House damage from pick-up - would be costly and annoying</li> </ul>	<ul style="list-style-type: none"> <li>• Gib fixers refusal to participate further is a strong possibility</li> </ul>
<b>How will installers be briefed/trained and by who?</b>	<ul style="list-style-type: none"> <li>• Installers to be advised of what can and can't be put into bin (i.e. no rubbish)</li> <li>• Enterprise to communicate directly with installers</li> </ul>		
<b>How will monitoring and evaluation work?</b> (What will we measure, how and when?)	<ul style="list-style-type: none"> <li>• Site visits to be undertaken by GR4CM during plasterboard install for each home</li> <li>• Flexibins to be inspected and photos taken – noting performance of bins, contamination, volumes etc.</li> <li>• Installer/supervisor to be briefly interviewed for feedback – benefits, problems and suggestions</li> <li>• Feedback to be written up and discussed between parties</li> <li>• Modifications/refinements to be rolled into next home</li> <li>• Feedback to be sought from collector after each collection in terms of ease of access</li> <li>• Feedback to be sought from processor after each delivery in terms of waste quality</li> <li>• More in-depth feedback sought from parties , installers and processor at mid-point and conclusion of pilot, with a focus on viability and economics</li> </ul>		

#### Pilot Design

<b>What waste receptacle will be used?</b> (Dimensions, contents etc.)	2 x 2m3 flexibins per site – 2m (L) x 1m (H) x 1m (D) Plasterboard only
<b>What is the receptacle volume?</b> (Will this be sufficient, how many will be needed?)	2m3 x 2 Should be sufficient but this will need to be closely monitored 3m3 x 1 is another possibility but unlikely to be sufficient size
<b>How and when will it be delivered?</b> (And who will initiate this?)	Supplied and delivered by WM as part of overall waste solutions Folds up to small package so easy initial delivery
<b>Where will it be stored?</b> (For how long, under cover, any problems with this?)	Erected by installer near front of garage when initially required Present for duration of plasterboard install (2 – 3 days) Potential for this to be in the way of installers
<b>Who will oversee and monitor the unit on site?</b>	Steve – Enterprise supervisor

<b>Are there any potential issues with placing waste in the receptacle?</b>	Will flexibin stand up on its own – no frame? Will waste fit into flexibin – is it the right size/dimensions for the waste? Will there be lots of gaps/spaces that use up volume?
<b>Who will sort waste – onsite or offsite?</b>	Onsite sorting – plasterboard only
<b>How will installers be encouraged to do what is required of them?</b>	“Asked nicely” to participate in the trial. To help test the system and potentially save Enterprise some money.
<b>Who will be responsible for waste quality?</b> (How will this be signed off by collector/processor?)	Will be checked off by site supervisor Will be checked by WM and feedback given to Enterprise Sliding scale to be applied by processor in terms of quality
<b>How will pick-up be initiated and how quickly will it happen?</b>	Site supervisor to notify WM when pick-up required Same day pick-up
<b>How/when will waste be transported to processor?</b>	On completion of the lining of the house.
<b>How will billing work – are all costs known?</b> (Do these costs ‘work’ for all participants?)	WM will bill Enterprise for overall waste solution Processor will bill WM based on sliding scale Costs viewed as acceptable for pilot phase
<b>Other comments</b>	

## APPENDIX 3: GR4CM Pilot Planning Document – Waste Management/Jennian

### Overall Pilot Objectives

- To create a sustainable and economically viable system for the collection of residential construction plasterboard waste
- To ensure that collected waste is high 'quality' – free from contamination and relatively dry
- To ensure that the system is easy to use and at least as attractive as existing options for all parties

### Pilot Information

#### *Pilot Management and Implementation*

Parties	GR4CM Project	Waste Management	Jennian Homes
<b>Representative</b>	Fraser Scott	Patrick Clancy	Bruce Maetzig
<b>Pilot role</b>	Overall management, monitoring and reporting	Waste solution provider and transporter	Building company – pilot site manager
<b>Others involved</b>	<ul style="list-style-type: none"> <li>• Plasterboard installers – Andrew Hobbs</li> <li>• Jennian construction manager – Spencer Dhue</li> <li>• Jennian project coordinator – Tim Hickey</li> <li>• Gib supplier – Carters</li> </ul>		
<b>Pilot description</b>	Trial use of flexibins on site for collection of clean residential plasterboard waste		
<b>Pilot timeframes and milestones</b>	1/12/2011 – 28/2/2012 Jennian to advise when plasterboard installation commencing for each home to allow site visit		
<b>Number of homes and addresses and predicted volumes (if known)</b>	Trial of 5 homes initially, this to be done from late Jan 2012. Addresses to be forwarded once known.		
<b>Key issues to test</b>	<ul style="list-style-type: none"> <li>• Will installers effectively sort waste into flexibins?</li> <li>• Will installers find flexibins to be an appropriate, convenient and user-friendly solution?</li> <li>• Will use of flexibins offer a cost-effective solution based on actual volumes and timings?</li> <li>• Will storage and collection from inside the garage work?</li> <li>• Will collection of flexibins be feasible (from an access perspective) and financially viable for WM?</li> <li>• Will waste be of good quality?</li> <li>• Will oversight systems work?</li> </ul>		
<b>Success criteria (what needs to happen for this to work?)</b>	<ul style="list-style-type: none"> <li>• Scalable, financially viable system</li> <li>• Installer uptake</li> <li>• Clean waste</li> </ul>	<ul style="list-style-type: none"> <li>• Service needs to be financially viable</li> <li>• Flexibin methodology needs to work</li> <li>• Collection/pickup and supply of bag needs to be simple &amp; straightforward</li> </ul>	<ul style="list-style-type: none"> <li>• Must be financially viable</li> <li>• Planning to be done before Gib delivered</li> <li>• Shared understanding of reasons for change</li> </ul>

<b>Drivers</b> (what will each party gain if this works?)	<ul style="list-style-type: none"> <li>Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing work with a new service &amp; involvement with a sustainable initiative</li> </ul>	<ul style="list-style-type: none"> <li>Tidier site as Gib waste taken sooner</li> <li>Environmentally acceptable</li> <li>Brand exposure</li> </ul>
<b>Cost Implications</b> (will cost savings or increases occur?)	N/A	<ul style="list-style-type: none"> <li>Dependant on number of collections and distance between them</li> <li>Currently cost matching with desire to offer discount</li> </ul>	<ul style="list-style-type: none"> <li>Gib fixer may increase costs (difficult to use flexi bin)</li> <li>Jennian may achieve cost savings over normal waste disposal methods</li> </ul>
<b>Key risks</b> (what do we think might go wrong?)	<ul style="list-style-type: none"> <li>Waste contamination</li> <li>Installer refusal to participate</li> <li>House damage from flexibin pick-up</li> </ul>	<ul style="list-style-type: none"> <li>Methodology not suitable for us or the client</li> <li>House damage from pick-up - would be costly and annoying</li> </ul>	<ul style="list-style-type: none"> <li>Rejection by Gib installers</li> <li>Waste too heavy for bag</li> </ul>
<b>How will installers be briefed/trained and by who?</b>	<ul style="list-style-type: none"> <li>Installers to be advised of what can and can't be put into bin (i.e. no rubbish)</li> <li>Jennian to communicate directly with installers</li> <li>Briefing with Jennian, installers, WM and GR4CM to take place in January</li> </ul>		
<b>How will monitoring and evaluation work?</b> (What will we measure, how and when?)	<ul style="list-style-type: none"> <li>Site visits to be undertaken by GR4CM during plasterboard install for each home</li> <li>Flexibins to be inspected and photos taken – noting performance of bins, contamination, volumes etc.</li> <li>Installer/supervisor to be briefly interviewed for feedback – benefits, problems and suggestions</li> <li>Feedback to be written up and discussed between parties</li> <li>Modifications/refinements to be rolled into next home</li> <li>Feedback to be sought from collector after each collection in terms of ease of access</li> <li>Feedback to be sought from processor after each delivery in terms of waste quality</li> <li>More in-depth feedback sought from parties, installers and processor at mid-point and conclusion of pilot, with a focus on viability and economics</li> </ul>		

#### Pilot Design

<b>What waste receptacle will be used?</b> (Dimensions, contents etc.)	2 x 2m3 flexibins per site – 2m (L) x 1m (H) x 1m (D) Plasterboard only
<b>What is the receptacle volume?</b> (Will this be sufficient, how many will be needed?)	2m3 x 2 Should be sufficient but this will need to be closely monitored 3m3 x 1 is another possibility but unlikely to be sufficient size
<b>How and when will it be delivered?</b> (And who will initiate this?)	Supplied and delivered by WM as part of overall waste solutions Folds up to small package so easy initial delivery

<b>Where will it be stored?</b> (For how long, under cover, any problems with this?)	Erected by installer near front of garage when initially required Present for duration of plasterboard install (2 – 3 days) Potential for this to be in the way of installers
<b>Who will oversee and monitor the unit on site?</b>	Jennian Construction Manager – Spencer Dhue
<b>Are there any potential issues with placing waste in the receptacle?</b>	Will flexibin stand up on its own – no frame? Will waste fit into flexibin – is it the right size/dimensions for the waste? Will there be lots of gaps/spaces that use up volume?
<b>Who will sort waste – onsite or offsite?</b>	Onsite sorting – plasterboard only
<b>How will installers be encouraged to do what is required of them?</b>	Ensure installers fully understand reasons for flexibin. Involve them in the trial by way of suggestions before trial starts and discussions after trial for any suggested improvements
<b>Who will be responsible for waste quality?</b> (How will this be signed off by collector/processor?)	Will be checked off by site supervisor Will be checked by WM and feedback given to Jennian Sliding scale to be applied by processor in terms of quality
<b>How will pick-up be initiated and how quickly will it happen?</b>	Site supervisor to notify WM when pick-up required Same day pick-up
<b>How/when will waste be transported to processor?</b>	As soon as possible (24 hours) after Gib installation completed
<b>How will billing work – are all costs known?</b> (Do these costs ‘work’ for all participants?)	WM will bill Jennian for overall waste solution Processor will bill WM based on sliding scale Costs viewed as acceptable for pilot phase
<b>Other comments</b>	



## APPENDIX 4: GR4CM Pilot Planning Document – Waste Management/Stonewood

### Overall Pilot Objectives

- To create a sustainable and economically viable system for the collection of residential construction plasterboard waste
- To ensure that collected waste is high 'quality' – free from contamination and relatively dry
- To ensure that the system is easy to use and at least as attractive as existing options for all parties

### Pilot Information

#### *Pilot Management and Implementation*

Parties	GR4CM Project	Waste Management	Stonewood Homes
<b>Representative</b>	Fraser Scott	Patrick Clancy	Warwick Stichbury
<b>Pilot role</b>	Overall management, monitoring and reporting	Waste solution provider and transporter	Building company – pilot site manager
<b>Others involved</b>	Plasterboard installers - SR Fixing and Interior Dry Liners		
<b>Pilot description</b>	Trial use of flexibins on site for collection of clean residential plasterboard waste		
<b>Pilot timeframes and milestones</b>	1/12/2011 – 28/2/2012 Stonewood to advise when plasterboard installation commencing for each home to allow site visit		
<b>Number of homes and addresses and predicted volumes (if known)</b>	Approx 5 homes Addresses are unavailable until the consents are issued, it is intended that the addresses are as close as possible to one another to enable monitoring.		
<b>Key issues to test</b>	<ul style="list-style-type: none"> <li>• Will installers effectively sort waste into flexibins?</li> <li>• Will installers find flexibins to be an appropriate, convenient and user-friendly solution?</li> <li>• Will use of flexibins offer a cost-effective solution based on actual volumes and timings?</li> <li>• Will storage and collection from inside the garage work?</li> <li>• Will collection of flexibins be feasible (from an access perspective) and financially viable for WM?</li> <li>• Will waste be of good quality?</li> <li>• Will oversight systems work?</li> </ul>		
<b>Success criteria (what needs to happen for this to work?)</b>	<ul style="list-style-type: none"> <li>• Scalable, financially viable system</li> <li>• Installer uptake</li> <li>• Clean waste</li> </ul>	<ul style="list-style-type: none"> <li>• Service needs to be financially viable</li> <li>• Flexibin methodology needs to work</li> <li>• Collection/pickup and supply of bag needs to be simple &amp; straightforward</li> </ul>	<ul style="list-style-type: none"> <li>• Minimise site waste and therefore reduce the amount of waste that is disposed ex site.</li> </ul>
<b>Drivers (what will each party gain if this works?)</b>	<ul style="list-style-type: none"> <li>• Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>• Ongoing work with a new service &amp; involvement with a sustainable initiative</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce costs for the disposal of waste and reduce the amount of product that is unused</li> </ul>

<b>Cost Implications</b> (will cost savings or increases occur?)	N/A	<ul style="list-style-type: none"> <li>• Dependant on number of collections and distance between them</li> <li>• Currently cost matching with desire to offer discount</li> </ul>	<ul style="list-style-type: none"> <li>• It is hoped that the reduction of waste will reduce the costs of disposal</li> </ul>
<b>Key risks</b> (what do we think might go wrong?)	<ul style="list-style-type: none"> <li>• Waste contamination</li> <li>• Installer refusal to participate</li> <li>• House damage from flexibin pick-up</li> </ul>	<ul style="list-style-type: none"> <li>• Methodology not suitable for us or the client</li> <li>• House damage from pick-up - would be costly and annoying</li> </ul>	<ul style="list-style-type: none"> <li>• Small risk of the installers failing to buy in to the reasons and therefore spend little time thinking about recycling, this will be mitigated by the refusal to offer the fixers any further work</li> </ul>
<b>How will installers be briefed/trained and by who?</b>	<ul style="list-style-type: none"> <li>• Installers to be advised of what can and can't be put into bin (i.e. no rubbish)</li> <li>• Stonewood to communicate directly with installers</li> </ul>		
<b>How will monitoring and evaluation work?</b> (What will we measure, how and when?)	<ul style="list-style-type: none"> <li>• Site visits to be undertaken by GR4CM during plasterboard install for each home</li> <li>• Flexibins to be inspected and photos taken – noting performance of bins, contamination, volumes etc.</li> <li>• Installer/supervisor to be briefly interviewed for feedback – benefits, problems and suggestions</li> <li>• Feedback to be written up and discussed between parties</li> <li>• Modifications/refinements to be rolled into next home</li> <li>• Feedback to be sought from collector after each collection in terms of ease of access</li> <li>• Feedback to be sought from processor after each delivery in terms of waste quality</li> <li>• More in-depth feedback sought from parties , installers and processor at mid-point and conclusion of pilot, with a focus on viability and economics</li> </ul>		

#### Pilot Design

<b>What waste receptacle will be used?</b> (Dimensions, contents etc.)	2 x 2m <sup>3</sup> flexibins per site – 2m (L) x 1m (H) x 1m (D) Plasterboard only
<b>What is the receptacle volume?</b> (Will this be sufficient, how many will be needed?)	2m <sup>3</sup> x 2 Should be sufficient but this will need to be closely monitored 3m <sup>3</sup> x 1 is another possibility but unlikely to be sufficient size
<b>How and when will it be delivered?</b> (And who will initiate this?)	Supplied and delivered by WM as part of overall waste solutions Folds up to small package so easy initial delivery
<b>Where will it be stored?</b> (For how long, under cover, any problems with this?)	Erected by installer near front of garage when initially required Present for duration of plasterboard install (2 – 3 days) Potential for this to be in the way of installers

<b>Who will oversee and monitor the unit on site?</b>	Stonewood have 4 site supervisors, it is intended that they will be responsible for the monitoring of the fixers and ensure that all practicable steps are taken to ensure the creation of minimum waste on site.
<b>Are there any potential issues with placing waste in the receptacle?</b>	Will flexibin stand up on its own – no frame? Will waste fit into flexibin – is it the right size/dimensions for the waste? Will there be lots of gaps/spaces that use up volume?
<b>Who will sort waste – onsite or offsite?</b>	Onsite sorting – plasterboard only
<b>How will installers be encouraged to do what is required of them?</b>	Being asked to do another job by Stonewood Homes. This is not negotiable the process must be adhered too.
<b>Who will be responsible for waste quality? (How will this be signed off by collector/processor?)</b>	Will be checked off by site supervisor Will be checked by WM and feedback given to Stonewood Sliding scale to be applied by processor in terms of quality
<b>How will pick-up be initiated and how quickly will it happen?</b>	Site supervisor to notify WM when pick-up required Same day pick-up
<b>How/when will waste be transported to processor?</b>	As soon as practicable after the completion of the fixings.
<b>How will billing work – are all costs known? (Do these costs ‘work’ for all participants?)</b>	WM will bill Stonewood for overall waste solution Processor will bill WM based on sliding scale Costs viewed as acceptable for pilot phase
<b>Other comments</b>	

## APPENDIX 5: GR4CM Pilot Planning Document – Mastagard/Stonewood

### Overall Pilot Objectives

- To create a sustainable and economically viable system for the collection of residential construction plasterboard waste
- To ensure that collected waste is high 'quality' – free from contamination and relatively dry
- To ensure that the system is easy to use and at least as attractive as existing options for all parties

### Pilot Information

#### *Pilot Management and Implementation*

Parties	GR4CM Project	Mastagard	Stonewood Homes
<b>Representative</b>	Fraser Scott	Sebastian Stapleton	Warwick Stichbury
<b>Pilot role</b>	Overall management, monitoring and reporting	Waste solution provider and transporter	Building company – pilot site manager
<b>Others involved</b>	Plasterboard installers - SR Fixing and Interior Dry Liners		
<b>Pilot description</b>	Trial use of wood/steel/plasterboard skip on site for collection of clean residential plasterboard waste		
<b>Pilot timeframes and milestones</b>	1/12/2011 – 28/2/2012 Stonewood Homes to advise when plasterboard installation commencing for each home to allow site visit		
<b>Number of homes and addresses and predicted volumes (if known)</b>	Approx 5 homes, including 7-Star Lincoln Showhome Other addresses are unavailable until the consents are issued, it is intended that the addresses are as close as possible to one another to enable monitoring.		
<b>Key issues to test</b>	<ul style="list-style-type: none"> <li>• Will installers effectively sort waste into special skip?</li> <li>• Will installers find special skip to be an appropriate, convenient and user-friendly solution?</li> <li>• Will use of special skip offer a cost-effective solution based on actual volumes and timings?</li> <li>• Will additional skip fit on site?</li> <li>• Will contamination, rubbish be thrown into skip?</li> <li>• Will plasterboard become water damaged in skip?</li> <li>• Will off-site partial sorting be effective?</li> <li>• Will collection of special skip be financially viable for MG?</li> <li>• Will oversight systems work?</li> </ul>		
<b>Success criteria (what needs to happen for this to work?)</b>	<ul style="list-style-type: none"> <li>• Scalable, financially viable system</li> <li>• Installer uptake</li> <li>• Clean waste</li> </ul>	<ul style="list-style-type: none"> <li>• Contamination kept to minimum.</li> <li>• Goal of 50% diverted from landfill from each site.</li> <li>• Cost to be cheaper than would have been if client hired general waste skips only.</li> </ul>	<ul style="list-style-type: none"> <li>• Minimise site waste and therefore reduce the amount of waste that is disposed ex site.</li> </ul>

<b>Drivers</b> (what will each party gain if this works?)	<ul style="list-style-type: none"> <li>Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>Provide onsite sorting and skip service to client.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce costs for the disposal of waste and reduce the amount of product that is unused</li> </ul>
<b>Cost Implications</b> (will cost savings or increases occur?)	N/A	<ul style="list-style-type: none"> <li>Goal is for the client to be able to recycle over 50% with costs being less than with hiring standard skip service.</li> </ul>	<ul style="list-style-type: none"> <li>It is hoped that the reduction of waste will reduce the costs of disposal</li> </ul>
<b>Key risks</b> (what do we think might go wrong?)	<ul style="list-style-type: none"> <li>Waste contamination</li> <li>Installer refusal to participate</li> <li>House damage from flexibin pick-up</li> </ul>	<ul style="list-style-type: none"> <li>Contamination.</li> </ul>	<ul style="list-style-type: none"> <li>Small risk of the installers failing to buy in to the reasons and therefore spend little time thinking about recycling, this will be mitigated by the refusal to offer the fixers any further work</li> </ul>
<b>How will installers be briefed/trained and by who?</b>	<ul style="list-style-type: none"> <li>Installers to be advised of what can and can't be put into bin (i.e. no rubbish)</li> <li>Stonewood Homes to communicate directly with installers</li> </ul>		
<b>How will monitoring and evaluation work?</b> (What will we measure, how and when?)	<ul style="list-style-type: none"> <li>Site visits to be undertaken by GR4CM during plasterboard install for each home</li> <li>Skips to be inspected and photos taken – noting contamination, water damage, volumes etc.</li> <li>Installer/supervisor to be briefly interviewed for feedback – benefits, problems and suggestions</li> <li>Feedback to be written up and discussed between parties</li> <li>Modifications/refinements to be rolled into next home</li> <li>Feedback to be sought from collector after each collection in terms of ease of access</li> <li>Feedback to be sought from processor after each delivery in terms of waste quality</li> <li>More in-depth feedback sought from parties, installers and processor at mid-point and conclusion of pilot, with a focus on viability and economics</li> </ul>		

### Pilot Design

<b>What waste receptacle will be used?</b> (Dimensions, contents etc.)	<ul style="list-style-type: none"> <li>1 x Combined plasterboard/wood/steel skip</li> <li>1 x General Residual Waste Skip</li> <li>1 x Polystyrene Wool Sack &amp; Frame</li> <li>1 x Cardboard Wool Sack &amp; Frame</li> <li>1 x Plastic Wool Sack &amp; Frame</li> <li>1 x Wheelie bin for comingle (plastic bottles, steel/aluminium cans, Glass bottles)</li> </ul>
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<b>What is the receptacle volume?</b> (Will this be sufficient, how many will be needed?)	On standard residential site 3 x 7.5 cubic metre skips are used for general waste totalling 22.5m <sup>3</sup> of material removed from site.  This is being replaced with: 1 x comingle skip for timber/plasterboard/steel (7.5 m <sup>3</sup> ) 1 x general residual skip (7.5m <sup>3</sup> ) Balance of 7.5 cubic metres made up of cardboard/plastic/polystyrene wool sack and frames.
<b>How and when will it be delivered?</b> (And who will initiate this?)	Supplied and delivered by MG as part of overall waste solutions
<b>Where will it be stored?</b> (For how long, under cover, any problems with this?)	Stored on site with other skips Present for entire build? Not covered or secured
<b>Who will oversee and monitor the unit on site?</b>	Stonewood have 4 site supervisors, it is intended that they will be responsible for the monitoring of the fixers and ensure that all practicable steps are taken to ensure the creation of minimum waste on site.
<b>Are there any potential issues with placing waste in the receptacle?</b>	Will volume be appropriate for combined waste?
<b>Who will sort waste – onsite or offsite?</b>	Partial onsite sorting, partial offsite sorting Will this be cost-effective and produce quality waste?
<b>How will installers be encouraged to do what is required of them?</b>	Good signage, potentially financial penalties for suppliers who do not co-operate. Ultimately the site manager/builder to be accountable.
<b>Who will be responsible for waste quality?</b> (How will this be signed off by collector/processor?)	Will be checked off by site supervisor Will be checked by MG and feedback given to Stonewood Homes Sliding scale to be applied by processor in terms of quality
<b>How will pick-up be initiated and how quickly will it happen?</b>	Site supervisor to notify MG when pick-up required Same day pick-up
<b>How/when will waste be transported to processor?</b>	As required when site manager/builder calls up.
<b>How will billing work – are all costs known?</b> (Do these costs 'work' for all participants?)	MG will bill Stonewood Homes for overall waste solution Processor will bill MG based on sliding scale Costs viewed as acceptable for pilot phase
<b>Other comments</b>	

## APPENDIX 6: GR4CM Pilot Waste Record - Builder

Please use this document to record details about waste plasterboard for the GR4CM waste plasterboard project. This document should be completed and signed off by the site supervisor.

Please note: it is important that you **contact GR4CM (Fraser Scott, 021 122 4167) once plasterboard installation has commenced**. Fraser or another representative of the project will visit the site to take photos of the waste bins and discuss the waste separation process with the plasterboard installers. This discussion will be brief and should not be disruptive.

Once the information required below has been collected, please email to [fraser@tnc.co.nz](mailto:fraser@tnc.co.nz) or fax to 03 341 3363.

<b>Building company:</b>	
<b>Waste contractor:</b>	
<b>Site address:</b>	
m2 of <b>plasterboard ordered</b> for home (and lengths if known):	
kg of waste <b>plasterboard collected</b> from site:	
Number and size (m3) of <b>waste receptacles</b> used:	
Other than plasterboard was there any <b>visible waste</b> in the receptacle? If yes, how much and what type of waste?	
Was the waste plasterboard <b>completely dry</b> ?	
Was any <b>damage caused</b> to the home when the container was picked up? If yes, please describe damage:	
Were there any <b>problems with the receptacle</b> or putting plasterboard waste into it? If yes, please provide a brief overview:	
Were there any <b>problems with the collection</b> ? If yes, please provide a brief overview:	
Were there any <b>other problems</b> ? If yes, please provide a brief overview:	
How <b>willing were the installers</b> to use the receptacle?	
Do you have any <b>recommendations or suggestions</b> for making the plasterboard waste collection system work better?	
<b>Completed by:</b>	
<b>Date:</b>	

## APPENDIX 7: GR4CM Pilot Waste Record – Waste Contractor

Please use this document to record details about waste plasterboard for the GR4CM waste plasterboard project.

Please note: it is important that you **contact GR4CM (Fraser Scott, 021 122 4167) once plasterboard collection has been arranged**. Fraser or another representative of the project may need to visit the site to take photos of the waste bins as they are collected.

In addition to this information, can you please **take photos of the collected waste**. Once the information required below has been collected, please email this document and photos to [fraser@tnc.co.nz](mailto:fraser@tnc.co.nz) or fax to 03 341 3363..

<b>Waste contractor:</b>	
<b>Building company:</b>	
<b>Site address:</b>	
kg of waste <b>plasterboard collected</b> from site:	
Other than plasterboard was there any <b>visible waste</b> in the receptacle? If yes, how much and what type of waste?	
Was the waste plasterboard <b>completely dry</b> ?	
Was any <b>damage caused</b> to the home when the container was picked up? If yes, please describe damage:	
Were there any <b>problems with the collection</b> ? If yes, please provide a brief overview:	
Were there any <b>problems dropping the waste off</b> at 5R Solutions? If yes, please provide a brief overview:	
Were there any <b>other problems</b> ? If yes, please provide a brief overview:	
Do you have any <b>recommendations or suggestions</b> for making the plasterboard waste collection system work better?	
<b>Completed by:</b>	
<b>Date:</b>	



## APPENDIX 8: GR4CM Pilot Waste Record – Processor

Please use this document to record details about waste plasterboard for the GR4CM waste plasterboard project.

In addition to this information, can you please **take photos of the collected waste**. Once the information required below has been collected, please email this document and photos to [fraser@tnc.co.nz](mailto:fraser@tnc.co.nz) or fax to 03 341 3363..

<b>Waste contractor:</b>	
<b>Building company:</b>	
<b>Site address:</b>	
kg of waste <b>plasterboard collected</b> from site:	
Other than plasterboard was there any <b>visible waste</b> in the receptacle? If yes, how much and what type of waste?	
Was the waste plasterboard <b>completely dry</b> ?	
Were there any <b>problems receiving the waste</b> from the waste contractor? If yes, please provide a brief overview:	
Were there any <b>other problems</b> ? If yes, please provide a brief overview:	
Do you have <b>any recommendations or suggestions</b> for making the plasterboard waste collection system work better?	
<b>Completed by:</b>	
<b>Date:</b>	

## APPENDIX 9: GR4CM Pilot Planning Document – Commercial Demolition

### Overall Pilot Objectives

- To create a sustainable and economically viable system for the collection of commercial demolition plasterboard waste, especially from earthquake demolition
- To ensure that collected waste is high 'quality' – free from contamination and relatively dry
- To ensure that the system is easy to use and at least as attractive as existing options for all parties

### Pilot Information

#### *Pilot Management and Implementation*

Parties	GR4CM Project	5R Solutions	Demolition Contractors (list below)
<b>Representative</b>	Fraser Scott	Chris Grant	Peter Ward – Ward Demolition (currently participating in trial)
<b>Pilot role</b>	Overall management, monitoring and reporting	Processor	Waste suppliers
<b>Pilot description</b>	Trial receipt and processing of earthquake demolition waste		
<b>Pilot timeframes and milestones</b>	1/12/11 – 28/2/11 Ongoing monitoring of quantity and quality to be undertaken Unless there are significant issues, receipt and processing will continue indefinitely		
<b>Number of buildings and predicted volumes (if known)</b>	CERA maintains online list of buildings to be demolished As at 1 December 2011 this equates to 524 buildings that are to be completely demolished and a further 138 that are to be partly demolished Volumes are not yet known		
<b>Key issues to test</b>	<ul style="list-style-type: none"> <li>• Can 5R provide sufficient capacity for demolition contractors, and can excess be stored?</li> <li>• If volumes are high, will contractors accept quotas?</li> <li>• Will logistics for drop-off operate effectively?</li> <li>• Will waste be of sufficient quality and dryness, and relatively contamination-free to allow successful processing?</li> <li>• Will collection and weighing systems operate satisfactorily?</li> <li>• Will volumes be sufficient and regular?</li> </ul>		
<b>Pilot description</b>	Trial receipt and processing of earthquake demolition waste		
<b>Success criteria (what needs to happen for this to work?)</b>	<ul style="list-style-type: none"> <li>• Financially viable and attractive for demolition contractors</li> <li>• Sufficient volume, and acceptance of volumes by contractors</li> <li>• Clean waste</li> </ul>	<ul style="list-style-type: none"> <li>• Demo contractors maintaining material specification.</li> <li>• Understanding potential volumes of materials to ensure we can meet demand.</li> <li>• Scheduling of processing equipment to meet demand.</li> </ul>	<ul style="list-style-type: none"> <li>• Lower costs per tonne - \$40 is good, \$30 would be better</li> <li>• Reliable system for drop-off and convenient drop-off location</li> </ul>

<b>Drivers</b> (what will each party gain if this works?)	<ul style="list-style-type: none"> <li>Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>Reliable, ongoing source of clean plasterboard waste</li> </ul>	<ul style="list-style-type: none"> <li>Lower costs of disposal</li> </ul>
<b>Cost Implications</b> (will cost savings or increases occur?)	<ul style="list-style-type: none"> <li>N/A</li> </ul>	<ul style="list-style-type: none"> <li>No change in terms of input and output costs provided waste is of sufficient quality.</li> </ul>	<ul style="list-style-type: none"> <li>Cost savings - \$40/tonne to dispose of plasterboard vs. \$125/tonne for mixed waste currently</li> </ul>
<b>Key risks</b> (what do we think might go wrong?)	<ul style="list-style-type: none"> <li>Low waste quality – inability to cost-effectively process</li> <li>Failure of drop-off/ logistical systems</li> </ul>	<ul style="list-style-type: none"> <li>Material not meeting the required standards.</li> <li>Scheduling of processing equipment in line with batch processing.</li> <li>Incoming volumes fluctuate greatly.</li> </ul>	<ul style="list-style-type: none"> <li>Rejection of waste due to quality</li> <li>Cessation of availability of processing</li> <li>Access while processing – too much dust</li> </ul>
<b>How will contractors be briefed/trained and by who?</b>	<p>Briefed directly by processor, briefing to be passed to contractor team by contractor</p> <p>Clear acceptance protocol developed and distributed</p> <p>Onsite site training may be required by processor to ensure quality.</p>		
<b>How will monitoring and evaluation work?</b> (What will we measure, how and when?)	<p>Measure volumes, throughput and quality constantly</p> <p>Interviews of each contractor after initial loads received</p>		

#### Pilot Design

<b>How will available capacity be allocated to contractors?</b>	<p>Once a clearer picture emerges with volumes and which demo contractors are focused on delivering the required standards. 5R can then set quotas based on our maximum weekly capacity.</p>
<b>What storage capacity is available and how will this be accessed by contractors?</b>	<p>5R has access to approximately 1500 tonnes of additional capacity of storage for finished product.</p> <p>CCC and CERA may aid in the storage of materials or demo contractors may look at storage on sites.</p>
<b>What waste receptacle will be used?</b> (Dimensions, contents etc.)	<p>TBC – likely standard skips.</p>
<b>Where will it be stored?</b> (For how long, under cover, any problems with this?)	<p>Not covered and exposed to weather, but should be delivered to 5R frequently minimising exposure</p>
<b>Who will sort waste – onsite or offsite?</b>	<p>On-site sorting part of existing system.</p>
<b>How will contractors be encouraged to do what is required of them?</b>	<p>Sliding scale charges for waste based on contamination level means risk is retained by contractor if contamination exists.</p>
<b>How/when will waste be transported to processor?</b>	<p>By contractor.</p>

<b>Who will be responsible for waste quality?</b> (How will this be signed off by collector/processor?)	Waste will be weighed and checked by processor upon delivery and isolated from waste from other contractors.
<b>How will contractors drop off waste at processing facility?</b>	Generally the demo contractors will have their own means of transport or use third party contractors.
<b>How will billing work – are all costs known?</b> (Do these costs 'work' for all participants?)	Contractors have sliding scale costs and have accepted given alternative costs. If contamination is high, push-back on costs is likely – this will need to be monitored. Contractors to be billed directly – will they pay reliably?
<b>Other comments</b>	

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