



DISTRICT PLAN
Homestar Cost-Scoring Appraisal
for Christchurch City Council

ii Table of Contents

1.0	Executive Summary	3
2.0	Background	4
3.0	The Homestar framework	6
4.0	Specification criteria.....	8
5.0	Preliminary specifications	9
6.0	Elemental specification costs	10
7.0	Cost-scoring appraisal.....	12
8.0	Specification and cost packages	14
9.0	Conclusions	16

1.0 Executive Summary

1.1 About

This study explores potential cost and specification implications associated with recognising the “Homestar” rating tool in the forthcoming Christchurch City District Plan revision.

1.2 Results

This study suggests that Homestar ratings for a sample 4 bedroom / 190sqm new house in Christchurch, which may at the time of undertaking this study (December 2013), could be achieved for the following construction cost increases over typical practice:

- 5 star rating: +\$2,260
- 6 star rating: +\$3,612.50
- 7 star rating: +\$27,332.50

1.3 Implications

This study indicates that:

- Changes in design and specification can be achieved using widely available products, without major change to construction methods.
- Homestar prioritises a well-insulated passive solar approach which is desirable and highly appropriate to the cool, bright Christchurch climate, and which offers direct health and comfort benefits to the population.
- Homestar incentivises smaller dwellings, which could also align with other measures to increase housing affordability.
- Reduced demand pressure for water and energy resulting from specification changes could reduce pressure on infrastructure.
- Potential benefits to consumers in the form of resulting energy and water bill savings are anticipated, to be assessed separately.
- Issues of policy operation should be considered in detail to ensure the crossover of information between Resource Consent and Building Consent documentation is well managed.

2.0 Background

2.1 Authorship

Christchurch City Council requested Jasmx Ltd to undertake this study.

Tim Robinson, Jerome Partington and Matthew Downs of Jasmx provided architectural specification and design input – both have experience of applying a range of sustainability ratings tools to design, specification and building. Jerome is a Greenstar Accredited professional and Matthew is a Homestar Assessor.

Jasmx were assisted in appraising cost implications by Trish Enright, a Greenstar Accredited Professional, of Rawlinsons Quantity Surveyors.

Matthew Cutler-Welsh of the New Zealand Green Building Council provided expertise around Homestar's intentions and technical framework.

2.2 Purpose

This study supports preparation of the draft District Plan for Christchurch City, and in particular the potential for using the "Homestar" rating tool in the District Plan. Homestar is a tool which can rate both existing and new dwellings – see section 3 for more information about the Homestar tool.

The purpose of this study is to identify the potential issues associated with adopting the Homestar tool with respect to:

- Specification changes required to achieve 5/6/7 Star ratings.
- Anticipated costs associated with revised building specifications.
- Alignment with the interests of owners and occupiers.

2.3 Scope

This work has been undertaken as a desktop study, replicating the preliminary stages in the planning of a development using standard industry methods and expertise.

This desktop approach has been necessary due to the relatively recent introduction of the Homestar tool, which means that there is only limited project-based evidence available. However, it is worth noting that some of the earliest adopters of Homestar are beginning to complete building projects, and in many cases are actively sharing cost and specification information, and providing valuable observations of how the resulting homes are received by the market.

The study only considers application of the tool to new-build homes, and was limited to investigation of parts of the 10-step Homestar scale:

- 3 stars will be achieved through new-builds that comply with the current Building Code. 4 Stars is likely to be achieved, although not guaranteed, through many commonly adopted building practices where developers seek to differentiate their product from a product that is driven by basic compliance. 4 stars and below were not investigated as they represent close to current practice or statutory minimum specifications.
- 8 Stars and above represents advanced low-energy or zero-energy dwelling design and is anticipated to incorporate technology such as solar electric panels and significant water recycling systems. This level of performance is not felt to be an appropriate target for mass adoption at an early stage, and therefore was not investigated.
- The intervening 5 to 7 Stars represent an opportunity for advancing the performance of buildings using relatively small adjustments to design and specification, while delivering potentially significant benefits to owners and occupiers. The implications of achieving the required performance for these levels has been the main focus of this study.

This study does not attempt to explain in depth the very extensive issues around why sustainability is important, what constitutes sustainability, and the very complex issues around building performance and materials science. It takes the Homestar framework (which incorporates a developed understanding of these issues) as a given and seeks to work with the targets and assumptions set by this tool. Further investigation of the wider and more technical details is possible, and recommended, starting with some of the reference notes included in the Homestar framework.

2.4 About Homestar

The Homestar tool was developed by and is operated through a joint venture between the New Zealand Green Building Council (NZGBC) and BRANZ. The tool is designed specifically for New Zealand application, and can be used to assess both existing and new dwellings. At present the tool does not apply beyond houses, but the authors are in the process of preparing for alternative versions which will target apartments and other dwelling forms.

Homestar is readily accessible through an online tool which provides an indicative rating and individualised advice for the public. In addition, qualified Assessors trained by Homestar are able to undertake certification of buildings.

This study has been undertaken using the Homestar tool as published and available during November 2013 (version 2), and adopting the scoring methodology used by the certification method rather than the online tool (the latter reflects a speculative approach rather than the evidence-based assessment).

2.5 Baseline comparison

The study also adopted use of a 'baseline' dwelling design against which to assess quantity-based costs. This sample design was obtained from recent Building Consent applications, representing current practice in the City. The Consent application was treated anonymously so that the assessment team were not influenced in any way by location, builder or designer. It was chosen as representing a typical mid-market product in Christchurch, with the following attributes:

- A single-storey 190m², four bedroom, two bathroom house with double garage on a relatively flat site. Homestar assesses this plan as 157m² of internal space plus the garaging. Refer to section 3.5 for a commentary on how home size affects the Homestar rating.
- Timber frame construction with 90mm external walls, on typical waffle slab foundation suitable for TC2 areas.
- A mix of wall cladding, primarily Rockcote Integra with a small area of James Hardie Linea weatherboard; solid aluminium frame double-glazed windows with no gas fill or special coatings, and long-run corrugated roofing.
- Electrical, mechanical and plumbing required to meet the Building Code, including a 300L mains pressure hot water tank.
- Mid-market specification for bathrooms, kitchens and other fittings. This included an assumption that a washing machine and a dishwasher were provided, both of which must meet water performance standards to be on the market in New Zealand.

2.6 Relevant research

The study also drew upon a range of relevant research relating to design, energy performance, health implications, and material specifications published in recent years by a variety of organisations. These included documents from BRANZ, Beacon Pathway, Otago, Canterbury, Victoria, UNITEC and Auckland Universities. These research documents are generally available through the websites of these organisations, and this study owes a significant debt to this pre-existing research for enabling specification decisions to be taken rapidly in the context of a wider understanding of how more sustainable and healthy homes can be delivered in New Zealand.

2.7 Methodology

The target for the methodology is a simple one – in effect it is:

“What specification/design scores most points for the least cost?”

This basic question drives the methodology, firstly looking to understand the points available and then researching the cost of suitable specifications. The word “suitable” is important here – a set of criteria were developed to guide what specifications were considered.

The study was therefore undertaken in key stages:

1. Appraisal of the Homestar framework itself, to understand what performance is required and how the distinct Star ratings can be achieved.
2. Identification of criteria for developing specifications.
3. Identifying current specification and cost benchmarks based on common industry practice. This resulted in the 'baseline' package referred to in the “Reference information” section above.
4. Assembling preliminary building specification elements together with packages of elements to meet 5, 6 and 7 Star ratings in the Homestar tool.
5. Cost appraisal of discrete specification elements.
6. Cost-benefit analysis and resulting adjustment of the packages required to provide out-turn costs for achieving 5, 6, and 7 Star ratings. Initial specification assumptions were also revisited to consider whether early exclusions were valid.
7. Review of outcomes; identifying conclusions and recommendations.

3.0 The Homestar framework

3.1 Overview

Homestar version 2 includes ten Star-rating performance levels, based on combinations of specification 'points' available for elements in six categories.

Few requirements are prescribed as to where points must be scored (see section 3.4 below). This allows designers, developers and homeowners to follow their own priorities, avoiding a prescriptive imposition, and enables people to take 'easy wins' before needing to address more challenging elements.

On the basis that a development may be seeking to achieve a target Star rating, there are two key steps in identifying a Homestar score:

1. Identify points scored under each element and category, including any minimum requirements for the target rating. See 3.3 and 3.4 below.
2. Add any bonus points for "Innovation" - this will not be a common score as it explicitly incentivises unusual, ground-breaking practices.
3. Multiply the total score based on Dwelling Size. This is a significant factor designed to incentivise smaller dwellings, see 3.5 below.

3.2 Star rating levels

This points framework translates into the following thresholds, with the Star ratings that this study is most interested in highlighted in green:

Rating	Required score
1 Star	0
2 Star	20
3 Star	30
4 Star	40
5 Star	50
6 Star	60
7 Star	70
8 Star	80
9 Star	90
10 Star	95

3.3 Categories

Homestar version 2 allocates requirements into thematic categories, with a total score of 100 available across all categories; these are shown on the chart opposite. An additional 5 points is available for innovation.

The Energy, Health and Comfort category provides the largest group of points (48), followed by Water (15) and Materials (12). This hierarchy aligns with the widely recognised logic of designing homes with reduced environmental impacts:

- Building "Envelopes" – the enclosing form of walls, floors and roofs – that create comfortable and health internal spaces by managing heat, moisture and air flows to work with local climate. In a 'heating' climate such as Christchurch's this is a particularly important performance feature
- Reducing imported energy and water demand with efficient appliances
- Using materials that are safer for humans and use less energy and water in their manufacture

3.4 Minimum requirements

Minimum points are required under Homestar version 2 for priority elements. These reflect key New Zealand opportunities and issues of passive solar design, insulation and moisture, directly addressing problems found in many homes:

1. 5 Star rating requires:
 - 7.6 points under Whole House Thermal Performance
 - 3 points under Moisture Control
2. 6 Star rating includes the requirements of Level 5, plus:
 - 10 points under Whole House Thermal Performance
 - 1.8 points under Internal Potable Water Use
3. 7 Star rating increases requirements to include:
 - 11.5 points under Whole House Thermal Performance

These minimum thresholds are indicated on the chart opposite.

3.5 Dwelling size

The intention of this is to recognise that smaller dwellings consume less resources (materials, energy and water used in construction, land, energy and other resources in use) and are therefore inherently more sustainable compared to a larger house with the same specification.

The multiplier identifies a benchmark size, at which the score remains unchanged – this benchmark size varies by the number of bedrooms.

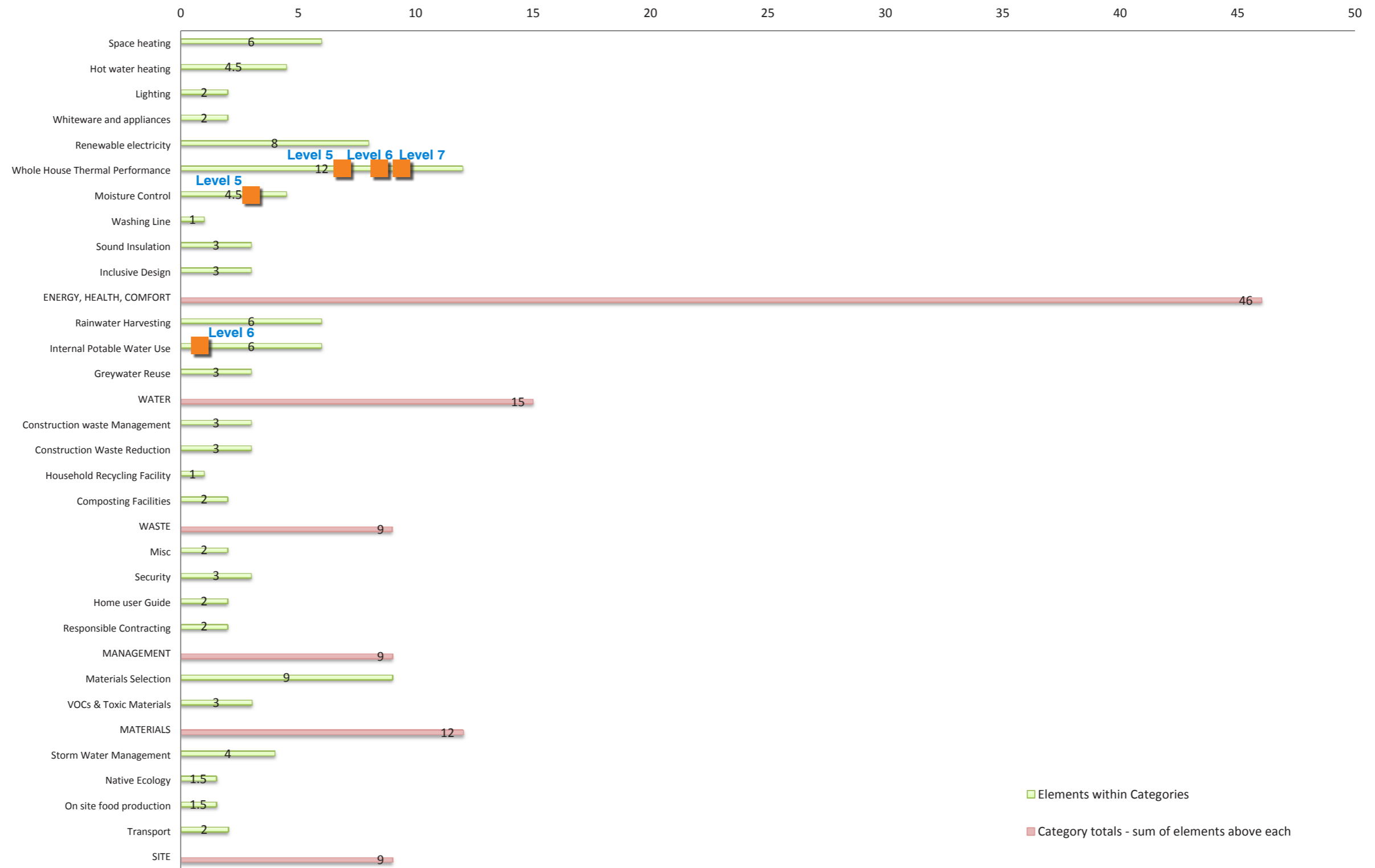
1. Smaller houses are rewarded by increasing their score.
 - Smaller houses need not be as highly specified to achieve ratings.
2. Larger houses are penalised by decreasing their score.
 - Larger houses need to be more highly specified to achieve ratings.

An excerpt of the Homestar table is set out here, showing factors in relation to sample Auckland build sizes - currently these often exceed the benchmark. The study plan is more efficient than the Benchmark at 4 bedrooms / 157m² internal.

Bedrooms / GFA						Factor	Percentage against Benchmark					
1	2	3	4	5	6		1	2	3	4	5	6
44	72	100	119	135	148	1.126	64%	65%	67%	65%	67%	71%
46	76	104	123	143	150	1.111	67%	69%	69%	68%	71%	72%
48	79	110	132	149	156	1.095	70%	72%	73%	73%	74%	75%
51	83	115	139	155	162	1.079	74%	75%	77%	76%	77%	78%
54	88	119	146	162	169	1.063	78%	80%	79%	80%	80%	81%
57	91	126	152	169	176	1.047	83%	83%	84%	84%	84%	84%
59	96	131	160	178	185	1.032	86%	87%	87%	88%	88%	89%
62	101	137	166	185	192	1.016	90%	92%	91%	91%	92%	92%
65	105	144	174	193	200	1.009	94%	95%	96%	96%	96%	96%
69	110	150	182	202	209	1	100%	100%	100%	100%	100%	100%
72	115	157	191	211	218	0.984	104%	105%	105%	105%	104%	104%
75	120	163	198	220	227	0.968	109%	109%	109%	109%	109%	109%
79	126	170	207	230	237	0.953	114%	115%	113%	114%	114%	113%
83	131	178	217	240	247	0.937	120%	119%	119%	119%	119%	118%
86	138	186	226	250	257	0.921	125%	125%	124%	124%	124%	123%
90	144	194	236	261	268	0.905	130%	131%	129%	130%	129%	128%
95	150	202	246	272	279	0.889	138%	136%	135%	135%	135%	133%

Sample Auckland Build Sizes (approximate) in each Bedroom category
 Note: 2 Bedrooms includes both Apartment and House sizes

Homestar Points Framework



4.0 Specification criteria

Specifications is a skill relevant to all building projects, but one which is practiced in many ways.

The most common practice is the re-use of standard specifications, or the carrying forward of the set of specifications last used by a builder or designer on a project. This practice offers the benefit of, hopefully, carrying forward lessons learnt as to what specification works well and is available at a cost effective price. Supporting this, many projects do look for new products to enhance their appeal to the consumer or to reduce costs. Some companies pursue new products and building methods; others tend to regard the safety of tried and tested methods as being more beneficial. As a very broad generalisation, much of the house building industry tends to adopt the latter method, in line with the relatively conservative and risk sensitive attitude shown by a large proportion of the home buying market.

Specifying for sustainability will by necessity challenge common specification practices in order to secure outcomes such as energy / water efficiency and human health. All building elements from foundations to superstructure and exterior cladding to systems, kitchens and bathrooms are called into question in terms of how they perform for these outcomes. Change in any of these specifications can result in resistance from designers, builders, consenting authorities and (not least) householders. One of the major reasons that more sustainable buildings are not being delivered as a widespread market response is that all of the above parties tend to regard change, and the potential cost of change, as being unwelcome from the points of view of the process involved, and the perceptions of the homes that may result.

A wide range of considerations were therefore taken into account when researching specifications to put forward for cost appraisal. These reflect the basic desire to make the proposed specification attractive, or at least acceptable, to householders and builders, and to minimise cost and procurement barriers in promoting these specifications.

The following broad criteria were kept in mind when researching and finalising specifications:

- Market acceptance and benefit to householders.
- Market availability and ease of substitution for existing specifications.
- Cost – effectiveness and magnitude.
- Opportunities for multiple benefits – products that ‘solve’ several performance aspects, for example insulation that improves energy performance and improves health outcomes for installers and occupiers.
- Local manufacture opportunities – this reflects concerns to both limit excessive transportation of materials and products, in itself a negative environmental impact, and to strengthen the national economy.
- Diverse manufacturing impacts associated with different competing products – for example, energy consumed and waste produced in manufacture can vary enormously between products that appear to be identical at the point of installation and use.

In considering issues such as ‘market acceptance’, it is recognised that awareness of specification issues varies widely – to some home buyers the ‘specification’ of their homes is interpreted as purely the square metre size of the house, the colour of the kitchen benchtop, or the number of garage spaces.

Market research undertaken by Homestar and the Real Estate Institute of New Zealand and published while this work was in hand does however identify that home buyers do actively seek the following:

- How well a home is orientated for the sun.
- What insulation a home has.
- What heating a home has.
- Whether a home has internal moisture issues.

5.0 Preliminary specifications

It is worth noting that because Homestar applies to both new and existing properties, many specification items are effectively included already in new homes in order to meet the Building Code or market expectations.

Often environmentally certified / high performance / low-impact products are competitively priced and in widespread use as 'standard' products, in which case designers, builders and home buyers need only ensure that a particular manufacturer's product is used.

Similarly, this study also assumes inclusion of key specification items that incur negligible expense (for example, ensuring extract fans in bathrooms are wired to lighting circuits) and are therefore accounted for at nil cost, but which contribute to creating an energy efficient and healthy home. In these instances, it is again up to designers, builders and home buyers to ensure good practice is adopted.

Initial scoping of the Homestar framework and potential products considered against the specification criteria suggested the following broad directions, set against the Homestar groupings.

The list below specifically identifies items which are over and above Building Code requirements, or which may normally be included but not thought of as 'sustainable' elements.

1. Energy, Health, Comfort

- Passive solar design – orientation of rooms, sizing of windows and doors, inclusion of concrete floors or other 'thermal mass'; double-glazing; above-Code insulation in walls, floors and roofs; Energy-rated whiteware; extract ventilation fans; efficient space heating – electric heat pumps; hot water storage tank with heat pump or solar hot water sources; LED lighting (Compact fluorescent as an alternative, but these types have greater toxicity and market perception issues); covered exterior area for washing lines.

2. Water

- Rainwater storage tank plumbed into WC's; WELS-rated showers, taps, WC's and whiteware.

3. Waste

- Construction waste management; waste sorting bins in kitchen; compost bin in garden.

4. Management

- Security ventilation catches to windows; compiling a home user manual;

5. Materials

- Environmentally certified concrete/timber/insulation/paints and coatings; low-formaldehyde MDF / Ply / particleboard; low VOC-paint and adhesives

6. Site

- Provision of a vegetable garden and fruit trees; provision of native species within garden plantings

Further explanation should be given to some of the specifications excluded in the initial specifications:

- Gas space and water heating can be beneficial to achieving points under Energy, Health and Comfort; however unflued gas space heaters and 'standard' instantaneous gas water heaters (low-efficiency, non-condensing models) should be avoided for health, internal air quality or efficiency reasons.
- Renewable energy (eg solar electric panels or wind turbines) were excluded due to their site-specific considerations and potential price.
- Double-layer plasterboards and laminated window glazing for sound insulation were excluded for anticipated cost reasons.
- The provisions for "Inclusive Design", which are based on the Lifemark standard, were generally excluded due to anticipated cost and complexity. Only the lowest level of scoring (Level 3) was pursued as the implications of the items required changed little in terms of specification, and would be relatively easy to achieve within the plan of many current houses.
- Greywater re-use was excluded due to the regulatory prohibition on using this type of equipment within the urban limits of Christchurch.
- Stormwater management installations were excluded due to the highly site-specific nature of these systems, the potentially high cost involved, and the interaction with regulatory requirements that are more likely to drive uptake of this type of system rather than householder preference.
- Transport access (ie public transport) was excluded due to the location-specific variability of this element, and the lack of control (other than selecting more central development sites) that is generally able to be exerted over this issue.

IMPORTANT NOTE:

Where specific products are identified by name in this document this does not preclude other products from being suitable, subject to their performance or achievement of a particular standard. Homeowners and professionals should satisfy themselves that any equivalent product is acceptable to the Homestar performance requirements.

References to specific products are included primarily to provide evidence that suitable products are available on the market. Secondary reasons for referencing products included identifying products which might satisfy multiple performance aspects - for example, human health benefits as well as environmental impact benefits.

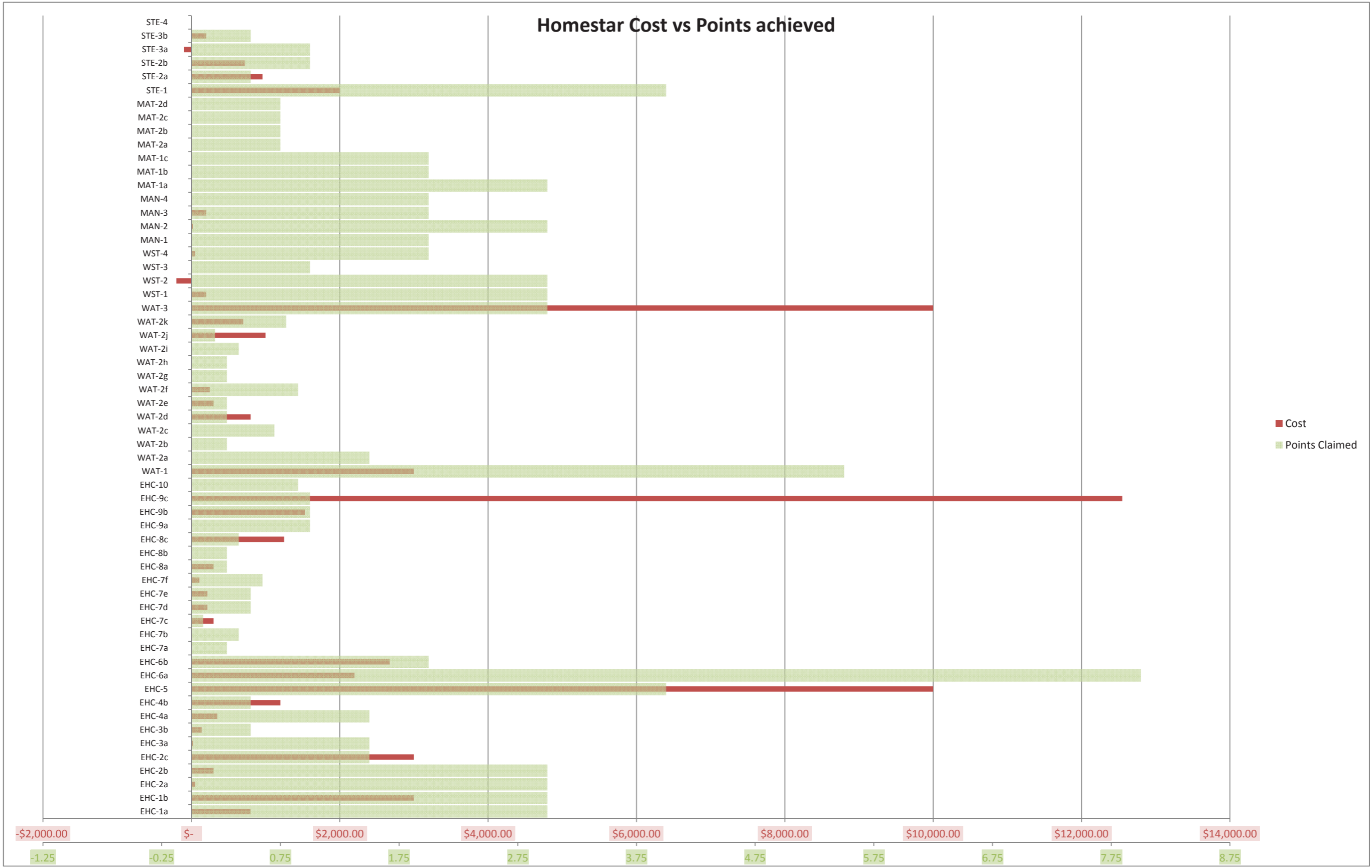
6.0 Elemental specification costs

The table below itemises specifications and costs for incremental upgrades above the baseline model. In many cases there are several upgrade steps against a Homestar category.

Category	Points Available	Points Claimed	Cost	Cost / Point	Specification	Notes
EHC-2c		0.9	\$4,600.00	\$5,111.11	Upgrade to HW Heat pump - Econergy HP4000 LT compressor head; storage tank as above (no element)	Relies on low flow showers for score
EHC-3a	2	1.5	\$42.50	\$28.33	CFL bulbs in 75% of internal fittings. All external lights have integrated daylight & movement sensor	
EHC-3b		0.5	\$140.00	\$280.00	As above, plus 25% of internal fittings are integral LED bulbs, and all external bulbs are CFL	
EHC-4a	2	1.5	\$250.00	\$166.67	2 star manual defrost fridge freezer, bottom freezer	
EHC-5	8	4	\$9,500.00	\$2,375.00	2.6kW output Solar PV panels, inverter, panels installed on north-facing roof - meets 50% of house annual demand	
EHC-6a	15	1.1	\$2,310.00	\$2,100.00	Upgrade step 1 - perimeter slab insulation only. 25mm XPS with 9mm fibrecement board glued to face.	
		2.4	\$15,180.00	\$6,325.00	Upgrade step 2 - Upgrade Ribraft waffle slab to Maxraft waffle slab for fully continuous insulation under slab, with integral perimeter insulation, plus 9mm fibrecement facing board. Omit 25mm XPS perimeter insulation. Upgrade windows to thermally broken frames and low-e glazing units. Upgrade roof insulation, add second layer of R3.2 blanket.	Ribraft does not offer fully continuous insulation under the slab and does not achieve a satisfactory R-value for Homestar purposes
EHC-7a	4.5	0.3	\$-	\$-	All washbasins/sinks and baths have overflows	
EHC-7c		0.1	\$300.00	\$3,000.00	Showerdome	
EHC-8a	1	0.6	\$300.00	\$500.00	Wall mounted fold out washing line frame, mounted externally in general garden area. 4sqm of external space dedicated to drying washing.	
EHC-8c		0.4	\$1,250.00	\$3,125.00	4sqm of polycarbonate roof on timber framing to cover washing drying area.	
EHC-9a	2	1	\$-	\$-	Habitable rooms include areas of carpet; mechanical extraction included; concrete floors. Noisy activity room enclosed, All plumbing tied back to frame with vibration isolators, eg rubber washers to each screwed fixture point.	Cost of plumbing isolation negligible in overall installation costs.
EHC-10	3	1	\$750.00	\$750.00	Lifemark Level 3: Assumes lever handles to all doors, all access doors 860 leaves (not stores/wardrobes etc), and relatively level access from parking to entrance door. Reallocate 2m2 of internal space for accessible WC.	
EHC-10b		2	\$1,680.00	\$840.00	Lifemark Level 5: Change vinyl flooring in kitchen to non-slip. Entrance door to have level access detail, include slot drain across path outside entry door. Change tile flooring in laundry and bathrooms to non-slip	
WAT-1	6	4	\$3,000.00	\$750.00	4000L above ground tank, pump and feeds to laundry and WC	Costs reported as \$2,500-3000 installed at Hobsonville Point - tank, pump, feeds to laundry and WCs
WAT-2a	6	2.2	\$-	\$-	Shower head with 9L maximum flow rate	Generally should be available at average market cost
WAT-2b		0.3	\$-	\$-	6/3L dual flush WC	Market standard installation
WAT-2c		0.7	\$200.00	\$285.71	Upgrade WC to WELS 4 star - 4.5L/3L dual flush - eg Robertson Heron Close Coupled WC or equivalent	
WAT-2e		0.3	\$200.00	\$666.67	Upgrade to WELS 4 star washing machine	Electrolux EWF1074 or LG WD11020
WAT-2f		0.9	\$700.00	\$777.78	Upgrade to WELS 5 star washing machine	ASKO W6444
WAT-2g		0.3	\$-	\$-	Upgrade Kitchen and basin taps to WELS 4 star (7.5L/minute) - eg Caroma / Dorf "Balance V" mixers	Several are available and do not appear to have a cost surcharge - cost is design not efficiency led
WAT-2h		0.3	\$-	\$-	Upgrade Kitchen and basin taps to WELS 5 star (6L/minute) - eg VCBC Crystal range mixers or Euroware TAP-CP-F0037 and TAP-CP-F0041	
WAT-2i		0.4	\$-	\$-	Upgrade Kitchen and basin taps to WELS 6 star (4.5L/minute) - eg Pacific Tapware 2000 series mixers	

Category	Points Available	Points Claimed	Cost	Cost / Point	Specification	Notes
WAT-2k		0.1	\$600.00	\$6,000.00	Upgrade dishwasher to WELS 4 star - BOSCH SMS63M18AU	
WAT-3	3	3	\$10,000.00	\$3,333.33	Greywater: Ecoplus three-toilet system plus garden irrigation addition, in-ground tank	
WST-1	3	3	\$200.00	\$66.67	Implement a site waste management plan in accordance with REBRI guidelines	
WST-2	3	3	-\$200.00	-\$66.67	90% of waste diverted for recycling, or less than 10kg/sqm sent to landfill	
WST-3	1	1	\$-	\$-	10L, 2 compartments sorting bin within kitchen - eg Hideaway KC30H, or Easy Recycling Double Bins HH2	Assumed standard kitchen design - no extra cost
WST-4	2	2	\$50.00	\$25.00	2L storage in kitchen, 240L compost bin in garden - eg, internal: Easy Recycling Triple Bins HH1 (deduct cost of bin to meet WST-3 to offset); external: Warehouse Round Compost Bin with Lid 240L	
MAN-1	2	2	\$-	\$-	No specifications to achieve. All new houses should comply. 0.5 points deducted for Cooling heat pump	
MAN-2	2	0.75	\$-	\$-	Two-step window handles. Front door facing street. Windows and fences arranged for street surveillance.	Assumes "secure locks" are standard to all doors, sensor lighting provided under EHC3, modern hot water tank installed properly to limit outflow temperature, smoke alarms fitted as standard code compliance.
MAN-2	2	0.25	\$20.00	\$80.00	Fire extinguisher (x1).	
MAN-2	2	0.25	\$200.00	\$800.00	Lockable wall mounted bathroom mirror cupboard.	
MAN-3	2	2	\$200.00	\$100.00	Time to compile owners manual, based on template document, designers drawings and installers manuals. Assume 2 hours of professional time at \$100 / hr	
MAN-4	2	2	\$-	\$-	Contractor Environmark Gold, with Environmental Management Plan, or EcoPlumber, IAONZ, EcoSmart Electrician	
MAT-1a	9	9	\$-	\$-	Environmental Choice products: Resene, Wattyl or Dulux paint; Autex, Pink Batts or Novatherm insulation; "Ecolabel" concrete from Firth or Golden Bay; GIB board to walls and ceilings. Alternatively, ISO14001 products to appropriate Chain certification - eg floor coverings from Godfrey Hirst, Feltex, Cavalier Bremworth; Concrete from Holcim.	
MAT-2a	3	0.75	\$-	\$-	Low VOC coatings - eg Resene / Dulux range	
MAT-2b		0.75	\$-	\$-	Low VOC adhesives - eg Bostik range	
MAT-2c		0.75	\$-	\$-	Low VOC carpet - eg Cavalier Bremworth, Heritage carpets Environmental Choice range, Feltex,	
MAT-2d		0.75	\$-	\$-	Any particle board, MDF, LVL, plywood and other engineered timber is low-formaldehyde to relevant AS/NZ standards. Eg Laminex Lakepine MDF, Nelson Pine Super E0 MDF, Laminex Superfine particleboard, CHH Kopine particleboards, CHH Ecoply, all CHH LVL products manufactured in NZ,	
STE-1	3	1	\$-	\$-	75% permeable site beyond roof footprint. No additional cost assumed for grass, soft planting.	Allows for approx 50sqm impermeable parking and patio on a 300sqm section
STE-2a	1.5	1	\$1,680.00	\$1,680.00	25% of site area (excluding under roof) planted with mix of 5 native species mix suitable for domestic garden. 4 plants per sqm, pb5 and pb8 mix. Offset cost against saving in seeded lawn. Christchurch species.	
STE-2b		0.5	\$1,680.00	\$3,360.00	Additional 25% of site area (excluding under roof) planted with mix of 5 native species mix suitable for domestic garden. 4 plants per sqm, pb5 and pb8 mix. Offset cost against saving in seeded lawn. Christchurch species.	
STE-3a	1.5	1	-\$100.00	-\$100.00	4sqm exposed topsoil in garden. Offset cost against saving in seeded lawn.	
STE-3b		0.5	\$200.00	\$400.00	Four fruit-producing trees, pb8.	

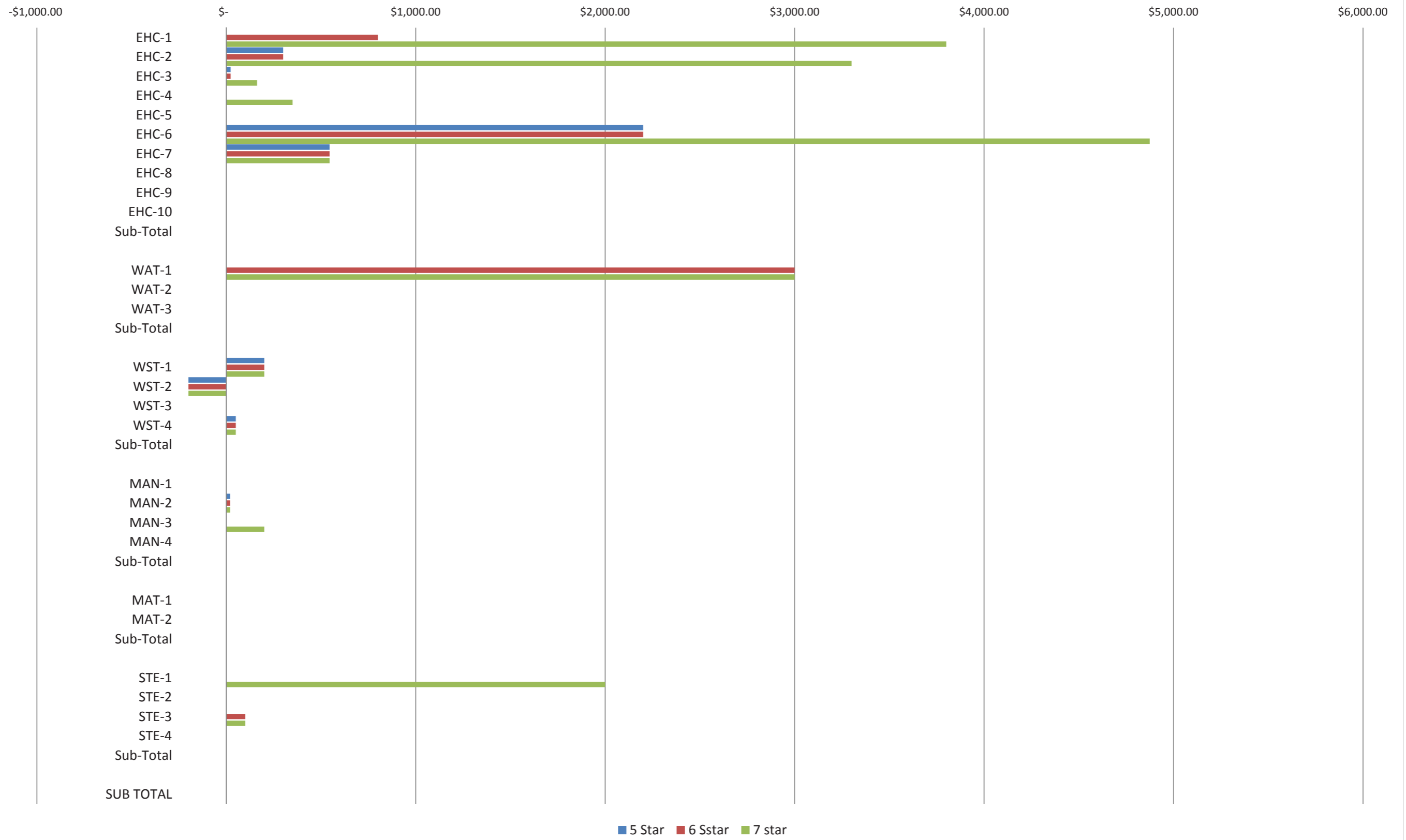
Homestar Cost vs Points achieved



8.0 Specification and cost packages

Ref No.	Baseline		4 star		Cost	5 Star		Cost	6 Star		Cost	7 Star		Cost
	Notes	Score	Upgrade Specification	Score		Upgrade Specification	Score		Upgrade Specification	Score		Upgrade Specification	Score	
EHC-1	High Wall heat pump for living; no installation for rest of house	4.1		4.1		Slab perimeter insulation	4.2			4.2		Continuous underslab insulation, thermally broken window frames with low-e glazing, additional R3.2 ceiling insulation	4.5	
EHC-2	Mains pressure 300L	2	Limit shower flow to 9L per minute	2.7			2.7			2.7			2.7	
EHC-3									90% internal lights Compact Fluorescent or LED, 100% external lights movement and daylight switched	1.5	\$182.50		1.5	
EHC-4									2 star manual defrost fridge freezer, bottom freezer	1.5	\$250.00	Upgrade to 4 star (energy) dishwasher	2	
EHC-6	R2.6 in walls. R3.2 in roof. No floor insulation. Solid Alu framed Double Glazed	10		10		Slab perimeter insulation - 25mm XPS faced with 9mm fibre cement board for protection	10.5	\$2,310.00		10.5		Continuous underslab insulation, thermally broken window frames with low-e glazing, additional R3.2 ceiling insulation	11.5	\$15,180.00
EHC-7	Extraction, openable windows, slab membrane, no open flues	1.9	Overflow containment to baths, basins	2.2		Slab perimeter insulation, window security latches	3			3		Slab upgrade	4.1	
EHC-8	Loation shown on drawings but no spec								Washing line - wall mounted rack in dedicated outdoor space	0.6	\$300.00	4sqm of polycarbonate roof on timber framing to cover washing drying area.	1	\$1,250.00
EHC-9	Mechanical extract fans, noisy activity rooms enclosed	0.86	Rubber washers to isolate pipework mounts in walls	1.14			1.14			1.14			1.1	
EHC-10												Lifemark Level 5.	3	\$2,430.00
WAT-2	Any new dishwasher, any new washing machine	0.5	WELS 3 star shower (9L/min), WELS 4 star WC (4.5/3L dual flush), WELS 6 star taps (4.5L/min)	4			4			4		Upgrade washing machine to WELS 5 star and Dishwasher to WELS 4 star	5.3	\$1,500.00
WST-1			REBRI site management plan	3	\$200.00		3			3			3	
WST-2			90% site waste diverted from landfill	3	-\$200.00		3			3			3	
WST-3			2 compartment recycling sorting bin in kitchen	1			1			1			1	
WST-4			Bin in kitchen for gathering compost waste and external composting bin	2	\$50.00		2			2			2	
MAN-1	Heat pump with cooling ability reduces score	1.5		1.5			1.5			1.5			1.5	
MAN-2	Front door faces street, hot tank temperature, smoke detectors	0.75		0.75		Window security latches	1		Windows and fence arranged for street surveillance. Fire extinguisher. Lockable bathroom cupboard.	2	\$220.00		2	
MAN-3									Time to compile owners manual, based on template document, designers drawings and installers manuals.	2	\$200.00		2	
MAN-4									Environmental Management Plan in operation on site.	1			1	
MAT-1						5 x Environmental Choice products	9			9			9	
MAT-2			TVOC (coatings) and VOC (adhesives & sealants, floor coverings) within limits, low formaldehyde engineered timber	3			3			3			3	
STE-2												50% of site area (excluding under roof) planted with mix of 5 native species mix suitable for domestic garden.	1.5	\$3,360.00
STE-3			Dependent on bedrooms: 3-4sqm vegetable garden	1	-\$100.00		1		Dependent on bedrooms: 3-4sqm vegetable garden and 3-4 Fruit trees	1.5	\$200.00		1.5	
TOTALS		21.61		39.39	-\$50.00		50.04	\$2,310.00		58.14	\$1,352.50		67.2	\$23,720.00
Score adjusted for dwelling size		22.6		41.2			52.4			60.9			70.4	
Score possible for smallest		24.3		44.4			56.3			65.5			75.7	
Score possible for largest		20.2		36.9			46.9			54.5			63.0	

Expenditure Profile for 5-6-7 Star





9.0 Conclusions

9.1 Key results

This study suggests that Homestar ratings for a sample 4 bedroom / 157sqm new house in Christchurch can be achieved for the following additional construction costs.

- 5 star rating: +\$2,260
- 6 star rating: +\$3,612.50
- 7 star rating: +\$27,332.50

9.2 Observations

This study also suggests that:

- Changes in design and specification needed to achieve 5 to 7 Star ratings can be achieved in many cases using widely available market products and without major changes to construction methods.
- That Homestar prioritises a passive solar approach which is strongly recognised in the home buying market as desirable and highly appropriate to the Christchurch "heating" climate.
- Homestar also incentivises smaller dwellings; while based on environmental outcomes, this could also support other measures to increase housing affordability.
- Many of the 'easy win' specification items include water saving items. While issues around water (cost, infrastructure demands) have relatively low priority in the home-buying market, the potential to reduce infrastructure demands could be a high value consideration for Council.

Additional observations:

- Any cost increases will be most noticeable in the lower value market segments, where additional costs represent a higher proportion of the construction and selling values.
- Based on experience of increasing building performance requirements through building codes and planning requirements, both locally and internationally, the cost of more expensive upgrade items can be expected to fall over time as supply increases and specifications become standard practice.

9.3 Qualifications

The study does not directly address the following:

- The cost of undertaking the Homestar assessment - including direct fees and indirect overheads for designers, developers and builders. Costs will undoubtedly apply under these headings, but these can be hard to quantify at present. Assessment fees are being examined by Homestar at present with the intention of achieving a low, cost-effective price point. It is also fair to expect that indirect overhead costs may initially be high while those involved in developing homes become familiar with a new approach and adjust their practices, but once practices change this can reasonably be expected to be absorbed within current cost margins. Homestar assessments can be undertaken quickly and with a high degree of certainty, potentially posing relatively low risk for developers compared to other elements of compliance.
- Costs have not been directly identified in relation to achieving a passive solar design layout. This approach was taken due to the variability of site-based factors (eg orientation, shading, site proportions) and the difficulty of identifying a baseline of how well typical market housing is currently performing. It is suggested that this is primarily a design agenda rather than a direct cost agenda - that is, good design will be able to create a good passive solar layout on many sites by using the same floor area and cost budget, notwithstanding site issues such as shading from neighbouring trees.
- Escalation of costs. The figures and specifications provided apply to market data as at November 2013.
- Extrapolation of construction costs to end sales costs as presented to the consumer, which would require taking account of varying development costs and profit margins, and GST.
- Analysis of the impacts of these costs for different dwelling sizes and market price points. This would be a worthwhile investigation to understand how any policy provisions may affect important issues such as affordability in lower market segments.
- Full cost-benefit analysis taking account of potential savings that householders can reasonably expect to realise through reduced energy and water consumption.
- Apartments. Homestar has developed capacity for apartment assessment, which recognises the different attributes and opportunities associated with different building and land use forms, at the time of undertaking this study. However, this typology was not included in the scope of work, and should be investigated separately should Council want to establish costs for this type of home.

9.4 Policy implications

Operative issues:

- Potential endorsement of Homestar in the District Plan would create a crossover between Resource and Building Consent information. This is due to the need to identify detailed building specifications earlier than normally documented in the development process, and the potential need to monitor detailed construction compliance beyond normal planning data. Potential impacts of this on the design, consenting and development processes may be significant. Management of this would need careful consideration; achieving a simple, workable system should be addressed as early as possible. Provision should be made for flexible evolution of detailed designs and specification between Resource Consent and Building Consent.
- Provision for correlation of revisions between the independently controlled District Plan and Homestar mechanisms would be necessary. Consideration should be given to creating a transparent 'roadmap' for how policy will recognise any changes in the Homestar tool, what the timescale for adopting any changes would be, and what timescale would be associated with any incremental increase in requirements over time.

