homestar®

v5.1 Technical Manual

version 5.1.0 for public release

Issue Date: March 24, 2025

NZGBC

TE KAUNIHERA HANGANGA TAUTAIAO

Purpose Statement

This document is to provide a comprehensive reference framework for Homestar Professionals who have completed their Homestar Designer and/or Assessor training to refer to during their engagement with Homestar Projects and Homestar NZGBC.

It outlines processes, standards and expectations on an administrative and technical level and should be considered the default initial reference document for queries relating to the implementation of Homestar.

This document is intended as a guide and whilst best efforts have been made, we cannot guarantee this document to be free from error. If you have concerns, please seek clarification at homestar@nzgbc.org.nz.

V5.1 exists to provide updated and clarified technical refinements to the tool.

UPDATED CREDITS

	Updated Credit.
1	EF4: Energy Use
2	HC2: Summer Comfort
3	HC3: Ventilation
4	HC4: Moisture Control
5	HC7: Healthy Materials
6	LV3: Eco-Friendly Living
7	LV4: Sustainable Transport
8	LV5: Adaptation and Resilience (NEW)
9	EN2: Embodied Carbon
10	EN3: Sustainable materials

** See also changes in Appendix B, C
*** Note that changes which include in-text changes have been highlighted in grey or/and by a sideline stroke |

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Whakamihi - Acknowledgements

Transforming the market takes more than a rating tool, it takes the whole industry working together - to build better homes for Aotearoa.

Homestar would not be possible without the input of valued experts and stakeholders from across the building industry, whose experience and insights helped us create a tool that sets an achievable challenge to guide industry towards building the healthy, warm and sustainable homes that all Kiwis deserve.

We would like to extend a warm thank you to all those that participated in various consultations and focus groups, provided one-on-one feedback, carried out technical analysis and testing, reviewed our drafts and continue to support this work. We would particularly like to acknowledge the following people and organisations for their contributions:

Please note that Organization attributions are, as the time of collaboration and consultation, and may not reflect current designation or organisation.

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Bupa	Metro Glass	Universal Homes
Ecubed Building Workshop	Ōtautahi Community Housing Trust	Urban Plus
Fletcher Building	Oceania Healthcare	Waka Kotahi
Green Gorilla	Panuku Development Auckland	Warren and Mahoney
Kāinga Ora	Raven Architecture	Waste Management
Lumen	Sustainability Trust	Watercare

New Zealand Green Building Council Team

Homestar v5 (5.1 is an iterative change to this) is our most ambitious rating tool development programme yet, and the culmination of more than a year of stakeholder and expert consultation, planning, technical design, testing and compilation. This tool would not be possible without many hours of work by the team at NZGBC. The following are our team members directly involved in the Homestar v5 programme, however we acknowledge the entire NZGBC team and their passion for transforming the built environment for the better.

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Introduction to Homestar

Homestar is a comprehensive nation-wide residential rating tool that evaluates the environmental and design attributes of New Zealand's homes; providing a scale that creates value around warm, healthy, sustainable, and efficient dwellings.

Homestar Background

The rating tool was released in 2009 as a result of a joint venture between BRANZ, Beacon Pathway and the New Zealand Green Building Council (NZGBC) for existing and new dwellings in New Zealand. It is now operated solely by the NZGBC. Based on a number of successful international rating tools, it was developed for Aotearoa's specific conditions in consultation with an Expert Reference Panel made up of industry professionals. The tool is periodically updated in response to industry feedback and development, leveraging on the expertise of stakeholders across the industry.

Aims and Objectives of Homestar

The overarching objective of the Homestar rating tool is to improve the performance and environmental impact of new and renovated New Zealand dwellings, making them warm, healthy, comfortable places to live. This also helps Aotearoa achieve its obligations under the Paris Climate Accord. To this end, the Homestar rating tool aims to:

1. Establish a common language and standard of measurement for efficient, comfortable, healthy homes.
2. Address key sustainability issues faced by New Zealand such as construction waste, as well as housing quality issues such as inadequate heating and ventilation.
3. Provide advice that enables the building and construction industry to produce targeted solutions that deliver results for owners and tenants.
4. Create a value proposition for investment into the attributes that improve the performance of New Zealand dwellings, by rewarding good design with a higher rating.
5. Raise awareness of the benefits of sustainability for owners and tenants and the construction industry.

A formal certified rating carried out by a Homestar Assessor shows exactly how a home rates across several sustainability criteria on a scale of 6 stars to 10 stars.

How Homestar Works

A Homestar Rating is an assessment of achievement within categories and credits that provide solutions to improving the health, comfort, sustainability, and quality of New Zealand homes.

Eligibility

The Homestar tool allows all types of dwellings to be rated. To be assessed, a dwelling must be considered as being 'self-contained' with the following minimum requirements:[1]

- At least one bathroom with toilet and shower or bath.
- At least one kitchen or kitchen area which must include a cooking appliance (e.g. oven, stove, microwave), a food preparation area and food storage space.
- Constructed on permanent foundations.

Categories

The Homestar tool is divided into four categories that form the key foundations of Homestar. Within each category are credits that address specific areas relating to that category.

1. Efficient

This category rewards smaller dwellings and residential developments with smaller footprints that consequently require fewer resources to build, operate and occupy, and attributes that contribute to a reduction in energy and water use within the dwelling.

2. Healthy and Comfortable

Rewards dwelling attributes that contribute to occupant comfort and health, such as ventilation, moisture control, acoustics, and natural light. It also recognises interior finishes that minimise the detrimental impact on occupant health from products that emit pollutants such as Volatile Organic Compounds (VOCs).

3. Liveable

Rewards safe, secure and adaptable dwellings.

4. Environmentally Responsible

Rewards dwelling attributes that contribute to having a lower environmental impact through responsibly sourced materials, effective stormwater management and measuring and reducing embodied carbon.

[1] More information about minimum requirements for dwellings, including sizes of kitchen areas (Clause 7) and bedrooms (Clause 8) can be found in the Housing Improvement Regulations 1947, http://www.legislation.govt.nz/regulation/public/1947/0200/latest/DLM3505.html

Points and Star Bands

Homestar rates a home on a scale of 1 to 10 stars; however, only those achieving a 6 to 10 Homestar Rating can be 'certified'. These stars correspond to the total number of points achieved against the Homestar credit criteria within each category, as well as the mandatory minimums met. There is a total of 132 points available within the tool for apartments and terraces, and - 130.5 for standalone homes, as well as 10 innovation points.

Star Bands	
Rating	Required Score
6 Homestar	60 – 69.9 points
7 Homestar	70 – 79.9 points
8 Homestar	80 – 89.9 points
9 Homestar	90 – 99.9 points
10 Homestar	100+ points

The assigned weight of each category (i.e. the number of points allocated to each category) was developed in consultation with the Expert Reference Panel (ERP) and in consideration of national and international precedents set within other relevant frameworks. The weightings have been fine-tuned to reflect the New Zealand built environment and the objectives of Homestar.

Category	Points Available	
	Apartments and Terraces	Standalone Homes
Efficient	39	39
Healthy and Comfortable	49	47.5
Liveable	13	13
Environmentally Responsible	31	31
Total	132	130.5
Innovation	10	10

To ensure a baseline standard, several key areas have mandatory minimum levels that must be achieved for a particular star rating. These mandatory minimum levels are outlined in the section titled "Mandatory Minimums".

Types of Homestar Assessments

5. Design Rating

A full assessment of a proposed dwelling based on detailed plans, specifications and any other documentation required to fully describe the build. A Design Rating is a checkpoint on the path to a Homestar Built Rating and expires two years after being issued.

6. Built Rating

A physical inspection of a completed dwelling by the Homestar Assessor. It can be conducted on an existing property without a prior Homestar Design Rating. If a Homestar Design Rating has been completed, the documentation may be used to streamline the process for a Homestar Built Rating.

7. Homestar Ready Design

Where a developer has standard house designs and specifications, aspects of these designs relating to various Homestar credits may be pre-assessed. Homestar Ready designs can be re-used for subsequent projects within applicable climate zones.

Types of Homestar Professionals

NZGBC trains and accredits industry professionals to promote Homestar within the market, advise home builders and owners on what the scheme entails, design homes to meet Homestar requirements, and carry out assessments. There are two professional accreditations:

1. Homestar Designer

Homestar Designers are trained to design and advise on the technical aspects of Homestar and the principles of sustainable design, so that they can apply this knowledge when working on a Homestar project. Homestar Designers are taught and have access to use the Energy and Carbon Calculator for Homestar (ECCHO) modelling tool.

2. Homestar Assessor

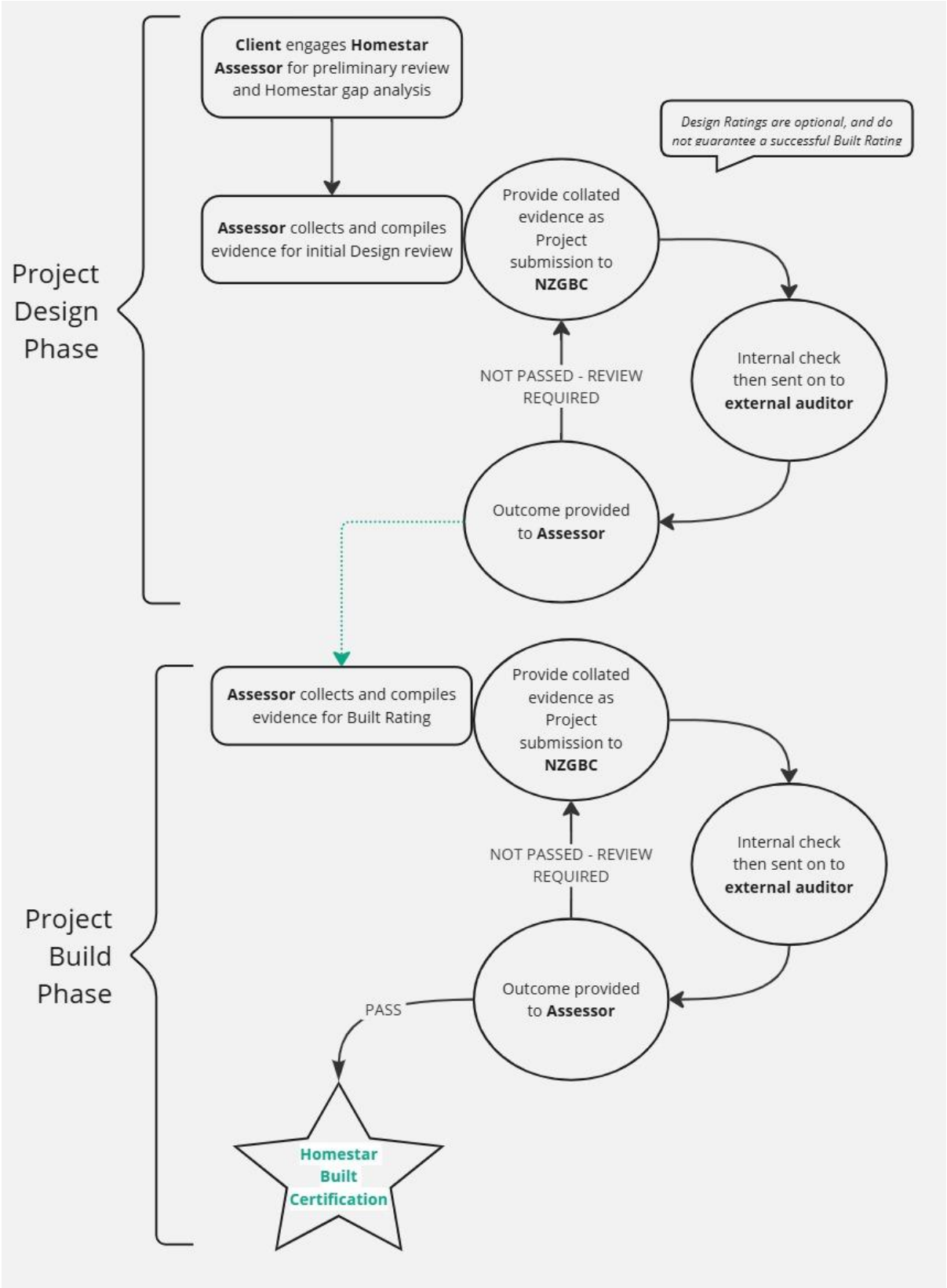
Homestar Assessors are responsible for compiling and submitting a project to NZGBC ready for auditing and certification. A Homestar project can only be submitted by an accredited Homestar Assessor.

The Homestar Practitioner accreditation no longer exists. It has now been replaced by the Homestar Fundamentals course which provides useful background information about the Homestar tool and is a prerequisite for the other courses but is not a formal accreditation. However, professionals with this previous accreditation are still recognised and points can be claimed for having this qualification in the relevant credit.

Homestar Auditors

Homestar assessments submitted to NZGBC are audited prior to the rating being confirmed. Experienced Homestar Assessors may be invited to become Homestar Auditors.

The Homestar Process



Registration

The first step in the Homestar process should be to contact a Homestar Assessor to discuss the viability of the Project. The Project will then need to be registered online at www.nzgbc.org.nz - this can be done by the client, or a representative - which can be the Homestar Assessor.

For large (30 or more dwellings) or complex (10 or more typologies) projects, consulting with NZGBC prior to registration is recommended.

Admin and Audit Fees

Each Project is invoiced an all-in NZGBC fee. This fee includes all NZGBC administration, processing and certification within the standard pipeline; and is determined by the count of typologies and dwellings in the Project.

Each Project is allowed two submission rounds for Design, and two submission rounds for Built. Note that Design submissions are optional, and do not generate a dwelling certification.

There may be additional costs for the following extras:

- Project amendments
- Energy modelling audits
- Technical Questions
- Additional audit rounds

Compiling a Submission

It is necessary to collect documentation to evidence the points claimed for the Homestar rating. The documentation requirements are noted in each credit, along with whether that documentation needs to be submitted with your assessment.

Submitting an Assessment

The Homestar Assessor must collate all the required audit documentation within the relevant credits in the Homestar submission folder and submit this, along with the completed Homestar scorecard and calculators, to NZGBC for audit. Please refer to Appendix G for further information on how to compile a good submission.

Proforma of Credit Compliance

Rather than submitting evidence, the Homestar Assessor may confirm compliance with the credit criteria by using the Pro forma of Credit Compliance for the following credits: HC6, LV2, LV3, LV4, EN1 and EN6. The Pro forma also includes a mandatory section for onsite flow rate testing for EF3.

If the Assessor does not wish to use the Pro forma, they may instead choose to provide the evidence listed for relevant credits in the Pro forma.

Audit Process

NZGBC is responsible for ensuring each assessment has been completed accurately and is consistent with Homestar Assessor guidance provided within the Homestar Technical Manual through an independent audit process. This is a desktop audit and not a peer review of the submission.

Two submission rounds are permitted so that the Assessor may submit further evidence or address any identified issues. If a third or subsequent rounds are required, these are charged as per the 'audit' component of the Homestar admin and audit fee.

The general principle applied to audit is that the Homestar Assessor takes responsibility for ensuring:

- All required documentation is included and is up to date.
- The submission contains the relevant documentation (highlighted or indicated as appropriate).
- The documentation is organised in an efficient filing structure with concise file names.

The role of the Auditor is to check that the supplied documentation meets the requirements of the Homestar Technical Manual. The general principles applied to audit are:

- The submission is complete, with accurate, relevant and precise information.
- Sufficient work is undertaken to verify that the documentation meets the credit requirements.
- Audits are handled confidentially and consistently across all projects.

Should the submission be deemed insufficient or incomplete, NZGBC will respond to the Assessor with questions. If a submission is deemed grossly insufficient, the Auditor may reject the submission without fully scrutinising all credits and request a fresh submission.

Audit Results

Following each audit round, the Homestar Auditor will provide responses to the Assessor in the following format:

Confirmed: all required documents have been submitted for the credit reviewed and based on these documents, points have been awarded correctly.

Confirmed with Comments: the submission contained documentation or interpretation errors for the credit reviewed that do not affect the points awarded in the credit but need to be noted for future assessments.

Not Confirmed: submission contains significant errors that affect the points awarded. The Assessor is to review the credit and alter/award points accordingly. If points still have not been confirmed at the end of the second audit round, a Homestar Assessor may apply for a Charged Credit Review.

Rating Adjustment

If a submission contains a significant number of not confirmed credits, a rating adjustment (i.e. change in star rating) may be required. Should this occur, and the Assessor is not

satisfied with the resulting rating, they will be given the opportunity to appeal against the decision at their own cost. Any projects that fail to achieve a 6 Homestar rating will be recorded against the Assessor. If this occurs on multiple occasions during a single accreditation cycle, the Assessor will be required to complete further training before they may renew their qualification.

Homestar Ready Design

The NZGBC has introduced a Homestar Ready Design process to efficiently certify large numbers of homes that share the same standard design and specification, but which are built across multiple sites. Homestar Ready Design enables the common elements of the dwelling design to be assessed once and then awarded to future dwellings that use this same standard design.

The Homestar Ready process allows projects to access the benefits of standardisation, including:

- Increased certainty that common design, processes and materials comply with best practice benchmarks.
- Increased marketing opportunities and ability to demonstrate corporate leadership in sustainability.

Achieving Homestar Ready designs demonstrates that an organisation can deliver sustainable homes as standard practice.

Process

There are two main stages in the Homestar Ready process:

1. Standard Design Assessment

The assessment follows the normal design rating process with the same documentation requirements, however targeted points do not have to be sufficient to achieve a Homestar rating. Only credits that relate to items that will be consistent across all dwellings built using the standard design should be submitted. Standard Homestar definitions of typologies and variants apply.

In addition, a Quality Assurance process will be submitted for review and approval by the NZGBC. This must be followed during the construction of any dwellings using this standard plan and must contain a component for each credit reviewed at the standard design assessment stage.

Points achieved following the standard design assessment will be totalled and a Homestar Ready assessment summary certificate awarded. A standard design that meets the 6 Homestar mandatory minimums and achieves at least 40 points under the design assessment may be marketed as 'Homestar Ready'. For a design that achieves fewer than 40 points, the points will still be valid, and a certificate will be issued, but the design cannot be marketed as 'Homestar Ready'.

Following this, the plan owner shall collaborate with Assessors to develop an onsite checklist based on the Homestar Ready assessment summary that can be integrated into the quality assurance process.

2. Individual Project Assessment

When projects that are based on a Homestar Ready design are registered, this will be indicated to the NZGBC, so the pre-assessed designs can be linked to the project.

Homestar Ready assessed credits only require sufficient documentation to demonstrate that the standard design has been built according to the pre-assessed design. Site-specific credits not assessed at the Design Assessment stage must be submitted following the normal Homestar requirements.

Using the Homestar Tool

The Homestar Tool consists of the Scorecard, Calculators, and the Technical Manual. Each serves an essential purpose in helping to complete a Homestar assessment.

The Homestar Scorecard

The Homestar Scorecard enables Assessors to record points awarded for credits, for Auditors to confirm/or deny those points and for both Auditors and Assessors to comment or respond to comments.

The scorecard comes in two parts:

- Project-wide credits scorecard: complete only once for each project
- Typology-based credits scorecards: complete for each typology within the project

Both parts of the scorecards have the Design Rating section on the right covering two rounds and the Built Rating section on the left covering two rounds. The awarded and confirmed points as well as the comments for each round and rating stage is on one page to allow the Auditor to easily reference previous rounds and stages. The total points claimed by the Assessor and/or confirmed by Auditor at each round is shown at the top of each typology-based credits scorecard. This total includes the points claimed/confirmed for project-wide credits as well.

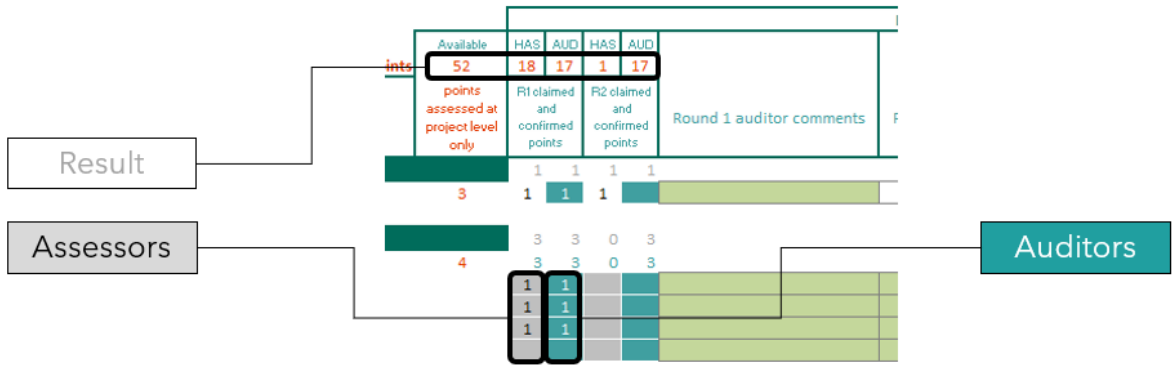
Coversheet and Change Log

The scorecard file also includes a change log and a coversheet where general project details such as location can be entered, the points for EF2: Urban Density can be calculated, and where the point summary for the whole project across all typologies can be seen.

Completing the Scorecards

Points for EF2: Urban Density are transferred automatically to the project-wide credits Scorecard. Given the limitations of MS Excel, this means that all rating stages and rounds will show the points currently claimed, not what was claimed at that stage. However, due to the nature of the credit, this is unlikely to change across stages. For all other credits, all values must be entered manually, including the points calculated using the provided calculators. This allows the same calculator file to be used across all stages and audit rounds while ensuring that the points recorded for past auditing rounds do not automatically change. It also ensures cross-platform reliability and performance.

In general, the grey cells can be modified by Assessors and the green cells may be modified by the Auditor only. The Auditor will award some or all the points in the 'Point Award' column. If points are awarded despite all required evidence not being sighted, the Auditor may select 'No' in the 'All Evidence Sighted' column to notify the Assessor. This may be used when outstanding evidence is expected at the next rating stage. The Auditor will then write comments, and these are highlighted using a traffic light system.



The final points tally (both targeted by the Assessor and awarded by Auditor) and the Star Rating can be seen at the bottom of the scorecard. You can also see the mandatory minimums milestones which will help both the Auditor and Assessor to verify if the mandatory minimums have been met.

Homestar Calculators

Homestar Calculators are provided to assist with calculating points for certain credits. Where a calculator is used, the calculated points still need to be transferred manually to the appropriate scorecard.

Energy and Carbon Calculator for Homes (ECCHO)

ECCHO is a comprehensive, whole-house, thermal performance and carbon calculation tool based on the Passive House Planning Package (PHPP) developed by the German Passive House Institute. This tool forms the primary compliance pathway for several credits. Refer to Appendix B for guidance on how to use ECCHO.

ECCHO allows you to see how your current design performs and to experiment with different variables that influence energy demand and emissions; from walls, roofs, floors, and windows, through to size, orientation, heating and hot water systems.

Homestar Embodied Carbon Calculator (HECC)

HECC is an embodied carbon calculator for standard constructions used commonly in NZ residential construction, developed for NZGBC by BRANZ.

Other Calculators

NZGBC also provides an Excel-based Homestar Calculation tool that includes the following:

Sheet	Credits
Summary	EF1
Overheating Risk Checklist	Determines eligibility for ECCHO
Water Calculator	EF3, EN5
Daylight Calculator	HC5
Materials Calculator	EN3, HC7
Adaptation & Resilience Checklist	LV5

Homestar Calculators by Credit		
Credit Name	**Calculator Used**	**Location**
EF1: Resource Efficiency	Coversheet	Homestar Scorecard
EF2: Urban Density	Coversheet	Homestar Calculation Tool
EF3: Water Use	Water Calculator	Homestar Calculation Tool
EF4: Energy Use	ECCHO or other*	ECCHO
HC1: Winter Comfort	ECCHO or other*	ECCHO
HC2: Summer Comfort	ECCHO or other*	ECCHO
HC5: Natural Lighting	Daylight Calculator or other*	Homestar Calculation Tool
HC7: Healthy Materials	Materials Calculator	Homestar Calculation Tool
EN1: Renewable Energy	ECCHO	ECCHO
EN2: Embodied Carbon	HECC or other*	HECC or other
EN3: Sustainable Materials	Materials Calculator	Homestar Calculation Tool
EN5: Site Water and Ecology	Water Calculator	Homestar Calculation Tool
LV5: Adaptation and Resilience	Climate Change Checklist	Homestar Calculator Tool

* see credit for details on alternative pathways

Credits

Each Homestar credit within the four categories is set out in a consistent manner:

1. **Credit Title**: name of the credit.
2. **Summary Table**: contains points, mandatory minimums, aim (purpose of the credit), whether it is project-wide and if there is a calculator available.
3. **Credit Criteria**: benchmarks or requirements to achieve points for the credit along with associated points.
4. **Evidence**: documentation required to be submitted for both Design and Built Ratings.
5. **Assessment**: Instructions for assessing the credit.

Terminology

Typologies

Typologies are designs that are repeated for multiple dwellings within the same development. Grouping multiple dwellings into a typology allows for a streamlined documentation process by only requiring one set of documentation to be submitted for most credits per typology. Only the 'worst case scenario' dwelling of each typology is assessed. The resulting points for that dwelling are then applied to all dwellings of that typology. All dwellings within a typology must meet or exceed the points claimed within each credit for that typology. The Homestar registration fee is dependent, In part, on the number of typologies in a project.

All dwellings within a typology must have the same:

- Number of bedrooms
- Number of bathrooms
- Conditioned floor area +/- 10%
- Claimed performance of specified (Design) or installed (Built) components (see below list)

The performance of installed or supplied components within each typology must be consistent across all dwellings when points are targeted based on this component. There can be variation in type of component, but the associated performance level must be the same. Where variation exists, documentation demonstrating equivalence must be submitted.

The performance of specified (Design) or installed (Built) components must be the same for the following (where points are being targeted):

- Plumbing fittings and fixtures: water efficiency
- Appliances: energy consumption and water efficiency (EN1 only)
- Lighting: total wattage +/- 10%
- Heating systems: type and efficiency
- Ventilation systems: ventilation rate and type

Within a typology, there may be variations that must be considered when determining the worst-case representative of that typology.

Variations within typologies

Dwellings within the same typology may have different orientations, be on the edge or in the middle of a row of units or be on different floors of an apartment block. This affects heating and cooling energy demand, and thus the overall energy-use and associated carbon emissions. For example, a dwelling in the middle of a row of terraces may have a lower heating demand than a dwelling at the end, due to the middle dwelling having fewer external walls to lose heat through.

Therefore, to determine the worst-case representative within each typology for EF4, HC1 and HC2, a separate ECCHO file must be completed and submitted for each instance within a typology where one of the following varies:

- Orientation +/- 45 degrees
- Glazing R-value and g-value (or SHGC) +/- 5%
- External wall area +/- 10%
- Floor construction R-value
- Roof construction R-value

From these files, the result from the worst-performing dwelling in each credit will determine the points for that credit.

Use the dwelling with the least amount of glazing and/or most likely to have significant shading to determine points for each typology under HC5.

Rating

The points achieved by the "worst case" dwelling determine the Homestar rating for each dwelling within a typology. However, a project may wish to demonstrate the energy, and carbon performance of dwellings that perform better than their counterparts within the same typology. In this case, NZGBC suggests separating the better performing dwellings out into separate typologies.

Area Definitions

Habitable Area

The Habitable Area of a dwelling is the total internal floor areas of bedrooms, lounge/living rooms, dining rooms, open plan kitchen areas, studies and entertainment rooms. For a typical studio, this will be the combined living, kitchen, dining and sleeping area. Habitable area excludes washrooms, laundry rooms, passageways, separate kitchens, garages, etc.

Habitable Area (areas not listed to be treated based on similar spaces below)	Ground floor	Upper floors
Bedrooms	✓	✓
Living, dining, study, entertainment, and open plan kitchen areas	✓	✓
Separate kitchens		
Passageways within dwelling		
Bathrooms, toilets, and laundry areas		
Closets and storage spaces		
Conservatories and winter gardens within the thermal envelope		
Thickness of internal walls		
Thickness of external walls		
Stairwells		
Lift shafts (internal to dwelling)		
Lift shafts (in common areas e.g. in apartments)		
Service cavities		
Habitable attic spaces (conditioned, upper floors only)		

Conditioned Floor Area (CFA)

Conditioned Floor Area is the space that is within the thermal envelope of the dwelling and could maintain a temperature band of between 20-25 degrees Celsius for 365 days of the year. Areas within the thermal envelope with a head height less than 1.5m (typically attic storage) are excluded.

Any area taken up by a staircase should be included and shared across the storeys accessed by the staircase.

Corridors outside apartments are not included within the conditioned space of these apartments.

In a standalone house, CFA will typically follow the insulation on the exterior of the house (but measured from the final Internal wall finish, e.g., inside line of GIB). If there is a garage, it is generally not included, but can be considered part of the conditioned space provided it is fully insulated with an insulated and sealed garage door.

For terraced houses and apartments, the CFA includes the area taken up by internal partitions but does not include inter-tenancy walls. Corridors outside apartments are also not included.

Conditioned Floor Area (areas not listed to be treated based on similar spaces below)	Ground floor	Upper floors
Bedrooms	✓	✓
Living, dining, study, entertainment, and open plan kitchen areas	✓	✓
Separate kitchens	✓	✓
Passageways within dwelling	✓	✓
Bathrooms, toilets, and laundry areas	✓	✓
Closets and storage spaces	✓	✓
Conservatories and winter gardens within the thermal envelope	✓	✓
Thickness of internal walls	✓	✓
Thickness of external walls		
Stairwells	✓	
Lift shafts (internal to dwelling)	✓	✓
Lift shafts (in common areas e.g. in apartments)		
Areas within the thermal envelope with a head height < 1.5m		
Service cavities		
Habitable attic spaces (conditioned, upper floors only)		✓
Common corridors, lobbies, and other common spaces in apartments		
Fully enclosed garages and storage areas on permanent foundations		
Club houses and other permanent outbuildings within development		
Mezzanines and voids above other internal spaces (upper floors only)		✓
Balconies (upper floors only)		

Pergolas, carports, and other semi enclosed external spaces		
Hard landscaping and decks not on permanent foundations		
Sheds and other enclosed buildings not on permanent foundations		

Building Footprint (BF)

The Building Footprint (BF) is the area of land that is taken up by the permanent foundations of the dwelling (including ANY other fully enclosed outbuildings with permanent foundations that are associated with the dwelling). This is measured as the total floor area of the ground floor, including the area taken up by the external walls, lift shafts, service cavities, stairwells, garages, ground level conservatories, permanent outhouses, fully enclosed permanent waste storage areas, and any permanent buildings used by the occupants.

If a dwelling is raised above ground level on columns or other structures, the BF must be measured from the lowest floor of the dwelling.

Areas that will NOT normally count towards the building footprint include hard landscaping, pergolas, carports, and other semi enclosed external spaces. Garden sheds will not count unless they are built on a permanent solid foundation and are fitted out as habitable space with heating, lighting, and power. Green roofs cannot be deducted from the building footprint calculation.

In terraced houses and apartments, the BF is calculated across the whole building block. For staggered dwellings where the upper floors may be larger than the ground floor, the BF will still be measured at the ground floor.

For mixed-use residential where other non-residential occupied spaces form the ground floor or other floors, the building footprint area must be measured as the net floor area of the lowest floor of the residential section. Where this section is adjoined by another part of the building that is outside the scope of the project or of Homestar (such as a retail area), the boundary of the BF shall run through the centre of the dividing wall.

Building Footprint (areas not listed to be treated based on similar spaces below)	Ground floor	Upper floors
Bedrooms	✓	
Living, dining, study, entertainment, and open plan kitchen areas	✓	
Separate kitchens	✓	
Passageways within dwelling	✓	
Bathrooms, toilets, and laundry areas	✓	
Closets and storage spaces	✓	
Conservatories and winter gardens within the thermal envelope	✓	
Thickness of internal walls	✓	
Thickness of external walls	✓	
Stairwells	✓	

Lift shafts (internal to dwelling)	✓	
Lift shafts (in common areas e.g., in apartments)	✓	
Service cavities	✓	
Habitable attic spaces (with insulation, lighting, etc., upper floors only)		
Common corridors, lobbies, and other common spaces in apartments	✓	
Fully enclosed garages and storage areas on permanent foundations	✓	
Club houses and other permanent outbuildings within development	✓	
Mezzanines and voids above other internal spaces (upper floors only)		
Balconies (upper floors only)		
Pergolas, carports, and other semi enclosed external spaces		
Hard landscaping and decks not on permanent foundations		
Sheds and other enclosed buildings not on permanent foundations		

Gross Floor Area (GFA)

The Gross Floor Area is the Building Footprint plus floor areas of fully enclosed parts of the building built on top of all spaces that were included in the Building Footprint. This includes the area taken up by all internal and external walls, garages and similar fully enclosed external spaces on permanent foundations, and the area taken up by stairwells, internal voids, and lift shafts at each floor level.

Similar to BF, GFA is calculated across the whole building rather than a single dwelling, in terrace and apartment development.

Gross Floor Area (areas not listed to be treated based on similar spaces below)	Ground floor	Upper floors
Bedrooms	✓	✓
Living, dining, study, entertainment, and open plan kitchen areas	✓	✓
Separate kitchens	✓	✓
Passageways within dwelling	✓	✓
Bathrooms, toilets, and laundry areas	✓	✓
Closets and storage spaces	✓	✓
Conservatories and winter gardens	✓	✓
Thickness of internal walls	✓	✓
Thickness of external walls	✓	✓
Stairwells	✓	✓
Lift shafts (internal to dwelling)	✓	✓
Lift shafts (in common areas e.g., in apartments)	✓	✓
Service cavities	✓	✓

Habitable attic spaces (conditioned, upper floors only)	✓	✓
Common corridors, lobbies, and other common spaces in apartments	✓	✓
Fully enclosed garages and storage areas on permanent foundations	✓	✓
Club houses and other permanent outbuildings within development	✓	✓
Mezzanines and voids above other internal spaces (upper floors only)		✓
Balconies (upper floors only)		
Pergolas, carports, and other semi enclosed external spaces		
Hard landscaping and decks not on permanent foundations		
Sheds and other enclosed buildings not on permanent foundations		

Mandatory Minimums

There are core issues within Homestar that are considered so important that a minimum performance level needs to be achieved before it is possible to achieve or progress to a specific Homestar Rating. These are referred to as mandatory minimum levels. If the assessed house fails to achieve these mandatory minimum levels, irrespective of the level of achievement in other areas of the tool, the dwelling's final star rating will be the highest rating where the mandatory minimums have all been met.

Mandatory minimums are in all the categories Efficient, Healthy and Comfortable, and Environmentally Responsible categories and are in place at all star bands. Outside these mandatory minimum requirements, Homestar is flexible – the project owner can choose which other credit criteria to meet.

Mandatory Minimums for All Homestar Star Bands (Pre-Requisites)

Requirement	Credit
The main living area must have an adequately sized fixed heating system.	HC1
All doors between conditioned space and garage must be fully sealed.	HC3
All combustion appliances must be room sealed.	HC3
Windows must be thermally broken.	HC4
All junctions between external walls, floors and roofs must be demonstrated to meet the minimum fRsi factors for the respective climate zone.	HC4
Ground vapour barrier must be installed to the ground below all suspended floors.	HC4
All projects must carry out a full lifecycle assessment including modules A-D of EN 15978.	EN2

Mandatory Minimums for 6 Homestar

Requirement	Credit
Maximum water consumption of 145 litres per person per day.	EF3
Maximum delivered electricity (kWh/m^2/year) associated with operation energy (excluding appliances) based on the climate zone in which the home is located.	EF4
Maximum 4 kg.CO_2-e/m^2 onsite greenhouse gas emissions associated with refrigerants. No fossil fuels are combusted on-site.	EF4
Maximum predicted demand for space heating (kWh/m^2/year) based on the climate zone in which the home is located.	HC1
The home must be demonstrated to not exceed 25°C for more than 7% of the year OR show compliance with CIBSE TM59.	HC2
Continuous extract ventilation meeting the requirements must be installed as a minimum.	HC3

Mandatory Minimums for 7 Homestar

Requirement	Credit
Maximum water consumption of 132 litres per person per day.	EF3
Maximum delivered electricity (kWh/m^2/year) associated with operation energy (excluding appliances) based on the climate zone in which the home is located as per benchmark table.	EF4
Maximum 4 kg.CO_2-e/m^2 onsite greenhouse gas emissions associated with refrigerants. No fossil fuels are combusted on-site.	EF4
Maximum predicted demand for space heating (kWh/m^2/year) based on the climate zone in which the home is located as per benchmark table.	HC1
The home must be demonstrated to not exceed 25°C for more than 7% of the year OR show compliance with CIBSE TM59.	HC2
Continuous extract ventilation meeting the requirements must be installed as a minimum.	HC3

Mandatory Minimums for 8 Homestar

Requirement	Credit
Maximum water consumption of 120 litres per person per day.	EF3
Maximum delivered electricity (kWh/m^2/year) associated with operation energy (excluding appliances) based on the climate zone in which the home is located as per benchmark table.	EF4
Maximum 2 kg.CO_2-e/m^2 onsite greenhouse gas emissions associated with refrigerants. No fossil fuels are combusted on-site.	EF4
Maximum predicted demand for space heating (kWh/m^2/year) based on the climate zone in which the home is located as per benchmark table.	HC1

The home must be demonstrated to not exceed 25°C for more than 5% of the year OR show compliance with CIBSE TM59.	HC2
Commissioned continuous extract ventilation meeting the requirements OR balanced mechanical ventilation must be installed as a minimum.	HC3
Maximum pressure test result at 50 Pa is 3 $m^3/m^2/hr$.	HC4
Air and vapour barriers must be identified for all external walls and roofs.	HC4
Projects must carry out a full lifecycle assessment, modules A-D of EN 15978.	EN2

Mandatory Minimums for 9 Homestar

Requirement	Credit
Maximum water consumption of 108 litres per person per day.	EF3
Maximum delivered electricity (kWh/m^2/year) associated with operation energy (excluding appliances) based on the climate zone in which the home is located as per benchmark table.	EF4
Maximum 2 kg.CO_2-e/m^2 onsite greenhouse gas emissions associated with refrigerants. No fossil fuels are combusted on-site.	EF4
Maximum predicted demand for space heating (kWh/m^2/year) based on the climate zone in which the home is located as per benchmark table.	HC1
The home must be demonstrated to not exceed 25°C for more than 3% of the year OR show compliance with CIBSE TM59.	HC2
Commissioned balanced mechanical ventilation or balanced ventilation with heat recovery.	HC3
Maximum pressure test result at 50 Pa is 2 $m^3/m^2/hr$.	HC4
Air and vapour barriers must be identified for all external walls and roofs.	HC4
The window installation detail(s) must be demonstrated to meet the minimum fRsi factors for the respective climate zone.	HC4
Projects must carry out a full lifecycle assessment, modules A-D of EN 15978.	EN2

Mandatory Minimums for 10 Homestar

Requirement	Credit
Maximum water consumption of 108 litres per person per day.	EF3
Maximum delivered electricity (kWh/m^2/year) associated with operation energy (excluding appliances) based on the climate zone in which the home is located as per benchmark table.	EF4
Maximum 2 kg.CO_2-e/m^2 onsite greenhouse gas emissions associated with refrigerants. No fossil fuels are combusted on-site.	EF4
Maximum predicted demand for space heating (kWh/m^2/year) based on the climate zone in which the home is located as per benchmark table.	HC1
The home must be demonstrated to not exceed 25°C for more than 3% of the year OR show compliance with CIBSE TM59.	HC2
Commissioned balanced mechanical ventilation or balanced ventilation with heat recovery.	HC3
Maximum pressure test result at 50Pa is 1 m^3/m^2/hr.	HC4
Air and vapour barriers must be identified for all external walls and roofs.	HC4
The window installation detail(s) must be demonstrated to meet the minimum fRsi factors for the respective climate zone.	HC4
Projects must carry out a full lifecycle assessment, modules A-D of EN 15978.	EN2

Glossary

Average daylight factor (ADF)	Average of the ratio of the light level inside a structure to the light level outside the structure.
Adhesives and sealants	Any adhesive and sealant product used in an interior application (including both exposed and concealed applications) and applied onsite.
Air permeability	Measure of inward or outward air leakage through the building envelope.
Air changes	The measure of air volume added to or removed from a space.
Apartment	Self-contained dwelling that only occupies part of a building.
Applied coating	Any liquid applied finish including paints, varnish, stains and oils used in either interior or exterior application.
Brownfield development	A property development which previously contained at least one building with permanent foundations within the previous legal boundary and in which the number of dwellings is no less than the number on site prior to development and any previously cultivated or pastoral farmland contains no more than 50% of the total footprint.
Building footprint (BF)	The area of land that is taken up by the permanent foundations of the dwelling(s). Refer Terminology for more details.
Built Rating	Homestar rating of a completed dwelling; a physical inspection of the property by the Homestar Assessor is required.
CIBSE	Chartered Institution of Building Services Engineers
Climate zone	Designation of areas within New Zealand that share similar climatic characteristics.
Competent professional	Individual possession the specialised knowledge, technical aptitude and experience required to carry out the required task to an acceptable standard. This includes having a formal qualification (or minimum 1 year experience) and a professional role relating to the field in question.
Conditioned floor area (CFA)	Space within the thermal envelope of the dwelling that could maintain a temperature band of between 20-25°C for 365 days of the year. Refer Terminology for more details.
Continuous extract ventilation	Whole-dwelling ventilation system that extracts air continuously at a low rate.
Design Rating	Homestar rating of a proposed dwelling based on detailed plans and specifications; expires two years after issue.
Drip line	The edge of a specimen or are of land located directly under the outer circumference of a shrub or tree's branches, used to ascertain the percentage of site covered by natives species.
EC	Electronically commutated; electric motors which have permanent magnets on the rotor and which use electronics to control the voltage and current applied to the motor.

Floor coverings	Coverings installed over the wooden or concrete floor structure, including but not limited to: carpet, parquet, wood planks, laminate, tiles and linoleum.
fRsi	Temperature factor; difference between the interior surface temperature and the exterior air temperature, divided by the average temperature difference between interior and exterior.
G-value	A measure of how much solar heat (infrared radiation) is allowed through a glazing unit relative to no glass.
Gross floor area (GFA)	Building Footprint (BF) plus all areas of fully enclosed parts of the building built on top of the BF, including area taken up by internal and external walls. Refer Terminology for more details.
Habitable area	Total internal floor area of bedrooms, lounge or living rooms, dining rooms, open plan kitchen areas, studies and entertainment rooms.
IIC	Impact Insulation Class, degree of soundproofing of the impact noise in a floor or ceiling construction assembly.
Mixed-use residential development	A development which includes commercial and/or retail areas as well as residential areas within a single building.
Multi-unit development	Where multiple separate housing units are contained within one building or multiple buildings constructed on a site or complex within a defined boundary.
MVHR	Mechanical ventilation with heat recovery; an energy recovery ventilation system that extracts stale air from a building while also resupplying fresh filtered air back in.
NRC	Noise Reduction Coefficient; average sound absorption performance of a material.
Passive House	Voluntary standard and quality management system designed to achieve ultra-low energy buildings.
Psi value	Measure of heat loss ('thermal bridging') within a junction of two thermal elements, measured in W/mK.
R-value	Thermal resistance rating used to determine a material or assembly's ability to resist heat flow.
Room-sealed appliance	An appliance designed so that air for combustion neither enters from, nor combustion products enter into, the room in which the appliance is located. (As defined in NZBC clause G4).
R_w	Weighted Sound Reduction Index; rating used to measure the level of sound insulation of walls, floors, windows and doors expressed in decibels (dB). Higher R_w values indicate better sound insulation.
sDA	Spatial Daylight Autonomy; describes how much of a space receive sufficient daylight.
Shading	A measure of how much solar heat gain enters through a window compared to an unshaded window.
Standalone home	A free-standing residential building; detached house with no intertenancy walls.

STC	Sound Transmission Class; rating of how well a partition in a building attenuates airborne sound.
Stormwater detention	Systems designed to slow the rate of stormwater runoff.
Stormwater retention	Systems designed to capture and store stormwater runoff; often re-used to supply non-potable and/or potable water.
Terraced home	A dwelling with at least one common wall with another dwelling.
Thermal envelope	The division between the outside (i.e. unconditioned and usually uninsulated) area of the house and the inside (i.e. conditioned and insulated) area of the house.
Typology	Dwellings with similar size, layout and thermal properties. Refer Terminology for more detail.
Volume Certification	Pathway for awarding credit points using a standard specification with a quality assurance process to ensure adherence.
WELS	Water Efficiency Labelling Scheme; designed to provide information through labelling at the point of sale to consumers buying products that use water.
Wet room	Rooms that are a common source of moisture in the home: bathrooms, kitchens and laundries.

Compulsory Evidence

The following evidence is compulsory for each typology within the Homestar submission. This evidence is shared across multiple credits and eliminates the need to submit the same evidence multiple times within a typology.

Design Rating

Required Evidence	Folder Name
All Pathways	
Completed (all relevant areas) ECCHO tool.	ECCHO
Dimensioned floor plan and elevations of each level of the dwelling, with the representative typology, bedrooms and Conditioned Floor Area (CFA) clearly marked.	Plans and Elevations
Marked up drawings showing the Gross Floor Area (GFA) and Building Footprint (BF).	Plans and Elevations
Ventilation specification(s) and/or details as outlined in HC3 as applicable.	Ventilation
Moisture control specification(s) and/or details as outlined in HC4 as applicable.	Moisture Control
Extracts from specification showing fixed space heating type(s), output and efficiency (if known).	Systems and Appliances
Calculations demonstrating heating demand of living areas.	Systems and Appliances
Extract from specification demonstrating lighting types and output in Watts.	Systems and Appliances
Extract from specification demonstrating hot water heating type, model and efficiency (if known).	Systems and Appliances
ECCHO and Energy Modelling	
Marked up drawings showing all wall construction types.	R-values
R-value calculations of all wall construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all floor construction types.	R-values
R-value calculations of all floor construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all roof construction types.	R-values
R-value calculations of all roof construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all window and skylight types.	R-values

R-value and g-value (or SHGC) of all glazing used. For the Built rating, the actual g-value (or SHGC) of the glass may differ from that used in the ECCHO model by +/- 5%. R-value, width and frame-edge psi-value of all window frames used. Note that these can sometimes be hard to source and so may be omitted if the generic window frames are used in ECCHO (non-thermally broken aluminium, thermally-broken aluminium, timber, uPVC etc). Where user-defined data is being used this must be backed up with data sheets for the particular frame.	R-values
Marked up drawings showing all window shading.	R-values
Energy Modelling	
Report containing the information/documentation as listed in Appendix A.	Modelling
Passive House	
Extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House. Signed contract from Certified Passive House Designer.	Modelling

Built Rating

Required Evidence	Folder Name
All Pathways	
Completed (all relevant areas) ECCHO tool.	ECCHO
Dimensioned floor plan and elevations of each level of the dwelling, with the representative typology, bedrooms and Conditioned Floor Area (CFA) clearly marked.	Plans and Elevations
Marked up drawings showing the Gross Floor Area (GFA) and Building Footprint (BF).	Plans and Elevations
Ventilation specification(s) and/or details as outlined in HC3 as applicable.	Ventilation
Moisture control specification(s) and/or details as outlined in HC4 as applicable.	Moisture Control
Photos, supplier/manufacturer information, receipts and/or invoices showing fixed space heating type(s), output and efficiency – Passive House exempted if no heating is provided.	Systems and Appliances
Calculations demonstrating heating demand of living areas.	Systems and Appliances
Photos, supplier/manufacturer information, receipts and/or invoices demonstrating lighting types and output in Watts.	Systems and Appliances
Photos, supplier/manufacturer information, receipts and/or invoices hot water heating type, model and efficiency.	Systems and Appliances

ECCHO and Energy Modelling	
Receipts, invoices and/or manufacturer data demonstrating bulk insulation R-value installed or supplied in each construction system.	R-values
Marked up drawings showing all wall construction types.	R-values
R-value calculations of all wall construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all floor construction types.	R-values
R-value calculations of all floor construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all roof construction types.	R-values
R-value calculations of all roof construction types (either using ECCHO or from external sources as set out in energy modelling protocol).	R-values
Marked up drawings showing all window and skylight types.	R-values
R-value and g-value (or SHGC) of all glazing used. For the Built rating, the actual g-value (or SHGC) of the glass may differ from that used in the ECCHO model by +/- 5%. R-value, width and frame-edge psi-value of all window frames used. Note that these can sometimes be hard to source and so may be omitted if the generic window frames are used in ECCHO (non-thermally broken aluminium, thermally-broken aluminium, timber, uPVC etc). Where user-defined data is being used this must be backed up with data sheets for the particular frame.	R-values
Marked up drawings showing all window shading.	R-values
Energy Modelling	
Report containing the information/documentation as listed in Appendix A.	Modelling
Passive House	
Extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House. Signed contract from Certified Passive House Designer.	Modelling

Homestar Tool Summary

Category	Credit	Code	Points	Project-wide
Efficient	Resource Efficiency	EF1	4 points	No
	Urban Density	EF2	3 points	Yes
	Water Use	EF3	12 points	No
	Energy Use	EF4	20 points	No
Healthy and Comfortable	Winter Comfort	HC1	22 points	No
	Summer Comfort	HC2	6 points	No
	Ventilation	HC3	5 points	No
	Moisture Control	HC4	6 points	No
	Natural Light	HC5	3 points	No
	Acoustic Performance	HC6	1.5 points (standalone) 3 points (other)	No
	Healthy Materials	HC7	4 points	Yes
Liveable	Inclusive Design	LV1	3 points	No
	Occupant Amenities	LV2	2 points	Yes
	Eco-Friendly Living	LV3	2 points	Yes
	Sustainable Transport	LV4	4 points	Yes
	Adaptation and Resilience	LV5	2 points	Yes
Environmentally Responsible	Renewable Energy	EN1	4 points	Yes
	Embodied Carbon	EN2	6 points	Yes
	Sustainable Materials	EN3	10 points	Yes
	Construction Waste Minimisation	EN4	6 points	Yes
	Water Sensitive Design and Ecology	EN5	4 points	Yes
	Responsible Contracting	EN6	1 point	Yes
Innovation	Innovation	IN1	10 points	-

EF1: Resource Efficiency

Points Available	4		
Mandatory Minimums	None		
Aim	To promote smaller dwellings that require fewer resources to build, operate and occupy.		
Project-wide	No	Calculator	Yes

Credit Criteria

Where the dwelling's conditioned floor area (CFA) in m^2 relative to the number of bedrooms is within the thresholds as per the table below:

1 bedroom (m^2)	2 bedrooms (m^2)	3 bedrooms (m^2)	4 bedrooms (m^2)	5 bedrooms (m^2)	6+ bedrooms (m^2)	Points
46	76	104	123	143	150	4.0
48	79	110	132	149	156	3.5
51	83	115	139	155	162	3.0
54	88	119	146	162	169	2.5
57	91	126	152	169	176	2.0
59	96	131	160	178	185	1.5
62	101	137	166	185	192	1.0
63	105	144	174	193	200	0.5

Evidence

Design and Built Rating

Refer Compulsory Evidence.

Assessment

Calculate the dwelling's conditioned floor area using floor plan drawings. Round this figure up to the nearest whole number. Determine the number of bedrooms, then use the credit criteria table to determine the number of points awarded out of a maximum of 4 points available. The Homestar Assessor is to use their discretion when determining whether a room that may be labelled as a 'study' is in fact a bedroom. If it is clearly not a bedroom, the study will need to be included as a living area for other credits. Due to requirements in

clause G7 of New Zealand Building Code, rooms without windows cannot be considered bedrooms.

The conditioned floor area thresholds are the maximum area allowed for within each half-point bracket. Therefore, a value between two of the thresholds will earn the lower of the achievement levels.

EF2: Urban Density

Points Available	3		
Mandatory Minimums	None		
Aim	To promote developments with smaller footprints, recognising the benefits of denser urban planning such as affordability and efficiencies in infrastructure and space utilization.		
Project-wide	Yes	Calculator	Yes

Credit Criteria

Where the ratio of gross floor area (GFA) to building footprint (BF) is two or more, use the following table to determine the points.

Density Ratio	Points
5+	3
3-4	2
2	1

Evidence

Design and Built Rating

Refer Compulsory Evidence.

Assessment

Calculate the building footprint (BF) and gross floor area (GFA) using floor plan drawings. Divide the GFA by the BF to obtain the density ratio. Round this figure down to the nearest whole number, then use the credit criteria table to determine the number of points.

For multi-unit developments, add together the total GFA of all buildings and the BF of all buildings. Divide the total project GFA by the total project BF.

For mixed-use developments, include the non-residential areas when completing the calculations.

EF3: Water Use

Points Available	12
Mandatory Minimums	Dwellings must not exceed the following indoor water consumption in litres per person per day:

6 Homestar	7 Homestar	8 Homestar	9 & 10 Homestar
145	132	120	108

Aim	To encourage and recognise water conservation through water efficient fittings and rainwater harvesting.		
Project-wide	No	Calculator	Yes

Credit Criteria

Up to 12 points are available where it is demonstrated that demand for potable water within the dwelling can be reduced through the provision of water-efficient fittings and fixtures, and/or where water conservation is encouraged through rainwater tanks and, individual metering.

Method	Approach	Points
(1)	Indoor Water Use	Up to 10 points
(2)	Rainwater Harvesting	Up to 2 points

Indoor Water Use

Points are awarded based on the daily individual indoor water consumption estimated by the Water Calculator, roundest to the nearest whole number using Swedish rounding.

Estimated Daily Indoor Water Consumption		Mandatory Minimums
Litres per person per day	Points	
≤ 145	4 points	6
≤ 138	5 points	
≤ 132	6 points	7
≤ 126	7 points	
≤ 120	8 points	8
≤ 114	9 points	
≤ 108	10 points	9 & 10

Rainwater Harvesting

Points are based on the percentage of total water demand from toilet flushing, dishwashing, laundry and outdoor use can likely be met through harvested rainwater in any two-week period of the year. For apartments this includes common area water use.

Percentage Offset	Points: Apartments	Points: Other dwellings
5%	0.5	-
10%	1	-
15%	1.5	-
20%	2	0.5
40%	2	1
60%	2	1.5
80% or more	2	2

Evidence

Design Rating

(1) Indoor water use – fittings, fixtures and appliances selected	Provide **all** of the following for **each** typology:
	Completed Water Calculator.
	Specification or drawing extract identifying make and model of all water fittings, fixtures and appliances included in the water calculator.
	Manufacturer's data for each fitting, fixture and appliance above to verify water use data entered into water calculator.
(1) Indoor water use – fittings, fixtures and appliances not selected	Provide **all** of the following for each typology:
	Completed Water Calculator.
	Specification or drawing extract identifying targeted flow rate or WELS rating of all water fittings, fixtures and appliances entered into the water calculator.
(2) Rainwater harvesting	Provide **all** of the following:
	Marked up plan(s) with highlighted roof catchment area.
	Marked up plan(s) or drawing(s) showing the location of overflow pipe(s) and capacity below the overflow of the rainwater tank(s).
	Marked up plan(s) or drawing(s) showing the connection(s) from the rainwater tank(s) to any fittings, fixtures and appliances (including outdoor taps).

Built Rating

(1)	Provide **all** of the following for **each** typology:
	Completed Water Calculator.

Indoor water use	Completed and signed Pro forma of Credit Compliance.
	Completed and signed Onsite Compliance Schedule.
	Manufacturer's data for each fitting, fixture and appliance above to verify water use data entered into water calculator
(2) Rainwater harvesting	Provide **all** of the following:
	Marked up plan(s) with highlighted roof catchment area
	Marked up plan(s) or drawing(s) showing the location of overflow pipe(s) and capacity below the overflow of the rainwater tank(s).
	Marked up plan(s) or drawing(s) showing the connection(s) from the rainwater tank(s) to any fittings, fixtures and appliances (including outdoor taps).
	Photograph, invoice or receipt of rainwater tank(s).

Assessment

Indoor Water Use

Points are awarded based on the daily individual indoor water consumption estimated by the water calculator. The water calculator output is rounded to the nearest whole number using Swedish rounding. Refer table in the credit criteria for points.

Design Guidance for 6 and 7 Homestar Only

Homes that are individually metered and billed can achieve the stipulated mandatory minimums and associated points for 6 or 7 Homestar by ensuring toilets, showers, kitchen taps and bathroom basin taps meet the following water efficiency standards:

	6 Homestar	7 Homestar
	Maximum flow rates	Maximum flow rates
Worst case Shower	9 L/min (3 Star WELS)	9 L/min (3 Star WELS)
Toilets	4.5L/3L dual flush (4 Star WELS)	4.5L/3L dual flush (4 Star WELS)
Worst case Kitchen and laundry taps	Calculator default (12 L/min)	7.5 L/min (4 Star WELS)
Worst case basin tap	Calculator default (12 L/min)	4.5 L/min (6 Star WELS)
All other fields	Calculator default	Calculator default
Points achieved	4 points	6 points

This information must be entered into the water calculator, except where calculator default rates are indicated in the table above.

Homes that are NOT individually metered and/or are located in areas of New Zealand without billing may require higher performance fittings to achieve the mandatory minimum water consumption for each respective Homestar star band.

Design Rating

For Design Ratings, inspect the design documentation to determine either the make, model and relevant water use data of specified fixtures fitting and appliances or, if specific products have not yet been selected, the specified performance of these as per Part A of the Water Calculator. Several entries in the water calculator are mandatory, while any field marked as "optional" may be left out (note that in this case, the calculator assumes conservative default water use values). Complete all the mandatory fields and as many "optional" fields as possible in the sections titled General Details and Part A.

Built Rating

For Built Ratings, follow the onsite compliance schedule below during inspection. Note that you will sometimes need to take photos, as per the schedule.

In accordance with standard Homestar protocol, where there are multiple dwellings within a typology or typologies, a sample of dwellings within each typology must be tested: 30% up to 10 dwellings, then 10% of any additional dwellings (e.g. 2 out of 5 dwellings, 3 out of 10 dwellings, 4 out of 11 dwellings, 6 out of 35 dwellings).

Fixture/fitting /appliance	Compliance checking methodology	Additional requirements (as per onsite compliance schedule)
Showers and taps	Run the tap at full flow for 1 minute and measure flow. For mixers, keep the tap in middle position (between hot and cold). Use the average across all tested examples of each fitting type (shower, kitchen tap, etc.).	None
Toilets, dishwasher and washing machines	Visually check WELS rating sticker on unit or manufacturer data to determine water use. The worst performing example of each appliance type in each typology is to be used in the calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of toilet, dishwasher and washing machine installed in the dwellings inspected in each typology.
Bathtub	Visually check if one is present. Check manufacturer data to determine capacity. If any dwellings of the typology have one installed, include in calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of bathtub installed in the dwellings inspected in each typology.
Waste disposal units (insinkerators)	Visually check if one is present. If any dwellings of the typology have one installed, include in calculator.	None

Points are based on estimated daily indoor water use per person. This is calculated based on the following usage estimates:

Item	Usage (per person per day unless stated)	Default usage assumptions (if no water use data entered)
Showers	1 x 6.21 minute shower	12 L/min flow rate
Toilets	4 half flushes and 1 full flush	6 L full flush, 3 L half flush
Bathroom vanity tap	(Flowrate x 1.58) + 1.58 L	12 L/min flow rate
Kitchen sink tap	(Flowrate x 0.44) + 10.36 L	12 L/min flow rate
Dishwasher	3.6 x L per cycle / no. of place settings	30 L per household added to kitchen tap daily use
Washing Machine	2.1 x L per cycle / load capacity (kg)	15 L per cycle per kg load
Laundry tub tap	(Flowrate x 0.44) + 10.36 L	12 L/min flow rate IF present
Bathtub	Capacity to overflow (L) x 0.11	No bathtub assumed
Sink waste disposal	If present, 3.08 L	None

Note that shower usage is reduced if a bath is also present, and the lack of a dishwasher will increase assumed demand on the kitchen tap. Studies show that individual metering AND billing may result in up to 5% reduction in daily water use, so calculated daily water use is reduced by a further 5% where the dwelling is metered and billed on usage. Where the dwelling is individually metered and billed, tick to select this option in Part A of the Water Calculator.

Rainwater Harvesting

Inspect the drawings and specifications or check onsite to confirm the presence of a rainwater harvesting system, including the volume of the tanks, roof catchment area, and number/type of connections. Make note of the roof type and slope to determine the run-off coefficient for use in the calculator. Enter this Information in Part B of the calculator to obtain points.

Note that if Part C of the calculator is not completed but the system supplies water for outdoor use, the calculator will assume a nominal 25L per day per household (not per person) for this purpose. Completing part C is not mandatory unless the project is also targeting points under EN5: Water Sensitive Design and Ecology.

EF4: Energy Use

Points Available	20
Mandatory Minimums	Maximum delivered electricity (kWh/m^2/year) associated with operational energy (excluding appliances) for each star rating:

Climate Zone*	6 Homestar	7 Homestar	8 Homestar	9 Homestar	10 Homestar
1	52	39	31	25	20
2	59	43	33	26	20
3	65	47	35	27	20
4	71	51	38	28	20
5	78	55	40	29	20
6	84	59	42	30	20

Maximum onsite greenhouse gas emissions (kg.CO_2-e/m^2) associated with refrigerants for all climate zones:

6 and 7 Homestar	8, 9 and 10 Homestar
4	2

No fossil fuels are combusted on-site.

Aim	To reduce operational energy consumption, energy costs and greenhouse gas emissions associated with the use of heating, hot water, ventilation, lighting, and refrigerants within the home.

Project-wide	No	Calculator	Yes

Credit Criteria

Pre-requisite: calculated on-site greenhouse gas emissions for the home must be less than those set out in the mandatory minimum table above. The only allowable greenhouse emissions are those associated with the leakage of refrigerants from heat pumps. Indirect emissions from electricity consumption are excluded.

To be eligible for Homestar the home must not combust fossil fuels. For the avoidance of doubt, this means that the home cannot include plumbed-in natural gas or LPG space heating, hot water or cooking equipment.

Points are based on the predicted electricity consumption associated with the use of heating, hot water, lighting and ventilation within the home as follows:

Total Predicted Energy Demand (kWh/m^2/year)									
Climate Zone*	12 points	13 points	14 points	15 points	16 points	17 points	18 points	19 points	20 points
1	52	45	39	35	31	28	25	22	20
2	59	50	43	38	33	29	26	23	20
3	65	55	47	41	35	31	27	23	20
4	71	60	51	44	38	32	28	24	20
5	78	65	55	47	40	34	29	24	20
6	84	70	59	49	42	35	30	25	20

* Climate zones and the distribution of districts among them are set out in Appendix C.

There are 3 compliance pathways:

1. Compliance by calculation
2. Compliance by energy modelling
3. Compliance by Passive House certification

Evidence

Design and Built Rating

Refer Compulsory Evidence.

Assessment

Pre-requisite: the on-site greenhouse gas emissions are calculated in ECCHO for all pathways and can be found on the Summary sheet once all relevant fields are completed. On-site greenhouse gas emissions are primarily a function of the type of fuel used for hot water and space heating.

There are 3 pathways through which this credit can be assessed:

1. Compliance by Calculation

Using the plans and specifications for the dwelling, up to 20 points may be awarded using the Homestar Energy and Carbon Calculator for Homes (ECCHO). For instructions on how to use ECCHO, please refer to Appendix B.

Points are awarded automatically in ECCHO as shown in the Credit Criteria. The calculated electricity use and on-site greenhouse gas emissions for the home are shown on the ECCHO Summary worksheet together with the calculated points.

2. Compliance by Energy Modelling

Using the plans and specifications for the dwelling, estimate the space heating demand for the home using an approved energy modelling software package and by following the Homestar Energy Modelling Protocol (see Appendix A).

Enter the estimated space heating demand (kWh/m^2/year) into ECCHO as well as the following information:

- Part A, Part B and Part C of the summary worksheet
- Systems, lights and appliances worksheet (appliances section is optional)
- If refrigerants are present (e.g. heat pumps): refrigerant calculator worksheet
- If following pathway 4 in HC2 (mechanical cooling to all habitable rooms): electricity demand from mechanical cooling equipment. Note that no cooling energy needs to be entered into ECCHO if the home meets the HC2 requirements through any other pathway, even if some mechanical cooling is provided (e.g. a living room heat pump).

Points are awarded automatically in ECCHO as shown in the Credit Criteria. The calculated electricity use and on-site greenhouse gas emissions for the home are shown on the ECCHO Summary worksheet together with the calculated points.

3. Compliance by Passive House Certification

Dwellings targeting Passive House Certification may use the calculated space heating demand (kWh/m^2/year) from PHPP, but must still enter this heating demand into ECCHO, as well as the following information:

- Part A, Part B and Part C of the summary worksheet
- Systems, lights and appliances worksheet – appliances section is optional
- If refrigerants are present (e.g. heat pumps): refrigerant calculator worksheet
- If following pathway 4 in HC2 (mechanical cooling to all habitable rooms): electricity demand from mechanical cooling equipment. Note that no cooling energy needs to be entered into ECCHO if the home meets the HC2 requirements through any other pathway, even if some mechanical cooling is provided (e.g. a living room heat pump).

It is acknowledged that PHPP calculates energy demand from lighting and hot water systems, however the methodology for doing this differs slightly from ECCHO and therefore Assessors must enter information for these systems into ECCHO to maintain consistency with other pathways.

Points are awarded automatically in ECCHO as shown in the Credit Criteria. The calculated electricity use and on-site greenhouse gas emissions for the home are shown on the ECCHO Summary worksheet together with the calculated points.

REVISION AND AMENDMENTS

Revision No.	Category	Description
v5.1	Revision	Pre-requisite|| No onsite GHG associated with space heating and hot water.

HC1: Winter Comfort

Points Available	22
Mandatory Minimums	The main living area must have an adequately sized fixed heating system. The maximum predicted demand for space heating (kWh/m^2 of Conditioned Floor Area) for each Homestar rating is as follows:

Climate Zone	6 Homestar	7 Homestar	8 Homestar	9 & 10 Homestar
1	40	30	20	15
2	50	36	22	15
3	60	42	24	15
4	70	48	26	15
5	80	53	28	15
6	90	59	29	15

Aim	To recognise the reduction of purchased energy associated with space heating of the home, through good design of the thermal envelope.		
Project-wide	No	Calculator	Yes

Credit Criteria

Pre-requisite: With the exception of the Passive House certification pathway, it must be demonstrated that the main living space has an adequately sized fixed heating system.

There are 3 pathways through which this credit can be assessed:

1. Compliance by calculation (ECCHO)
2. Compliance by energy modelling
3. Compliance through Passive House Certification

Points are based on the predicted energy demand for space heating, expressed as kWh/m^2 of Conditioned Floor Area (CFA) as follows:

Total Predicted Demand for Space Heating (kWh/m^2 of CFA)								
Climate Zone*	15 points	16 points	17 points	18 points	19 points	20 points	21 points	22 points
1	40	34	30	26	23	20	17	15
2	50	42	36	30	26	22	18	15
3	60	50	42	35	29	24	19	15
4	70	58	48	39	32	26	20	15
5	80	65	53	43	35	28	21	15
6	90	73	59	48	38	29	22	15

* Climate zones and the distribution of districts among them are set out in Appendix C.

Evidence

Design and Built Rating

Refer Compulsory Evidence.

Assessment

Pre-requisite - Fixed Heating

It must be demonstrated that the main living space has an adequately sized fixed heating system. The main living space is the largest room that is used for general, everyday living – for example a lounge or family room. If this is open plan (such as including a kitchen or dining room), calculations must include all of the adjoining spaces if they are not able to be physically closed off. This includes any open stairwells connected to this space, as well as any other rooms open to the stairwell that cannot be closed off.

Heater(s) must be fixed (not portable), at least 1.5kW in heating capacity and meet the minimum required heating capacity for the main living room. The capacity required can be calculated using the Tenancy Services Heating Assessment Tool[1] (for homes compliance with 2008 insulation values, or apartments) or ECCHO.

In most cases, the acceptable types of heater(s) will be a larger fixed heating device like a heat pump, wood burner, pellet burner or flued gas heater[2]. In some cases, such as small apartments, a fixed electric heater may be enough.

[1] https://www.tenancy.govt.nz/heating-tool/

[2] Note that for any Homestar rating all combustion appliances must be room-sealed - see credits HC3 and HC4.

Unacceptable heaters include:

- open fire
- un-flued combustion heater
- heat pumps or electric heaters without a thermostat
- electric heaters when the required heating capacity is more than 2.4kW

1. Compliance by Calculation

Using the plans and specifications for the dwelling, up to 22 points may be awarded by completing a heating demand calculation using the Homestar Energy and Carbon Calculator for Homes (ECCHO) assuming a heating temperature of 20°C 24/7. Points are awarded as shown in the Credit Criteria.

For instructions on using ECCHO please refer to Appendix B.

2. Compliance by Energy Modelling

Using the plans and specifications for the dwelling, estimate the space heating demand for the home using an approved energy modelling software package and by following the Homestar Energy Modelling Protocol (see Appendix A).

Points are awarded as shown in the Credit Criteria. Points are calculated by entering the estimated heating load from the energy modelling software into the ECCHO.

3. Compliance through Passive House certification

Homes that can demonstrate that they are targeting or have achieved Passive House certification will be awarded 22 points by default but must still enter the heating demand (kWh/m^2) calculated in PHPP into ECCHO.

HC2: Summer Comfort

Points Available	6		
Mandatory Minimums	Using an approved calculation method, the home must be demonstrated to not exceed 25°C for more than the following percentage of the year, for each star band: 6 & 7 Homestar: 7% 8 Homestar: 5% 9 & 10 Homestar: 3% Alternatively, for any star rating, projects may either a) demonstrate by dynamic simulation compliance with CIBSE TM59 or b) meet the energy demand requirements of EF4 with the inclusion of mechanical cooling.		
Aim	To reduce the risk of summertime overheating.		
Project-wide	No	Calculator	Yes

Credit Criteria

There are four pathways and up to 6 points available for this credit:

(1)	Calculation (ECCHO)	Up to 6 points
(2)	CIBSE TM59	6 points
(3)	A building targeting (Design) or certified (Built) as Passive House by the Passive House Institute of Germany	Up to 6 points
(4)	Where mechanical cooling is provided to all habitable rooms, including the energy demand as a result of mechanical cooling in credit EF4.	4 points

1. Compliance by Calculation (ECCHO)

Total predicted hours of overheating (percentage of year)			
Points	2 points	4 points	6 points
All climate zones	7%	5%	3%

2. Compliance with CIBSE TM59

6 points are awarded where the home is demonstrated to comply fully with the requirements in CIBSE TM59 using an approved energy modelling software package.

3. Passive House Certification

Homes that can demonstrate that they are targeting or have achieved Passive House certification may use the estimated percentage hours of overheating from PHPP when modelling a single dwelling i.e., a standalone house. For other building typologies i.e., terrace and apartments, projects are required to run an overheating analysis either in ECCHO, PHPP, or other tools on the worst-case dwelling (for each typology) to critically review the overheating risk. Points are awarded as per the Compliance by Calculation (ECCHO) pathway.

4. Mechanical Cooling

4 points are awarded where homes have mechanical cooling to all habitable rooms (e.g., ducted heat pump). Homes targeting this pathway must include the energy demand from mechanical cooling in the electricity consumption figures submitted for credit EF4: Energy Use.

Evidence

Design and Built Rating

Refer Compulsory Evidence.

Assessment

1. Compliance by Calculation

Pre-requisite of pathway 1: The home must be shown to be at low or medium risk of overheating using the qualitative overheating risk assessment found in ECCHO. The risk assessment considers a range of factors including location, area and orientation of glazing and external noise.

Using the plans and specifications for the dwelling, up to 6 points may be awarded by completing an overheating calculation using the Homestar Energy and Carbon Calculator for Homes (ECCHO). Points are awarded as shown in the Credit Criteria. For instructions on using EECHO, please refer to Appendix B.

2. Compliance by Energy Modelling

Using the plans and specifications for the dwelling, complete an energy model using an approved energy modelling software package following the guidance in CIBSE TM59. 6 points are awarded where the home is demonstrated to comply fully with the requirements in CIBSE TM59, i.e. the home meets criteria a) and b) from section 4.2.

3. Compliance through Passive House certification

Pre-requisite of pathway 3: The home must be shown to be at low or medium risk of overheating using the qualitative overheating risk assessment found in the Homestar calculator. The risk assessment considers a range of factors including location, area and orientation of glazing and external noise.

Homes that can demonstrate that they are targeting or have achieved Passive House certification may use the estimated percentage hours of overheating from PHPP when modelling a single dwelling i.e., a standalone house.

For other building typologies i.e., terrace and apartments, projects are required to run an overheating analysis either in ECCHO, PHPP, or other tools on the worst-case dwelling (for each typology) to critically review the overheating risk. This analysis, including corresponding evidence, must be provided at submission and the final overheating result, together with building systems entered into ECCHO.

4. Mechanical Cooling

Using the plans and specifications for the dwelling, demonstrate that a sufficiently sized mechanical cooling system (or systems) is provided to all habitable rooms. Habitable rooms include all living areas, kitchens and bedrooms.

Note that ECCHO does not include the ability to calculate the required size of mechanical cooling equipment. This means that the project team must calculate the equipment size using other means, e.g., PHPP or supplier calculations.

REVISION AND AMENDMENTS

Revision No.	Category	Description
v5.1	Update	Overheating threshold for 7 Star compliance lowered to 7%. Added further guidance for the Passive House pathway. Mechanical Cooling.

HC3: Ventilation

Points Available	5		
Mandatory Minimums	The achievement of the following points is mandatory for the respective star rating: 6 & 7 Homestar: 2 points 8 Homestar: 3 points 9 & 10 Homestar: 4 points		
Aim	To encourage and recognise ventilation measures that control indoor moisture levels, improve indoor environment for occupants, reduce respiratory illnesses and the risk of mould, and increase the durability of the dwelling.		
Project-wide	No	Calculator	No

Credit Criteria

Up to 4 points are available where it is demonstrated that indoor moisture levels have been managed through one of the three methods listed below. In homes targeting a pressure test result of less than 1 $m^3/m^2/hr$, balanced mechanical ventilation must be installed as a minimum. An additional 1 point can be attained through commissioning of any type of compliant ventilation system.

Method	Approach	Points
Moisture Management Through Ventilation		
(1)	Continuous extract ventilation	2 points
(2)	Balanced ventilation	3 points
(3)	Balanced ventilation with heat recovery (MVHR)	4 points
Commissioning		
(4)	Ventilation system commissioning	1 point

Evidence

Design Rating

(1) Continuous extract ventilation	Provide marked up drawings and/or specifications demonstrating **all** of the following:
	Location of each wet room extract, including assumed ventilation paths highlighting inflow and outflow points.
	Fans to be set to produce a total of 0.35 air changes per hour (ACH) throughout the entire home.
	All doors to habitable spaces will be undercut or air transfer grilles specified in accordance with the submission requirements.
	Door(s) between the conditioned space and garages to be fully sealed.
	All combustion appliances (including wood stoves) to be room sealed.
	All fans fitted with EC (Electronically Commutated) motors.
	Location and type of background ventilation provided in habitable spaces.
(2) Balanced mechanical ventilation (3) Balanced mechanical ventilation with heat recovery	Provide marked up drawings and/or specifications demonstrating **all** of the following:
	Ventilation plan showing location of fan unit, intake and exhaust, and input and extraction points.
	Calculations detailing total volume of dwelling and airflow rate from each of the rooms.
	All doors to habitable spaces to be undercut or air transfer grilles are specified in accordance with the submission requirements.
	All combustion appliances (including wood stoves) to be room sealed.
	Door(s) between the conditioned space and garages to be fully sealed.
(4) Commissioning of ventilation systems	Specifications showing that ventilation systems are to be commissioned according to the requirements.

Built Rating

(1) Continuous extract ventilation	Provide photographs, marked up drawings and/or specifications demonstrating compliance with all of the following:
	Location of each wet room extract, including assumed ventilation paths highlighting inflow and outflow points.
	Fans are set to produce a total of 0.35 air changes per hour (ACH) throughout the entire home.
	All doors to habitable spaces are undercut or air transfer grilles are specified in accordance with the submission requirements.
	Door(s) between the conditioned space and garages are fully sealed.
	All combustion appliances are room sealed.
	All fans are fitted with EC (Electronically Commutated) motors.

	Location and type of background ventilation provided in habitable spaces.
(2) Balanced mechanical ventilation (3) Balanced mechanical ventilation with heat recovery	Provide photographs, marked up drawings and/or specifications demonstrating **all** of the following:
	Ventilation plan showing location of fan unit, intake and exhaust, and input and extraction points.
	Calculations detailing total volume of dwelling and airflow rate from each of the rooms.
	All doors to habitable spaces are undercut or air transfer grilles are specified in accordance with the submission requirements.
	All combustion appliances (including wood stoves) to be room sealed.
	Door(s) between the conditioned space and garages to be fully sealed.
(4) Commissioning of ventilation systems	Letter or commissioning report showing that ventilation systems have been commissioned according to the requirements.

Assessment

1. Continuous Extract Ventilation

A whole house continuous extract system is installed consisting of extract fans in (or one extract fan ducted from) each wet room (bathroom, kitchen, laundry) according to the requirements below:

- Fans are set to produce a total of at least 0.35 air changes per hour (ACH) of outdoor air throughout the entire home or 7.5 litres per second per occupant, whichever is greater as per NZS4303.
- Fans have EC (Electronically Commutated) motors in order to minimise the noise produced by normal system operation.
- Doors to habitable rooms are undercut with either a 20 mm high gap over unfinished floor or 10mm high gap if carpeted OR suitable alternative transfer grills are installed.
- The door connecting an attached garage to the conditioned space of the house is sealed on all four edges to minimise ingress of pollutants. This would require stops around the sides and header. The bottom would either have a stop or rubber seal.
- Combustion appliances are room-sealed.
- This option is not permitted for homes targeting or achieving a pressure test result of less than 1 $m^3/m^2/hr$.
- All homes must include an identifiable air path for each habitable room showing the intended pathway(s) from a designed and intentional opening or openings.
- Refer to the Best Practice Guide below for optimal installation and performance of the system.

2. Balanced Mechanical Ventilation

A whole-house balanced ventilation system is installed consisting of ducted supply and extract fans according to the requirements below:

- Balance of flow rates for air volume and supply must be calculated for the system and meet at least 0.35 ACH of outdoor air throughout the entire home or 7.5 litres per second per occupant, whichever is greater as per NZS4303.
- Doors to habitable rooms are undercut with either a 20 mm high gap over unfinished floor or 10mm high gap if carpeted OR suitable alternative transfer grills are installed.
- The door connecting an attached garage to the conditioned space of the house is sealed on all four edges to minimise ingress of pollutants. This would require stops around the sides and header. The bottom would either have a stop or rubber seal.
- Combustion appliances must be room-sealed.
- Refer to the Best Practice Guide below for optimal installation and performance of the system.

3. Balanced Mechanical Ventilation with Heat Recovery

A whole-house balanced ventilation system with heat recovery is installed consisting of ducted supply and extract fans according to the requirements below:

- It is equipped with a heat recovery system to transfer heat from exhaust air to incoming fresh air.
- Balance of flow rates for air volume and supply must be calculated for the system and meet at least 0.35 ACH of outdoor air throughout the entire home or 7.5 litres per second per occupant, whichever is greater as per NZS4303.
- Doors to habitable rooms must be undercut with either a 20 mm high gap over unfinished floor or 10mm high gap if carpeted OR suitable alternative transfer grills are installed.
- When ducting extends past the thermal envelope it must be insulated with the equivalent of at least 25 mm of material having a thermal conductivity of ≤0.04 W/(m.K).
- The door connecting an attached garage to the conditioned space of the house is sealed on all four edges to minimise ingress of pollutants. This would require stops around the sides and header. The bottom would either have a stop or rubber seal.
- Combustion appliances must be room-sealed.
- Refer to the Best Practice Guide below for optimal installation and performance of the system.

** Where the bathroom and kitchen fans are not able to meet these extraction rates, the dwelling may not be compliant with Regulation 23 of the Healthy Homes Standards 2019.*

4. Commissioning of Ventilation Systems

Installed ventilation systems are inspected and checked and required volume flow rates are measured. A report or letter is provided demonstrating that all items in the commissioning checklist below have been carried out as a minimum.

System	Required Testing and Commissioning
(1) Continuous	**Functional checks**
	Verify that any temporary protection and packaging has been removed and that shutters open and close correctly.

extract systems	Check for the presence of any abnormal or loud noises on start up or when the system is running in normal background ventilation mode.
	Verify that systems providing continuous ventilation can only be switched off at the main isolator.
	Verify that boosted ventilation rates for the kitchen and bathrooms can be controlled manually by the occupant or are humidistat controlled.
	Air flow measurements
	Air flow measurements with closed door should be carried out using a calibrated air flow device and results recorded in litres per second at each room terminal.
	Record the extract air flow for each extract fan.
	Verify required rates are achieved.
(2,3) Balanced mechanical systems (with and without heat recovery)	**Functional checks**
	Verify that any temporary protection and packaging has been removed and that shutters open and close correctly.
	Verify that the air flow direction is correct at each room terminal.
	Check for the presence of any abnormal or loud noises on start up or when the system is running in normal background ventilation mode.
	Verify that boosted ventilation rates for the kitchen and bathrooms can be controlled manually by the occupant.
	Air flow measurements
	The systems should be balanced to ensure that design air flow rates are achieved at each terminal.
	Air flow measurements should be carried out using a calibrated air flow device and results recorded in litres per second at each room terminal.
	Verify required rates are achieved.

Other Methodologies

In specific dwellings and climates, passive ventilation may be used instead of mechanical ventilation in habitable rooms (not wet areas, which still require mechanical extract). For this method to be used the Homestar Assessor must submit a Technical Question to confirm the alternative method will be accepted before they submit for a rating. It will be required to prove ventilation rates of 0.35 ACH can be achieved for the whole house without occupant interaction; therefore, some amount of automation is required. Calculations should relate to those set out in CIBSE AM10 or a similar document.

Best Practice Installation Guide

These items are in addition to the requirements listed above and are not mandatory; they provide best practice guidelines to ensure correct functioning of the systems.

Fan Performance Recommendations

- Energy demand of continuous mechanical extract should be limited to no greater than 0.7 W/l/s

- Energy demand of mechanical balanced pressure should be limited to no greater than 1.5 W/l/s
- Systems installed in dwellings designed for social housing or for rent should only be able to be switched off at the main isolator.

Background Ventilation for Continuous Extract Systems

- Where possible, install only in habitable rooms, not in wet rooms with extract grilles (refer the below recommendations to minimise short-circuiting).
- Background ventilators should have a minimum equivalent area of 2500mm^2 per habitable space
- These should be located a minimum of 1.7m above floor level to help minimise draughts.
- Background ventilators can be either manually adjustable or automatically controlled.

Noise Reduction Recommendations for Continuous Extract Systems

- The average A-weighted sound pressure level in wet rooms should not exceed 35 dB $L_{Aeq,T}$.

Noise Reduction Recommendations for Balanced Mechanical Ventilation Systems

- Silencers should be installed on the external intake and exhaust if this is in close proximity to regularly occupied outdoor space (either on the same or neighbouring property).
- Single duct runs only; all ducting should run directly back to the distribution box.
- Distribution boxes should be insulated.

Recommendations to Minimise Air Flow Short-Circuiting

- It is important to avoid short circuiting (for extract-only systems in particular), where make-up air is being extracted after it has mixed with or displaced stale air. Avoid the use of permanent openings such as trickle vents in rooms containing extract grilles.
- Air supply terminals should be installed at a high level away from internal doors, and directed across an area of unobstructed ceiling.
- Air extract terminals should be positioned to clear as much air from as much of the room as is practical and, when in a wet room, should be positioned over the bath or shower.
- Open plan areas that contain both supply and extract terminals should have these terminals adequately separated by at least 2/3 of the largest room dimension.
- In continuous extract systems care should be taken to avoid permanent openings (such as trickle vents) in wet rooms containing extract grilles. This is to ensure that air is being drawn through the rest of the home.

Ductwork Recommendations

- Ducts should not be installed where they can easily be damaged, e.g., across an open attic where they may be stood on or have items placed on them.
- The routing of ducts should aim to minimise overall duct length and number of bends. Total duct length should not exceed 1.5 time the direct path length.
- The number of bends should be limited to two for fan flow rates of up to 30 l/s, and to one when higher rates are required.

- When ducting extends past the thermal envelope it should be insulated with the equivalent of at least 15 mm of material having a thermal conductivity of ≤0.04 W/(m.K).
- Ducts within the thermal envelope carrying cold air should be insulated with the equivalent of at least 15 mm of material having a thermal conductivity of ≤0.04 W/(m.K).
- Where a duct breaches a vapor control layer the continuity of the layer should be reinstated.
- Bends should have a minimum inside radius equal to the diameter of the duct.
- Rigid ductwork should be used wherever possible. However, in situations where this is not possible, flexible ductwork may be used, providing extract ventilation rates are not compromised and their lengths are kept to a minimum.

Flexible Ductwork Recommendations

- Flexible ductwork should be pulled taut; this is achieved when extended to 90% of its possible length.
- When a flexible duct is connected to an axial fan, the length should be limited to 1.5m, for centrifugal fans the length should be limited to 6 m.
- Flexible ducting should be properly supported along its length to ensure the duct can run straight without distortion or sagging and with no kinks at any bends.
- Supports should be at intervals no greater than 600 mm.

REVISION AND AMENDMENT

Revision	Category	Description
5.1	Update- Continuous extract pathway	All homes must include an identifiable air path for each habitable room showing the intended pathway(s) from a designed and intentional opening or openings. Previously, only homes designed to a permeability of less than $5m^3/m^2/h$ required a clearly identified intake and pathway.

HC4: Moisture Control

Mandatory Minimums

Any Homestar rating:

All junctions between external walls, internal walls, floors and roofs must be demonstrated to meet the following minimum fRsi factors for the respective climate zone:

Climate Zone	1	2, 3, 4 and 5	6
Minimum temperature factor fRsi	0.55	0.55	0.55

Any project unable to meet this fRSi requirement is required to be fitted with *commissioned*, continuous mechanical ventilation and to have been awarded the commissioning point in credit HC3.

Windows must be thermally broken. Thermally broken frames are defined as having a minimum R-value of R0.25. Thermally broken aluminum, timber and uPVC frames are deemed to comply.

A ground vapour barrier must be installed on the ground below all suspended timber floors.

8 Homestar and above:

Homes must be pressure tested and achieve the following maximum air leakage:

Homestar rating	8 Homestar	9 Homestar	10 Homestar
Maximum pressure test result at 50Pa, $m^3/m^2/hr$	3.0	2.0	1.0

Air and vapour control must be identified for all external walls and roofs.

9 and 10 Homestar:

The window installation detail must be demonstrated to meet the minimum fRsi factors for the respective climate zone.

Points Available

6

Aim	To encourage and recognise measures that reduce condensation on and within building components to improve the indoor environment for occupants, reduce the risk of mould and respiratory illness, and to increase the durability of the dwelling.		
Project-wide	No	Calculator	No

Credit Criteria

Up to 6 points are available where it is demonstrated that indoor moisture levels have been managed through one or more of the three methods listed below.

Method	Approach	Points
(1)	Minimising condensation on internal surfaces	Up to 3 points
AND		
(2)	Minimising condensation in the building envelope	Up to 3 points
OR		
(3)	A building targeting (Design Rating) or certified (Built Rating) as Passive House by the Passive House Institute of Germany	6 points

Evidence

Design Rating

(1) Minimising condensation on internal surfaces	Where points are targeted, provide marked up drawings and/or specifications for **all** of the following:
	Confirmation of thermal bridge fRsi temperature factor values calculated in accordance with ISO 10211 for junctions of the external wall with ground floors, suspended floors and mid-floors. OR Reference to the standard detail used and fRsi factor achieved. OR Evidence that the ventilation system will be commissioned as per the requirements of credit HC3.
	Confirmation of thermal bridge fRsi temperature factor calculated in accordance with ISO 10211 for all roof/external wall junctions. OR Reference to the standard detail used and fRsi factor achieved.
	All window frames are thermally broken. OR Window minimum fRsi temperature factor calculated in accordance with ISO 10211.

	OR Reference to the standard detail used and fRsi factor achieved.
(2) Minimising condensation within the building envelope	Where points are targeted, provide marked up drawings and/or specifications for **all** of the following:
	Ground floor is either in-situ concrete or ground vapour barrier (GVB) is specified below all suspended timber floors.
	Designated air and vapour control layers in all wall, roof and (if suspended) floor constructions. Where the vapour control layer is not on the interior of 75% of the insulation R-value, confirmation that the building assemblies have adequate air and vapour control for the climate and expected internal loads. This means that the vapour control layer must either be: a) on the interior surface of the insulation, or b) 75% of the R-value of the wall is on the cold side of the vapour control layer, i.e. it's positioned no more than 25% deep into the insulation thickness assuming a homogeneous insulation layer.
	Extract from specification confirming that air leakage testing will be performed. Airtightness testing is to be to Method 1, per ISO 9972. The target air tightness should be confirmed.
(3) Building certifying as Passive House	Passive House certificate or extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House.

Built Rating

(1) Minimising condensation on internal surfaces	Where points are targeted, provide photographs referenced to a floor plan **or** marked up drawings showing:
	Confirmation of thermal bridge fRsi temperature factor calculated in accordance with ISO 10211 for junctions of the external wall with ground floors, suspended floors and with mid-floors. OR Reference to the standard detail used and fRsi factor achieved. OR Evidence that the ventilation system has been commissioned as per the requirements of credit HC3.
	Confirmation of thermal bridge fRsi temperature factor calculated in accordance with ISO 10211 for ceilings and walls on the thermal envelope. OR Reference to the standard detail used and fRsi factor achieved.
	All window frames are thermally broken. OR Window minimum fRsi temperature factor calculated in accordance with ISO 10211. OR

	Reference to the standard detail used and fRsi factor achieved.
(2) Minimising condensation within the building envelope	Provide marked up drawings and/or specifications for **all** of the following:
	Ground floor is either in-situ concrete or ground vapour barrier is provided below all suspended timber floors.
	Designated air and vapour control layers in all wall, roof and (if suspended) floor constructions. Where the vapour control layer is not on the interior of 75% of the insulation R-value, confirmation that the building assemblies have adequate air and vapour control for the climate and expected internal loads. This means that the vapour control layer must either be: a) on the interior surface of the insulation, or b) 75% of the R-value of the wall is on the cold side of the vapour control layer, i.e. it's positioned no more than 25% deep into the insulation thickness assuming a homogeneous insulation layer.
	Confirmation of the result of air leakage testing according to Method 1, per ISO 9972. The achieved result should be confirmed.
(3) Building certifying as Passive House	Extracts of "overview" and "verification page" from PHPP energy modelling report showing that dwellings have already met the design criteria of Passive House. Signed contract from Certified Passive House Designer.

Assessment

1. Minimising Thermal Bridging

Up to 3 points are awarded where required junctions meet or exceed the appropriate fRsi temperature factor for the climate zone.

Mandatory Minimum for all Homestar ratings	
The junctions between external walls and floors (including mid-floors), and external walls and roofs meet the fRsi factor appropriate for the climate zone. AND All windows must be thermally broken.	2 points
Mandatory Minimum for 9 and 10 Homestar	
The installation detail for all windows must meet the fRsi factor appropriate for the climate zone.	1 point

The table below shows the minimum fRsi factor by climate zone for junctions between external walls and:

- floors
- roofs
- windows
- internal walls

Climate Zone	1	2, 3, 4, and 5	6
Minimum fRsi temperature factor	0.55	0.55	0.55

The fRsi temperature factor for most standard New Zealand timber frame details can be found on the Homestar Assessor resources pages on the NZGBC website. These may be referenced without calculation. Where standard details are not available, the fRsi factor must be calculated according to ISO 10211.

6 and 7 Homestar Only: Exemptions and Deemed to Satisfy Details

The horizontal junction between the conditioned parts of the dwelling and a balcony or an unheated garage (or other internal unheated spaces) may be exempted from the fRsi requirements.

2. Minimising Building Envelope Condensation

Points are awarded for building constructions that slow the migration of moisture through the building envelope in winter. To be awarded points, external wall, floor (if suspended) and roof constructions must show a designated air and vapour control layer in the envelope which is continuous and sufficient for the climate. Additionally, air leakage testing must be carried out prior to interior lining to verify that the air control layer is intact and performing to expectations.

Optional 6 and 7 Homestar	
Air leakage testing is performed, and the final as-tested airtightness is reported to NZGBC for anonymous reporting aggregated by climate zone. Airtightness testing is to be to Method 1, per ISO 9972. Where there is an air control layer, it is recommended to perform an initial test prior to interior lining while this layer is still accessible for repair. Final test results should be carried out after lining is affixed. For 8 Homestar and above, refer air permeability thresholds below.	0.5 point
Mandatory Minimum for all Homestar ratings	
Ground vapour barrier (GVB) must be installed on the ground below all suspended timber floors. Concrete floors are assumed to be impervious by default.	
Mandatory Minimum for 8 Homestar and above	
Air and vapour control layers are identified on wall, roof, and floor (if suspended) construction drawings. Where the vapour control layer is not on the interior of 75% of the insulation R-value, a specific hygrothermal model of the assembly in the appropriate climate must be provided demonstrating low risk of interstitial moisture; note: this includes where concrete or masonry constructions are insulated internally.	1 point
Mandatory Minimum for 8 Homestar	
Air permeability measured to be under 3 $m^3/m^2/hr$ as per requirements above.	1 point
Mandatory Minimum for 9 Homestar	

Air permeability measured to be under 2 $m^3/m^2/hr$ as per requirements above.	1.5 points
Mandatory Minimum for 10 Homestar	
Air permeability measured to be under 1 $m^3/m^2/hr$ as per requirements above.	2 points

3. Building Certifying as Passive House

At the Design stage, verify that a Passive House Designer has been engaged in the project and that a modelling report is available demonstrating that the dwelling meets the Passive House design criteria.

For a Built Rating, provide the Passive House certificate or signed contract from Certified Passive House Designer, as well as the extracts from the "overview" and "verification" sections.

Further Guidance

Standard NZ construction details that do not meet Homestar standards

External wall to ground slab details with no slab edge insulation are typically not acceptable even if the footer and slab are insulated.

90mm external wall corner details built to current practice with three studs are acceptable in Climate Zone 1 but are not acceptable in climate zones 2 through to 6. In these colder climates 2-stud corners (and the like) will be required.

Guidance for Airtightness Test.

1. In calculating the volume of the dwelling internal dimensions should be used. The volume of internal walls can be ignored. Note that this methodology differs from that required by Passive House. This simplified method is deemed acceptable for Homestar projects targeting an airtightness rate of more than 1ACH at 50 Pa (or permeability of more than 1 $m^3/m^2/hr$) or Homestar ratings below 8 stars.
2. As per the above simplification, midfloor thickness (for a multistorey dwelling) can be ignored in the volume calculation.
3. For 6 and 7 Homestar, it is acceptable to seal all intentional ventilation openings (including trickle vents, passive inlet, and exhaust fan ducts in the bathroom, laundry, and kitchen) for testing. This is in accordance with the ISO9972 Method 1 standard. e
4. For 6, 7, and 8 Homestar, a single airtightness test when the air control layer is complete and accessible for repair is sufficient. Although a final test at completion is recommended, it is not required for the purpose of Homestar certification.

5. For 8, 9, and 10 Homestar, only the MVHR openings may be sealed for testing in accordance with Passive House practice.
6. For 9 and 10 Homestar, an airtightness test when the air control layer is complete and accessible for repair is recommended and a final test on completion is required.

Blower door test guidance for multi-dwelling and large projects (i.e., retirement villages).

i) In case the residential development consists of fewer than four dwellings, all dwellings within the development will be tested.

ii) For developments with four or more homes; either three homes or 25% of the total number of dwellings (whichever is greater) must be tested. This includes;

- For apartment buildings; at least one dwelling on the top floor, one on the bottom floor, and the dwellings with both the largest and smallest testing areas.
- For townhouse developments (attached dwellings); at least one end unit, one middle unit, and the units with both the largest and smallest testing areas.
- For detached dwellings; the units with both the largest and smallest testing areas.
- The selection of sample dwellings should be nominally random and not disclosed to contractors prior to testing.
- In ALL instances at least one of each Homestar typology must be tested.

Note: the area is the internal surface of the boundary of the unit/dwelling. All walls, floors and ceilings that belong to the apartment, excluding internal walls.

The apartment walls/ceiling/floors that are adjacent to neighbouring apartments form part of this boundary - means air leakage into neighbouring units will be part of the test result.

iii) Where the pressure test result is within 10% of the targeted ACH at design, no changes need to be made to the thermal model and resubmitted at the built stage.

Where the pressure test exceeds the targeted ACH, the energy model must be revised and resubmitted with the pressure test result||.

REVISION AND AMENDMENTS

Revision No.	Category	Description
	Revision	fRsi requirements revised and alternative compliance of commissioning ventilation system.
	New	Minimising condensation on internal surfaces: Alternative compliance for fRsi
	Removed	Deemed to satisfy for concrete slab and wall using minimum product (R-values).
	Revision	Minimising condensation within the building envelope: Clarification & Revised airtightness testing method.
	New	Guidance for airtightness test.
v5.1	New	Added guidance for blower door test.

HC5: Natural Light

Points Available	3		
Mandatory Minimums	None		
Aim	To encourage and recognise dwellings that provide good levels of natural light for occupants.		
Project-wide	No	Calculator	Yes

Credit Criteria

Up to 3 points are available where it is demonstrated that good levels of natural light have been provided. The distribution of points awarded depends on the number of bedrooms, as per the table below.

Dwelling Type	Space	Points
Studio	All habitable (living and sleeping) spaces comply	3 points
1 bedroom dwelling	Living room and kitchen complies	2 points
	Bedroom complies	1 point
2+ bedroom dwelling	Living room and kitchen complies	1 point
	The largest bedroom complies	1 point
	All other bedrooms comply	1 point

There are three methods that can be used to verify compliance:

1. Window to floor area ratio
2. Average daylight factor (ADF)
3. Spatial daylight autonomy modelling (sDA)

Evidence

Design Rating

*A worst-case representative design should be selected for each typology.

(1) Window to floor area ratio	Marked up drawings and/or calculations demonstrating that the sum of window areas in each bedroom and/or living area meet the stipulated minimum window to floor area ratio.
(2a) ADF –	Provide **all** of the following for **each** typology:
	All values used and assumptions made.

manual calculation method	Results of calculation method showing average Daylight Factor for compliant rooms.
(2b) ADF - computer modelling method	Provide **all** of the following for **each** typology:
	Email or letter from the competent professional undertaking the model confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) modelling software used and d) the results of the model relating to the Homestar requirements.
(3) Spatial Daylight Autonomy (sDA)	Provide **all** of the following for **each** typology:
	Email or letter from the competent professional undertaking the model confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) modelling software used and d) the results of the model relating to the Homestar requirements.

Built Rating

*A worst-case representative should be selected for each typology.

(1) Window to floor area ratio	Marked up drawings and/or calculations demonstrating that the sum of window areas in each bedroom and/or living area meet the stipulated minimum window to floor area ratio.
(2a) ADF – manual calculation method	Provide **all** of the following for **each** typology:
	All values used and assumptions made.
	Results of calculation method showing average Daylight Factor for compliant rooms.
(2b) ADF - computer modelling method	Provide **all** of the following for **each** typology:
	Modelling software used to calculate the Daylight Factors.
	Email or letter from the competent professional undertaking the model confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) modelling software used and d) the results of the model relating to the Homestar requirements.
(2c) Physical measurement method	Provide **all** of the following for **each** typology:
	Email or letter from the competent professional undertaking the measurement confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) measurement methodology and d) the results of the measurements relating to the Homestar requirements.
(3) Spatial Daylight Autonomy (sDA)	Provide **all** of the following for **each** typology:
	Email or letter from the competent professional undertaking the model confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) modelling

	software used and d) the results of the model relating to the Homestar requirements.

Assessment

Use one of the following verification methods to demonstrate compliance with the credit criteria.

1. Window to floor area method

This method is applicable to 6 and 7 Homestar only.

Window areas in external walls are no less than:

- 15% of the floor areas for living areas and bedrooms where the windows are not significantly shaded.
- 20% of the floor areas for living areas and bedrooms where the windows are significantly shaded, e.g. by eaves, balconies, purpose designed shading.

Living Areas

For this credit, the term "living areas" includes kitchens whether they are part of a single open plan living/dining/kitchen area or a separate room. Home theatres and TV rooms are excluded as these do not have a high daylight requirement

Bedrooms

The Homestar Assessor is to use their discretion when determining whether a room that is labelled as a 'study' is in fact a bedroom. If it is clearly not a bedroom, the study will need to be considered under living areas, due to the importance of daylight for the likely use of these spaces. These may be a separate room or a part of the larger living area depending on the design. Due to requirements in clause G7 of New Zealand Building Code, rooms without windows cannot be considered bedrooms.

Shading

Windows are considered "not significantly shaded" if they have no eaves, balconies, deep reveals, or purpose designed shading devices above or around them on the same floor as the window. Windows with eaves no more than 300 mm deep are also considered unshaded. If the window does not meet these criteria, then the project can either opt to meet the percentage glazing for significantly shaded windows or calculate the angle of visible sky as below to show that the window is not significantly shaded.

Angle of Visible Sky

The angle of visible sky is the vertical angle between the lowest and highest points of the sky that are visible from the centre of the window. Windows should be considered significantly shaded if the angle of visible sky is less than 45°.

2. Average Daylight Factor (ADF)

This method is applicable for any rating and must be used for 8 Homestar or higher.

Using either the manual calculation method or computer modelling, determine compliance using the following benchmarks by room type:

- **Kitchens (both separate and connected to living areas):** an Average Daylight Factor of no less than 2.0% (as calculated at the working plane under an overcast sky) for kitchens.
- **Other living areas and bedrooms:** an Average Daylight Factor of no less than 1.5% (as calculated at the working plane under an overcast sky).

Manual Calculation Method

There must be negligible overshadowing of glazed areas and a separate calculation must be provided for each of the bedrooms, kitchens, and living areas.

The equation below is a simplified method that calculates the Average Daylight Factor (ADF) for a rectangular room whose depth is less than 2.5 times the window head height, under an overcast sky. The manual calculation should be completed using the calculator provided, however the calculation can be done individually if needed.

$$ADF = \frac{VT\ x\ angle\ of\ visible\ sky\ x\ area\ of glass}{total\ surface\ area\ x\ (1 - LR\ average\ 2)}$$

VT is the visible transmittance of the glazing (data available from window suppliers).

Angle of visible sky is the vertical angle between the lowest and highest points of the sky that are visible from the centre of the window. For a vertical window, this value will be between 0 and 90 degrees.

Area of glass (not including frame) is approximately 80 percent of the overall window size.

Total surface area is the total area of interior surfaces (walls, floor, ceiling and doors).

LR average is the area-weighted average of the interior surfaces. This is calculated using the following:

$$\frac{wall\ area\ x\ wall\ reflectance}{total\ surface\ area} + \frac{floor\ area\ x\ floor\ reflectance}{total\ surface\ area} + \ldots etc.$$

Computer Modelling Compliance Method

Review outputs of the daylight model to confirm the following:

- Modelling software used to calculate the Daylight Factors
- Weather file used to calculate the Daylight Factors where climate-based daylight modelling is used

- Values of reflectance and transmittance used for each relevant material/glazing
- Uniform Design Sky or CIE Standard Overcast Sky used for the daylight model
- Output from the daylight modelling showing the Daylight Factors for living spaces and bedrooms

Acceptable software: 3DS Max Design, AGI32, Daysim, Dial+, Dialux, Diva for Rhino, Ecotect, Evalglare, Groundhog, IESVE, Lightsolve, Radiance, and Relux and Velux daylight visualiser.

Point calculations

The Daylight Factor must be calculated for at least one point for each square metre of floor area. A maximum 1m² grid must be overlaid over the floor plan to determine these points and at all perimeters, and each 1m² must begin at the façade. Daylight Factor is then calculated in the centre point for each box in the grid.

Reflectance

The ratio of the flux reflected from a surface to the flux incident on it.

The following table can be used to determine the reflectance of surfaces where the exact materials are not yet specified. Actual reflectance must be used when specific materials have been selected.

Reflectance level required	Minimum surface reflectance		
	Ceilings	Walls[1]	Floor
Medium reflectance	0.7	0.4	0.2
High reflectance[2]	0.7	0.6	0.4

1. Reflectance calculation for walls does not include windows.
2. All apartments are required to use the high reflectance level.

Physical Measurements Method (Built Rating)

- Measurements using a lux meter can only be taken on an overcast day and when the outdoor illuminance is no greater than 10,000 lux; internal and external measurements need to be taken at the exact same time.
- To determine the outdoor illuminance, the sky needs to be completely visible with no obstructers nearby (no less than 10 m to the obstruction that is less than 5 m in height).
- If the outside lux measurement is less than 10,000 lux, then internal measurements can be taken to demonstrate compliance with the Credit Criteria (an average of 150 lux would correspond to an ADF of 1.5%).
- A minimum of 5 measurements are to be taken for each room and the results averaged. A measurement is to be taken in each corner of the room, 1 m out from the wall at floor level and then a final measurement in the centre of the room.
- Measuring devices must be calibrated. Smartphone applications are only acceptable if these can be (and are) calibrated and connect to a separate physical measuring device rather than the light sensor on the smart phone. This is due to the inaccuracy and variability of results between phone applications and different phones.

Overshadowing: Overshadowing must be taken into account. A nearby building or feature (such as a retaining wall or fence) must be accounted for in overshadowing.

Overcast sky: A recognised and validated overcast design sky model with an illuminance of 10,000 lux is to be used and, for physical measurements, a uniform overcast sky with an illuminance of 10,000 lux or less.

Standard year: For the purposes of determining natural lighting, the hours between 8 am and 5 pm each day with an allowance being made for daylight saving.

3. Spatial Daylight Autonomy (sDA)

SDA is an approved method of climate-based daylight modelling from the Illuminating Engineering Society and defines the percentage of floor area that at minimum receives 300 lux at a working plane for 50% of occupied hours yearly. Compliance is achieved where:

- Living areas and bedrooms: a Spatial Daylight Autonomy above 150 lux for 50% of the occupied year (8am – 5pm) for 60% of the living areas and bedrooms (sDA150lux50%).
- Kitchen: a Spatial Daylight Autonomy above 200 lux for 50% of the occupied year (8am – 5pm) for 60% of the kitchen (sDA200lux50%).

HC6: Acoustic Performance

Points Available	Standalone dwellings: 1.5 points Terraces and Apartments: 3 points		
Mandatory Minimums	None		
Aim	To encourage and recognise the provision of an improved acoustic environment.		
Project-wide	No	Calculator	No

Credit Criteria

Up to 1.5 points for standalone dwellings and 3 points for terraces and apartments are available where it is demonstrated that the home has an acceptable acoustic environment.

Standalone Dwellings

Dwelling Type	Space	Points
Standalone	Internal ambient noise	Up to 1.5 points
Terraces and Apartments	Internal ambient noise	Up to 1.5 points
	Sound insulation	1 point
	Absorptive finishes in common areas	0.5 point

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

For Design Ratings, review drawings and/or acoustic design reports.

For Built Ratings, review drawings, acoustic design reports and/or acoustic testing results and conduct any relevant site inspections.

Internal Ambient Noise – all dwelling types

This credit criteria relates to the ability of the building envelope to keep ambient noise (road traffic, etc) levels to an acceptable level. This depends on the external acoustic environment in which the dwelling is placed, as well as how the envelope is constructed. These factors are classified into “neighbourhoods” and are defined as follows:

Neighbourhood	Definition	Typical Night Time External Noise Levels
Rural	Locations away from minor and major environmental noise sources, such as road and rail networks, flight paths, industrial areas and entertainment premises.	< 45 dB LAeq,8hr (23:00 – 07:00)
Suburban	Locations close to minor environmental sources of noise, such as minor roads, but away from major sources of environmental noise.	< 55 dB LAeq,8hr (23:00 – 07:00)
Urban	Locations within inner city limits, near major roads, or major environmental sources of noise such as the rail network, industrial premises or entertainment precincts.	> 55 dB LAeq,8hr (23:00 – 07:00)

There are two pathways for establishing compliance:

(1)	Prescriptive pathway: STC and R_w ratings (dwellings in rural and suburban neighbourhoods only)	0.5 point
(2)	Acoustic measurement and testing (all dwelling types)	1.5 points

1. Prescriptive Pathway – rural and suburban neighbourhoods only

0.5 point is achieved where the following elements in all applicable spaces meet corresponding STC or R_w ratings. The rating is for the entire element, which may be a construction of several parts (e.g., walls have insulation, linings, framing and cladding).

House Type	Element	Min STC Rating or R_w Rating
All house types	External walls and ceilings	43
	Windows	33

Note: the listed benchmarks for this pathway are indicative only for the v5 draft release and are currently being finalised.

Applicable spaces depend on the type of neighbourhood in which the dwelling is located, as per the table below:

Type of Neighbourhood	Compliance spaces
All (rural, suburban and urban)	Bedrooms
Suburban and urban	Living and kitchen areas
	Studies and work areas
	Apartment common areas

2. Acoustic Measurement and Testing

1.5 points are available where a letter or report from a suitably qualified[3] acoustic engineer confirms that the internal ambient noise levels are no more than the stipulated maximum design sound levels. If the dwelling is designed for natural ventilation, ambient noise levels must be achieved with the ventilation openings positioned to achieve minimum code-compliance background ventilation rates. If noise levels cannot be met with natural ventilation, mechanical ventilation and/or cooling must be provided to comply with credits HC2 and HC3.

The envelope of the dwelling should be designed such that internal ambient noise levels are no more than the maximum design sound levels as per the table below.

Neighbourhood	Space	Max. Design Sound Level ($L_{Aeq.T}$), dB(A)
Rural	Bedrooms (11 pm-7am only)	30
Suburban or near minor roads	Bedrooms (11 pm-7am only)	35
	Living and kitchen areas	35
	Studies and work areas	40
	Apartment common areas	50
Urban	Bedrooms (11 pm-7am only)	35*
	Living and kitchen areas	40
	Studies and work areas	40
	Apartment building common areas**	50

** This meets AS/NZS 2107 requirements (rather than 5dB above), but is in line with best practice guidance as per the Auckland Unitary Plan.*

*** common areas typically include corridors, hallways, etc., which residents will occupy and expect reasonable noise levels. Rooms that are not typically occupied and/or are not noise sensitive (e.g. plant rooms, store cupboards) are not required to meet this sound level.*

The internal ambient noise levels should include the cumulative noise from external noise sources and mechanical services operating at their design rate to meet the requirements of credits HC2 and HC3. measurements are to be taken over a 15-minute period within the worst-case hour (typically 6am to 7am) of the stipulated timeframe with mechanical services in operation (a longer period is acceptable, but not required).

Sound Insulation – terraces and apartments only

1 point is available where acoustic engineering documentation and/or construction details to confirm if the in-situ Impact Sound insulation (IIC rating) AND in-situ airborne sound insulation (STC and R_w ratings) levels are 5dB better than minimum stipulated levels in NZ

[3] A suitably qualified acoustic engineer is defined as a member of the Acoustical Society of New Zealand, or part of a team that is a member firm of the Association of Australasian Acoustical Consultants.

Building Code clause G6. Refer minimum design values of the following table. As per the NZ Building Code clause G6, a relaxation of 5dB is permitted for on-site performance (AIIC and ASTC).

Element	Min IIC rating	Min STC/R_W rating
Intertenancy walls	No requirement	60
Intertenancy floors	60	60
Entrance doors (to dwelling)	No requirement	30

Absorptive Finishes – terraces and apartments only

0.5 point is available where acoustic engineering documentation confirms that all enclosed entranceways, lobbies, stairways, corridors and hallways leading to dwellings have an area at least equivalent to the ceiling area covered with an absorptive finish achieving NRC 0.55 or greater. Compliance is achieved by default where the terrace or apartment development does not have such areas.

Finishes that are deemed to satisfy the NRC 0.55 absorptive requirement, and that would typically be utilised in this environment, include:

- Acoustic mineral fibre ceiling tiles
- Perforated plasterboard with a cavity comprising mineral wool insulation
- Perforated timber/metal with a cavity comprising mineral wool insulation

In shared common areas of apartments (e.g. corridors), the floor finish typically comprises a durable, hard-wearing material e.g. commercial grade carpet or a hard floor finish, with walls typically comprising a plasterboard finish. The ceiling finish is therefore considered the most suitable place for installing absorptive treatment.

A carpeted floor finish is unlikely to achieve the NRC specification on its own. However, it is recommended for the control of footfall noise in these areas. Absorptive wall panels could also be utilised; however, these may not be considered a preferred option due to potential for damage and maintenance reasons.

HC7: Healthy Materials

Points Available	4		
Mandatory Minimums	None		
Aim	To encourage and recognise the specification and use of interior finishes that have a reduced impact on indoor air quality and occupant health.		
Project-wide	Yes	Calculator	Yes

Credit Criteria

Up to four points are available in this credit:

Method	Approach	Points
(1)	80% of applied coatings by volume (L) within the interior of the dwelling meet the VOC limits as specified by a NZGBC-recognised IAQ scheme or eco-label.	1 point
(2)	80% of floor coverings by area covered (m^2) within the interior of the dwelling meet the VOC limits as specified by a NZGBC-recognised IAQ scheme or eco-label.	1 point
(3)	All engineered wood used in shelving and cabinetry doors and carcasses and any other exposed engineered wood surfaces within the interior of the dwelling meet the VOC limits as specified by a NZGBC-recognised IAQ scheme or eco-label.	1 point
(4)	80% of adhesives and sealants by volume (L) used within the interior of the dwelling meet the VOC limits as specified by a NZGBC-recognised IAQ scheme or eco-label.	1 point

Evidence

Design Rating

All	Completed Materials Calculator.
Each product category for which points are claimed	Provide **one** of the following:
	Copies of eco-label or IAQ scheme certificates and/or VOC test reports demonstrating that each product claimed meets the requirements. If VOC levels are determined by laboratory testing, the supporting information must include the test report from a laboratory competent to complete the relevant test method.

	Extract from the specification and/or commitment from the project owner or main contractor to meet the compliance requirements.

Built Rating

All	Completed Materials Calculator.
Each product category for which points are claimed	Provide **all** of the following:
	Copies of eco-label or IAQ scheme certificates and/or VOC test reports demonstrating that each product claimed meets the requirements. If VOC levels are determined by laboratory testing, the supporting information must include the test report from a laboratory competent to complete the relevant test method.
	Purchase receipts, invoices and/or photos showing products used.

Assessment

For a Design Rating, review the plans, specifications or confirmation letters to verify what products or materials are specified and check the datasheets and/or materials' third-party verification scheme certificates to determine if it is compliant. See product-specific guidelines below.

For a Built Rating, invoices or receipts are required to demonstrate that the specified products have been used in construction. A copy of the datasheet and/or third-party verification scheme certificate is also required. See product-specific guidelines below.

Assessable Areas

For the purpose of this credit, the interior of the dwelling means:

- Within the conditioned floor area of standalone or terrace houses
- The conditioned floor area AND fully enclosed internal corridors, lobbies, stairwells and hallways in apartments that are located between building entrances and apartments, as well as any other common areas within the building that are used by residents

Assessors who believe an area should be excluded in a particular project should submit a Technical Question outlining their reasoning.

Compliance Pathways

With the exception of products or materials that can be claimed compliant by default, as outlined within each subsection below, all other types of surfaces that are claimed must demonstrate compliance through one or more of the following pathways:

- NZGBC-recognised eco-label certification (see NZGBC website for list)
- NZGBC-recognised IAQ scheme certification (see NZGBC website for list)
- competent* independent laboratory testing demonstrating compliance with the limits set by one of the NZGBC-recognised eco-label or IAQ scheme
- competent* independent laboratory testing demonstrating compliance with the limits set out in the maximum TVOC content tables below

** Laboratories may demonstrate their competency by being accredited or registered to ISO/IEC 17025 from International Accreditation New Zealand (IANZ) or another recognised accreditation agency (e.g. NATA in Australia).*

The table below outlines which products can be deemed compliant and under which circumstances, without needing to provide a certificate or report.

Product or Material	Compliance
Floor and wall tiles	Default
Metal	
Solid timber	Default, however any applied coatings are subject to the credit criteria.
Other naturally-occurring materials (e.g. clay, stone, cork)	Default, however any adhesives, binders, chemical treatments or applied coatings are subject to the credit criteria.

1. Applied Coatings

Only consider coatings that are applied on-site to walls, ceilings, floor(s) or flooring and/or cabinetry. Offsite applied coatings are excluded.

Coatings to be considered are:

- paints
- primers
- sealers
- architectural sealants
- stains
- varnishes

Coating Type	Maximum TVOC content (g/L)
Low sheen (interior)	60
Low sheen (exterior)	60
Flat washable (interior)	55
Flat ceiling (interior)	60
Flat (exterior)	55
Semi-gloss (interior)	65
Semi-gloss (exterior)	65
Gloss (interior)	75
Gloss (exterior)	75
Stains and varnishes	100
Exterior timber primer	60
Interior sealer	60
Latex primer (for galvanised iron and zincalume)	50
Exterior latex	60
Interior latex	60
One and two pack performance coatings for floors	140
Intumescent paints	100

Architectural sealants (exposed to interior only)	250

2. Floor Coverings

The following products should be included:

- Carpet
- Resilient flooring

Where floor coverings targeting points in this credit do not have eco-label certification or certification with a recognised IAQ scheme, compliance may be confirmed via VOC emissions testing. All VOC emission limits and compliance testing must meet or exceed those stated within, one of the appropriate and recognised eco-labels or IAQ schemes, e.g. Eco-choice Aotearoa, GreenTag GreenRate, CIAL-ECS, GECA, etc. Compliance for engineered timber flooring is established using the methods outlined in 3. Engineered wood Cabinetry and Shelves below.

3. Engineered Wood Cabinetry and Shelves

Products include:

- engineered wood panels used for cabinetry
- engineered wood panels used for shelves
- engineered timber flooring

The emission levels for engineered wood products must be established by an IANZ (International Accreditation New Zealand), NATA (National Association of Testing Authorities) or ISO/IEC 17025 registered laboratory as per the testing methodologies provided below.

In lieu of certification with an eco-label that restricts VOC content, compliance with these requirements shall be demonstrated by providing test reports from a competent laboratory using the relevant test methods below.

- AS/NZS 4266.16 Reconstituted wood-based panels – Methods of test – Formaldehyde emission – Desiccator method
- AS/NZS 2098.11 Determination of formaldehyde emission from plywood
- AS/NZS 4357.4 Structural laminated veneer lumber - Part 4 Determination of formaldehyde emissions

Panels shall demonstrate a level equivalent to or below E1 limit values provided in the table below.

Test Protocol	E1 Emission Limit / Unit of Measurements
AS/NZS 2269:2004 - testing procedure AS/NZS 2098.11:2005 method 10 for plywood	< 1.0 mg/L
AS/NZS 1859.1:2004 - particle board, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.5 mg/L
AS/NZS 1859.2:2004 - MDF, with use of testing procedure AS/NZS 4266.16:2004 method 16	< 1.0 mg/L

JIS A 5908:2003 – particle board and plywood, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A 5905:2003 - MDF, with use of testing procedure JIS A 1460	< 1.0 mg/L
JIS A1901 (not applicable to plywood)	< 1.0 mg/L
ASTM D5116	<0.1 (+/- 0.0005) mg/m²hr (may also be represented as mg/m²/hr)
ISO 16000 part 9, 10 and 11 (also known as EN 13419)	<0.1 (+/- 0.0005) mg/m²hr (may also be represented as mg/m²/hr)
ASTM D6007	0.12mg/m³*
ASTM E1333	0.12mg/m³**
EN 717-1 (also known as DIN EN 717-1)	0.12 mg/m³
EN 717-2 (also known as DIN EN 717-2)	3.5 mg/m²hr (may also be represented as mg/m²/hr).
**The test report must confirm that the conditions of Table 1 comply for the particular wood product type, and the final results must be presented in EN 717-1 equivalent (as presented in the table) using the correlation ratio of 0.98.*	
*** The final results must be presented in EN 717-1 equivalent (as presented in the table), using the correlation ratio of 0.98.*	

4. Adhesives and Sealants

Products include any adhesive or sealant applied on site within the conditioned area.

Any adhesive and sealant product(s) used within the conditioned area and applied on site must meet the VOC limit criteria for the applications outlined below. This includes exterior-grade and solvent-based sealants and adhesives used in internal applications, as well as sealants used to enhance fire and water-proofing properties.

Product Type	Maximum TVOC content (g/L)
Indoor carpet adhesive	50
Carpet pad adhesive	50
Wood flooring and laminate adhesive	100
Rubber flooring adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Dry wall & panel adhesive	50
Multipurpose construction adhesive*	70
Structural glazing adhesive	100
Architectural sealants*	250
**N.B. clause in information above the table for multipurpose and architectural sealants.*	

REVISION AND AMENDMENTS

Revision No.	Type/Date	Description
v5.1	Update	Clarification on floor coverings Moved "Engineering timber flooring" to 3. Engineered wood Cabinetry and Shelves

LV1: Inclusive Design

Points Available	3		
Mandatory Minimums	None		
Aim	To encourage and recognise dwellings that are inclusive, visitable, easily adaptable, and accessible, to meet the changing needs of current and future occupants.		
Project-wide	No	Calculator	No

Credit Criteria

Points are awarded based on the specific features in the dwelling or through third-party assessment, such as Lifemark™ Certification.

1. Checklist Pathway – up to 2.25 points

All items in Design for Vision Impaired Occupants Checklist achieved.	0.5 point
All items in Visitable Design Checklist achieved.	1 point
All items Adaptable Design Checklist achieved (includes all criteria of Visitable Design Checklist).	1.75 points
All items in Design for Vision Impaired Occupants and Visitable Design Checklist achieved.	1.5 points
All items in Design for Vision Impaired Occupants and Adaptable Design Checklist achieved.	2.25 points

2. Third-Party Assessment Pathway – 3 points

Lifemark™ Certification	3 points
OR	
Third-party expert assessment of contextually appropriate universal design needs with recommendations incorporated into the design and build.	3 points

Evidence

Design Rating

Checklists: Vision impaired Visitable Adaptable design	For each checklist claimed, provide **one** of the following:
	Marked up drawing(s) and/or specification(s) demonstrating compliance with each checklist requirement.
Lifemark™ certification Universal design	Provide **all** of the following:
	Documentation demonstrating engagement with a suitably qualified or certified third-party organisation or individual, including any relevant qualifications, training or experience.
	Summary of recommendations, identifying which were adopted.
	Marked up drawing(s) and/or specification(s) demonstrating compliance with consultation results.

Built Rating

Vision impaired Visitable Adaptable design	For each checklist claimed, provide **one** of the following:
	Marked up drawing(s) and/or specification(s) demonstrating compliance with each checklist requirement.
Lifemark™ certification	Copy of the Lifemark™ certificate.
Universal design	Provide **all** of the following:
	Documentation demonstrating engagement with a suitably qualified or certified third-party organisation or individual, including any relevant qualifications, training or experience.
	Summary of recommendations, identifying which were adopted.
	Marked up drawing(s), specification(s) or photograph(s) demonstrating compliance with consultation results.

Assessment

1. Checklist Pathway

To achieve points, the design must include all the features on the relevant checklist.

Design for Vision Impaired Occupants Checklist	
Achieve all requirements below:	
Glare control	Matte colours used for walls, doors and floor.
	Floor surfaces have a matte finish.
	Lighting is diffused to avoid a reflective effect on floors below ceiling mounted lights.
Depth perception	Skirtings more than 100mm high are the same colour as the walls.
Hazard mitigation	Stair edgings, handrails and other safety features are detailed and coloured to stand out from the background.

Colour contrast	Light Reflectance Value (LRV) of adjacent walls and ceiling is at least 30 points apart.
	Doors and door handles, switches, and power/phone outlets contrast with the background.
Switch and power point placement	All light switches, service controls and door handles are aligned and located between 900mm and 1200mm above finished floor level.
	Each room has at least one power outlet between 900mm and 1200mm above finished floor level.
	Where applicable, a phone jack point (BS6312, 6P2C or 8P8C) is located between 900mm and 1200mm above finished floor level.
	Switches, power point and phone jack points are placed in a cluster within 300mm of a doorway (measured from the edge of the opening).

Visitable Design Checklist	
Achieve all requirements below:	
Entrance and internal access	Step-free, slip-resistant path that extends to property boundary and any vehicle parking area within the boundary has a gradient of no more than 1 in 12 and width of at least 1200mm. Additional for apartment buildings: the path from the building entrance to the dwelling entrance is slip-resistant with step-free access.
	Hallways are at least 1050mm wide.
	All internal and external doors have a minimum clear opening of 810mm (860mm door leaf).
	The entry is under cover and slip resistant.
Habitable rooms	There is a habitable room on the entry level of the house.
Bathroom	A toilet is located on the entry level.
	There is provision for a future clear transfer space of 800mm beside and/or in front of the toilet. The toilet pan is 450-460mm from the side wall.
	The vanity extends a minimum of 400mm from the back wall.
	The room is step-free.
Fixtures and fittings	There are lever handles on all doors.
	Power points, TV, phone and computer outlets are a minimum of 300mm above the finished floor.
	Light switches, other service controls and door handles are aligned at between 900mm to 1200mm above the finished floor level.
Kitchen	Dining and cooking areas are located next to each other.
Car parking	Designated disable parking or a safe drop off zone with step -free access to the property. The safe drop-off zone has space for a vehicle to park to pick up and drop off a disabled rider, with step-

	free access to a footpath and without requiring the rider to move through moving or parked traffic.
	OR
	Vehicle parking is provided with space adjacent to the parking spot that can be widened to 3500mm.

Adaptable Design Checklist	
Achieve all requirements below:	
Visitable	All requirements met from Visitable Design Checklist.
Kitchen	All appliances are located at least 300mm from a corner.
	The minimum distance between two fixed kitchen benches is 1200mm (e.g. kitchen island and wall-fixed bench).
Bedroom	There is space on the entry living level where a standard single bed (measuring 900mm x 1900mm) can fit.
	There is a minimum 800mm clear space available around one side and the foot of the bed.
	There is a minimum 800mm wide path from the door to the side of the bed.
	This room is not the main living area.
Bathroom	The bathroom walls are reinforced to provide a fixing surface for grab rails.
	There is, or there is provision for (including plumbing), an entry level shower with a minimum dimension of 1200mm x 1200mm.
Laundry	The laundry space or room is large enough to provide at least 1050mm clearance in front of fixed benches and appliances.
Stairs (multi-storey dwellings)	Stairwells have a minimum clear width of 1000mm and are straight in design with no winders.
	A handrail is installed along the entirety of the staircase.

2. Third-Party Assessment Pathway

Lifemark™ Certification	The project has achieved Lifemark certification (any level).
Other	The project has completed all of the following:
	Worked with the intended occupants to identify their specific, contextual needs, as well as those of others associated with the dwelling (residents and visitors, including service providers and emergency services).
	Consulted a practitioner or advocacy organisation with expertise in those specific accessibility needs in order to establish how to best meet these needs.
	Detailed report as to how these recommendations were implemented in the project.

LV2: Occupant Amenities

Points Available	2		
Mandatory Minimums	None		
Aim	To recognise homes that are designed, built and located such that they meet occupants needs and are convenient to live in.		
Project-wide	Yes	Calculator	No

Credit Criteria

Up to 2 points are awarded where the following amenities are provided or located in proximity to the dwelling:

Method	Approach	Points
(1)	Home User Guide	Up to 1 point
AND		
(2)	Access to amenities	Up to 1 point

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

For standalone and terraced dwellings, each individual dwelling must have the feature for which points are being claimed.

1. Home User Guide

1 point is awarded for the provision of a Home User Guide (HUG) which conveys detailed information on the features of the dwelling to the occupants. This document must include all of the following as a minimum:

- Features designed to save energy, water and carbon emissions
- Other sustainable features of the house including material choices, and what makes the home warm and dry
- Good ventilation practice guidelines

- Managing household waste
- Maintenance work, including maintenance guidance* and contractor information
- Landscaping and ecology information

Where available/applicable:

- House plans and construction details
- Appliance manuals
- Warranties and Guarantees
- Local transport and community information

**Not required for social housing, units in retirement villages and other dwellings where maintenance is managed by an external body.*

NZGBC provides a template that may be used to develop the HUG. However, as long as ALL of the above items are included where appropriate, it is not mandatory to use the NZGBC HUG template.

2. Access to Amenities

0.25 point is awarded per onsite or neighbourhood amenity within walking distance (800m), up to 1 point. Only one amenity per row can be awarded points with the exception of educational facilities, where multiple facilities are available catering to different age groups (e.g., secondary, tertiary, early childhood), or those serving a gender not served by another facility (e.g., co-ed secondary school and a girls-only secondary school), can be counted separately.

1	Café, restaurant, takeaways
2	Chemist, medical centre
3	Community centre
4	Dairy, service station
5	Educational facility
6	Fitness centre or gym
7	Marae
8	Place of worship
9	Post office
10	Public library
11	Public park, domain, sports field
12	Supermarket, superette

Measuring Distance

For single homes, measure walking distance from the front entrance to the property.

For large developments with defined boundary and access points, distance to an amenity is measured from these access points. Distance should also be measured along a current or future accessway (road, footpath, cycle path) safe for pedestrian use. These could include safe paths through open public parks and domains. Future accessways can only be

included if they are slated to be completed within two years of the assessed project's completion.

LV3: Eco-Friendly Living

Points Available	2		
Mandatory Minimums	None		
Aim	To encourage and promote developments that provide a safe and sustainable community that promotes an active lifestyle.		
Project-wide	Yes	Calculator	No

Credit Criteria

Up to two points are available in total across the eco living and safety checklists below. There is no requirement to target a minimum number of points in either checklist, however each checklist has a maximum number of points that can be targeted from it.

Method	Approach	Points
(1)	Eco-Living checklist	Up to 1 point
(2)	Safety checklist	Up to 2 points

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

For standalone and terraced dwellings, each individual dwelling must have the feature for which points are being claimed. For Design ratings, use plans and specification to establish features that will be present on the property. For Built Rating, inspect on site.

1. Eco-Living Checklist

0.5 point is awarded per feature, up to a maximum of 1 point.

Standalone and Terraced Dwellings	Apartments and Communal Housing
Vegetable gardens – per m^2	Integrated, dedicated internal bins for separating rubbish and recycling and food bins.
Fruit trees – per two trees	
Integrated, dedicated internal bins for separating rubbish, recycling and food waste. *Where it is confirmed that the dwelling (s) would be provided with a kitchen or compost caddy by the council (evidence required), this may be accepted as the third bin.* AND Where a collection service is available: an accessible external space to store food and, if applicable, garden waste. OR Home composting facilities.	Communal facilities to sort and store rubbish, recycling and food waste separately and away from pests, for collection by waste removal operator. AND The development is part of a community, commercial or local authority composting service.

Vegetable garden areas

The area measured is the total area used or designated for vegetable planting. Make an assumption where the planted area is not clearly defined and /or there is mixed planting.

Fruit trees

When counting fruit trees do not include those where the fruit is purely ornamental; however, include if at all edible.

Capacity of waste facilities

To be counted for points, communal waste facilities should be sufficiently sized for the number of dwellings that will utilize them. Rubbish and food waste storage facilities must have capacity for storing a total of 50L per dwelling per week in between collections, and recycling storage facilities must have capacity for storing 40L per dwelling served. Rubbish and recycling should not be comingled, and waste storage containers should have clear labelling designating what type of waste /recyclables /food waste, etc are accepted.

2. Safety Checklist

0.5 point is awarded per feature, up to maximum of 2 points.

Standalone and Terraced Dwellings	Apartments and Communal Housing
House number is clearly visible from street entrance (including at night).	Apartment building street address and/or name is clearly visible from the main street entrance.
Security lighting has a daylight and motion sensor by main entrance and garage (if present).	Security lighting is on daylight and motion sensors by all access doors to building(s) and pathways between access doors and street entrance.
At least one living or kitchen area window or glazed door is visible from neighbouring properties, street or shared driveway; any fencing across the sightlines is no more than 1.2m high.	There is CCTV covering street access points to the property, with clear signage to deter intruders.
Fencing on other orientations is at least 1.8m high.	Fencing around the development boundary that faces the street or shared driveway is no more than 1.2m high, with fencing on other orientations at least 1.8m high.
-	There is a dedicated forum to facilitate a residents' group that can meet to discuss safety and security issues.

Safety Features

For multi-unit developments or communal housing, safety features should be assessed on the overall site rather than each individual dwelling. For large developments with a number of standalone homes, compliance maybe assessed on each dwelling (in this case all dwellings should comply individually), or on the overall site.

REVISION AND AMENDMENTS

Revision No.	Type/Date	Description
v5.1	Update	Added further guidance for internal bin requirement - Eco-living.

LV4: Sustainable Transport

Points Available	4		
Mandatory Minimums	None		
Aim	To encourage and recognise the reduction of greenhouse gas emissions and improved resident wellbeing through provision of safe and convenient access to sustainable transport options.		
Project-wide	Yes	Calculator	No

Credit Criteria

Up to 4 points are available where it is demonstrated that the following sustainable transportation methods and means are accessible to occupants.

Method	System	Points
(1)	Access to cycling and public transport networks	Up to 1 point
(2)	Cycle parking facilities	Up to 1.5 point
(3)	Provision of additional sustainable transport amenities	Up to 0.5 point
(4)	Electric vehicle charging	Up to 1 point

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

1. Access to Cycling and Public Transport Networks

Up to 1 point is available where the project meets one or more of the following:

There is a cycleway within 300m of a property entrance (to claim this at least 0.5 point must be achieved for secure cycle parking facilities)	0.5 point
There is a public transport station within 800m of property entrance.	0.5 point

Cycleway

A cycleway may be separate dedicated cycle paths (they may also allow foot traffic) or sections of a road a designated lane or footpath set aside for cyclists. In all cases, the

cycleway must be clearly demarcated and separated from vehicular traffic by clear road markings as a minimum, but ideally by a physical barrier.

Public Transport

Public transport services are defined as any bus, train, and tram or ferry service going in any direction from a stop within 800m of the site and available every weekday.

The proximity of public transport stops and hubs within 800m walking distance shall be confirmed during the site visit. The Homestar Assessor shall discuss the walking route(s) suggested by Google Maps (or similar) with the owner/tenant (if able) because Google Maps (or similar) tend to rely on roads only. There may be other pathways that are available and commonly used. The acceptance of alternative pathways is at the discretion of the Homestar Assessor. Access to alternative pathways should be legal and available for people of all ages and an average level of fitness.

2. Cycle Parking Facilities

Up to 1.5 points are available where the project provides dedicated, covered, well-lit and secure bicycle parking facilities for the exclusive use of residents and visitors to the property. Points are awarded based on the number of cycle parking spaces provided.

Provision of secure and covered parking facilities with no less than: 1 resident parking space per 1, 2, or 3 bedroom dwelling 2 resident parking spaces per 4 bedroom or larger dwelling At least 1 visitor park per every 10 dwellings up to 20 parks	0.5 point
Additional 25% spaces above requirement for resident parks.	1.0 point
Provision of secure and covered resident parking facilities with no less than 1 space per bedroom of each dwelling plus at least 1 visitor park per 10 dwellings up to 20 parks.	1.5 points

These facilities may include bicycle storage lockers, lockable cages, surveillance cameras, cycle friendly elevators, racks or access restricted parking stations.

Suitable Cycle Parking Facilities

There are a range of cycle parking/locking facilities that would comply with this credit. These range from cycle racks to enclosed storage lockers and cages.

For standalone or terraced homes, wall-mounted bicycle stands within a secure, covered space such as a garage is appropriate.

To be acceptable, the facilities should have all the following attributes:

Secured against theft

It should be possible to have the bicycle secured within a lockable enclosure (cage) or have the frame and both wheels secured to a rack using a 'D-lock' a cable lock, or both. Both cages and racks should be securely fastened to the building structure or ground so that the entire rack /cage cannot be easily removed.

Accessible

A cycle park should have step free access such that the rider does not need to carry the bicycle to the storage facility. There should also be clear signage for the cycle parking facility and signage to direct riders to the cycle park if it is not visible from the main entrance. It should work for many types of cycles including cargo, e-bikes, mobility trikes, and children's cycles. The park should meet the minimum dimensions for size and spacing as set out in NZTA's cycle parking planning and design guidance.

Safe for riders

The park should be in an area that is well lit and/or under video surveillance. In addition, if access to the cycle park for pedestrians or cyclists (between dwelling or property entrance to parking facility) requires crossing one or more vehicle roadways, ensure that there is a designated crossing point that is well lit, and visible clearly to motorists.

Cycle Racks

Any cycle rack not in a fully enclosed access-restricted area must allow the frame and at least one wheel to be secured.

The table below shows acceptable and unacceptable stand types, as per NZTA's cycle parking planning and design guidance. Please refer to this document for images, examples, and installation guidance.

Acceptable Types	Unacceptable Types
Hoop (preferred)	Slot stand
Inverted U (preferred)	"Toast" or "wave" styles
Custom stands	Compact stands
Sign post mounted hoop	
Artistic stands	
Hitching rail	
Rack	

3. Additional Amenities

0.5 points are available for each of the following additional items that encourage cycling by presenting it as a safe and convenient option, IF at least 0.5 points is achieved for cycle parking facilities.

There is a safe, designated cyclist friendly street crossing point within 50m of the main cyclist entrance to the property.	0.5 point
Designated cycling or shared pedestrian and cycling path between property access and parking facilities of at least 2.5m wide, OR Driveway designated as pedestrian and cyclist priority with 10 km/h maximum speed limit, complete with signage.	0.5 point
Secure lockers provided to store cycling gear that is adjacent to and accessible from the parking facilities.	0.5 point

Designated e-bike charging points WITHIN cycle parking/storage facilities that at a minimum equal the lesser of either 10 spaces or 20% of the total number of cycle parking spaces available AND can be used while the bicycle is secured to a parking bay.	0.5 point
A workshop area with shelves, lighting and power outlets that can be used to carry out maintenance work on bicycles.	0.5 point
The public transport station within 800m is accessible to cyclists	0.5 point

Cycle-friendly Crossings

These may or may not have cyclist crossing signals, however the ramps as well as the crossing itself should be constructed so that a cyclist may ride their bike safely from one side of the street to the other. This may include consideration for suitable construction of ramps and traffic islands, lighting, and avoiding placement of manholes and other hazards along the crossing.

Accessibility of Public Transport Amenities to Cyclists

To be considered 'accessible' to cyclists, public transport terminals such as bus stops or train stations should have step-free access to the boarding area/platform from access routes used by the cyclist. While a bus stop on a footpath that can be used by cyclists will comply, a ramp or lift large enough to accommodate a bicycle maybe required for a train station where the platform is above or below street level. In addition, the transport terminal should include secure and if possible covered cycle parking facilities and/or at least one of the public transport modes served by the terminal should allow cyclists to take their bicycles on board.

4. Electric Vehicle Charging

Up to 1 point is available for electric vehicle charging locations. Review provided documentation and observations on site to confirm that the EV charging station(s) for which points are claimed meet the requirements outlined below. For safety, these charge points should have their own circuit breakers. Regular mains power outlets without additional infrastructure do not comply. An EV charging station should not be connected to a supply of electricity using a plug and socket.

For apartments, all dwellings across all typologies will achieve the same points for communally provided EV chargers.

Standalone	
"Smart" electric vehicle charging point with minimum charging rate of 3.6kW provided within the property.	1 point
Apartments and Terraced Houses	
There are dedicated electric vehicle charging points provided within the development numbering no less than 5% of the total number of apartments or terraced. Chargers may be either dedicated to particular units or communal.	0.5 point
Wiring or accessible cable ducting is installed to allow the future installation of compliant EV charge points for at least 80% of parking	0.5 point

spaces (including those already provided) for apartments and 100% of spaces for terraced houses.	
OR	
There are dedicated electric vehicle charging points provided within the development numbering no less than 5% of the total number of apartments, which are available for use by residents AND the public.	1 point

Smart Charger Requirements

Charge points must deliver a minimum charging rate of 3.6kW and have their own circuit breaker. They must also be "smart" chargers; while there is no formal definition of a smart EV charger, for the purposes of this credit it must meet the data communication protocol detailed below.

Data communication protocol	Be able to be accessed remotely, through a data communication protocol and communication technology, by utilising the Open Charge Point Protocol (OCPP) version 1.6 (or above), or equivalent.

Smart Charger Guidelines

Data management	Be able to receive and process information provided.
	Be able to react to information received by adjusting the rate of charging or discharging.
	Be able to monitor and record energy consumption and be able to transmit this information.
Cyber security	Have appropriate security measures to ensure its functions are resilient to cyber-attack and that any communications are exchanged securely with an appropriate level of encryption to prevent interception by an unauthorised third party.

REVISION AND AMENDMENTS

Revision No.	Category	Description
V5.1	Revision	Electric Vehicle Charging | 0.5 points for terraced houses where 5% of the development has dedicated electric charging points and communal chargers and ducting for ALL units.

LV5: Adaptation and Resilience

Points Available	2		
Mandatory Minimums	None		
Aim	To evaluate and prepare solutions that address the building's capacity to respond and adapt to changing conditions and extreme weather events.		
Project-wide	Yes	Checklist	Yes

Credit Criteria

Up to 2 points are available where the project has identified climate risks and implemented at least two solutions to either prevent and/or mitigate the risks of climate change to support adaptation and resilience.

Method	Approach	Points
(1)	Simplified checklist completed to identify climate change risks. It is advisable to complete this checklist prior to the detailed design/(or during developed design) to give room for the design team to make any adaptive changes.	0.5 point
OR		
(1b)	An in-depth report identifying climate risk and building-specific adaptation plan in accordance with a recognised standard developed by a suitably qualified professional. The report MUST include as a minimum the following information; • Summary of the building's characteristics (site, location, climatic characteristics); • Summary of locally relevant climate change projections and associated hazards. It is recommended that at a minimum project teams should use the Representative Concentration Pathway (RCP) 8.5 as specified in the Intergovernmental Panel on	1 point

	Climate Change (IPCC) Fifth Assessment Report or any newer version, at two time horizons (e.g. 2050 and 2100) that are relevant to the project's anticipated lifespan. These projections should consider a range of climate-related hazards including, but not limited to: o Sea level and coastal inundation o Increase rainfall and flooding o Solar radiation o Temperature increase (including heat island effect) o Water or moisture ingress o Extreme weather conditions - wind and storms o Subsidence or ground movement o Groundwater rise and potential for increased liquefaction vulnerability; and o Increase potential for fire weather and drought. • Identification of potential risks to the building and its occupants and visitors. • Assess risks in consultation with representatives from within the project team, and relevant external stakeholders. This risk assessment is to be based on a recognised standard as listed below) • A list of actions and responsibilities for all high and extreme risks identified • Details of stakeholder consultation that was undertaken during plan preparation and how the issues raised have been incorporated.	
(2)	At least two solutions have been implemented that specifically address any high or extreme risks identified in the risk assessment component of the adaptation plan. If no 'high' or 'extreme' risks are identified, then this would indicate the build/project has been designed to an appropriate standard of climate resilience. The justifications for risk ratings should be captured and this will provide the necessary evidence required for	1 point

	this credit. In this instance, no adaptation design responses will be required.	

Development of the Climate Adaptation Plan

A Climate Adaptation Plan outlines the responses to identified priority risks, or in other words, how resilience can be improved. Examples of approaches to improving adaptation/resilience include:

- Resistance: Preventing damage or disruption by providing the strength or protection to resist the hazard or its primary impact.
- Reliability: The asset or systems are designed to operate under a range of set conditions and hence mitigate damage or loss from an event.
- Redundancy: The availability of backup installations or spare capacity to enable operations to be switched or diverted to alternative parts of the system in the event of disruption to ensure continuity of service.
- Response and recovery: Enabling a fast and effective response to and recovery from disruptive events.

Suitably Qualified Professional: For the purpose of this credit, a suitably qualified professional is defined as someone with a formal tertiary Environmental Science, Environmental Engineering, Planning, or similar qualification; or may alternatively include persons with at least 3 years' experience developing Climate Change Risk Assessment and Adaptation Plans, familiarity with the recognised Standards and demonstrated ability to assess climate change scenarios; or a Business with verified practitioner capability.

Recognised Standards: For the purposes of this credit, the recognised standards are listed below:

- Ministry for Environment 2021: A Guide to Local Climate Change Risk Assessments. This guide was developed in alignment with the National Climate Change Risk Assessment (NCCRA) to enable local level risk assessments to be undertaken. The risk assessment methodology is based on an assessment of exposure, sensitivity and adaptative capacity. Link here.
- Australian Standard (AS) 5334:2013 Climate change adaptation for settlements and infrastructure - A risk-based approach. The risk assessment used in this guide is based on an assessment of likelihood and consequence. Link here.
- Australian Greenhouse Office 2006 Climate Change Risks and Impacts: A Guide for Government and Business. The risk assessment used in this guide is based on an assessment of likelihood and consequence. Link here.

Should project teams wish to demonstrate compliance using an equivalent alternate standard or framework, a Technical Question may be submitted to the NZGBC to confirm equivalency.

Evidence

Design and Built Rating

(1)	Completed & Signed Climate Change Checklist.
(1b)	Provide an in-depth report identifying climate risk and building-specific adaptation plan and relevant evidence supporting claims in the report.
(2)	Climate Adaptation Plan (or relevant extracts) demonstrating the compliance.
	Drawings and specifications demonstrating design responses to the Climate Adaptation Plan.
	Commissioning report or other technical document demonstrating design responses to the Climate Adaptation Plan.

REVISION AND AMENDMENTS

Revision No.	Type/Date	Description
v5.1	New	This a new credit added to v5.1

EN1: Renewable Energy

Points Available	4		
Mandatory Minimums	None		
Aim	To encourage and recognise the installation and operation of local renewable electricity generation systems to reduce carbon dioxide (CO_2) emissions as part of everyday dwelling operations.		
Project-wide	No	Calculator	Yes

Credit Criteria

Points are awarded based on the offset of household CO_2 by on-site renewable energy generation. The table below provides indicative benchmarks; however, points are interpolated when the offset falls between these. Energy must be generated on-site and can be used in the building and/or exported to the grid.

Offset	Points
20% offset	Up to 1 point
40% offset	2 points
60% offset	3 points
80% or more offset	4 points

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

Energy must be generated on-site and can be used in the building and/or exported to the grid. Energy supplied by remote large-scale electricity generating plants (national grid) or procured through a carboNZero retailer or any other green tariff or carbon offset scheme may not be included. All figures used in this credit are based on standardised operational behaviour and, as such, may not be reflective of the actual household energy usage. For multi-unit projects where several dwellings share a single PV system, the total annual

energy generation from the system should be apportioned to each dwelling by dividing the conditioned floor area of that dwelling from the total conditioned floor area across all dwellings connected to the system. This energy portion is then entered into the ECCHO model for the typology representing the dwelling in question to determine points.

Calculating the Emissions Offset – Photovoltaic

Use the online BRANZ Photovoltaic Generation Calculator to determine the kWh/yr generated by the PV system and input this into the appropriate cell in the summary tab of ECCHO.

BRANZ PV Generation Calculator inputs	
Angle of inclination	horizontal = 0°
Orientation	this must be based on true (not magnetic) north
Peak rated output	for amorphous this should be the stabilised rated output
Type	monocrystalline, polycrystalline or amorphous

Calculating the Emissions Offset – Other

Contact the NZGBC for assistance in determining the energy production and associated points.

Reference CO_2 Load

The reference CO_2 load is calculated by summing the contributions from space heating and cooling, hot water heating, appliances and lighting in the dwelling being assessed. This is automatically generated in ECCHO. A default figure relating to the number of occupants is used for the appliance-related CO_2 contribution.

EN2: Embodied Carbon

Points Available	6		
Mandatory Minimums	All projects must carry out a full lifecycle assessment modules A-D of EN 15978.		
Aim	To reduce greenhouse gas emissions associated with products and materials used to construct a home.		
Project-wide	Yes	Calculator	Yes

Credit Criteria

One point is awarded for carrying out a full lifecycle assessment of the greenhouse gas (GHG) emissions associated with products and materials used to construct the home, calculated in accordance with ISO14040 and EN 15978 modules A-D. For 6 and 7 Homestar, exemptions for individual assemblies and systems can be sought by way of a Technical Question where;

- assemblies used in the design are not available in the Homestar Embodied Carbon Calculator (HECC), or
- the component(s) (i.e., fixings, skirting) are unlikely to contribute to 95% of the building's total GHG emissions (*see further clarification in Appendix C*)

Approach	Points
Full lifecycle assessment, modules A-D of EN 15978	1 point

Additional points are based on the predicted cradle-to-gate and construction stage emissions (modules A1-A5 of EN 15978). Maximum points are awarded for homes that reduce A1-A5 emissions below 60kg.$CO_{2\text{-}e}$/m^2.

Percentage increase on emissions target	Materials and construction stage (A1-A5) emissions: kg.CO_2-e/m^2	Points
<160%	156	1 point
<120%	132	2 points
<80%	108	3 points
<40%	84	4 points
NZ residential carbon budget required to limit global warming to 1.5°C.	60	5 points

For homes falling outside the limitations of NZS3604:

Percentage reduction on a *reference* building	Points
>10%	1 point
>20%	2 points
>30%	3 points
>40%	4 points
>50%	5 points

Reference Building

For non-NZS3604 buildings, points may be awarded by following the 2-model (reference) pathway from Green Star Design and As-Built NZ v1.1. The reference building should be defined following the guidance in the Green Star Embodied Carbon Methodology

There are two pathways for demonstrating compliance with this credit:

1. Homestar Embodied Carbon Calculator
2. Calculation by a Competent Practitioner

Evidence

Design and Built Rating

Homestar Embodied Carbon Calculator/Greenstar Embodied Carbon Calculator	Provide **all** of the following for each building:
	Completed Homestar Embodied Carbon Calculator.
	Floor plans and elevations for each floor level, with gross floor area(s) clearly marked.
	Detailed drawings showing build-up of key assemblies.
	Products and materials specification of components and assemblies included in the assessment. This should include evidence that timber is responsibly sourced where biogenic sequestration is being claimed.

Bespoke calculations according to ISO14040 and EN 15978	Provide **all** of the following for each building:
	Email or letter from the competent practitioner* undertaking or reviewing the model confirming that a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) modelling software used and d) the results of the model relating to the Homestar requirements.

**refer to the definition of a competent practitioner for this credit in the Assessment section below.*

Assessment

Project teams must calculate the whole of life embodied greenhouse gas emissions associated with the products and materials used to construct the project using either the Homestar Embodied Carbon Calculator or calculations carried out by/peer-reviewed by a Competent Practitioner.

Scope

With either pathway, the scope of the embodied carbon assessment must include all the following components and assemblies:

- External walls
- Internal walls
- Windows
- Roofs
- Mid-floors
- Ground floor
- Floor coverings
- On-site electricity generation

Default assemblies in HECC include over 95% of the assemblies embodied carbon impacts. Any custom assemblies entered into HECC must include at least 95% of the total embodied carbon of the dwelling/project is accounted for, ***See Appendix C***.

All bulk materials that make up the assemblies must be included in the assessment. This includes final finishes such as paint but excludes minor componentry such fixings, brackets and screws that would not normally be quantified in a Bill of Quantities and/or BIM model.

For multi-unit dwellings (such as apartments or units), calculate the life cycle emissions for the whole building (rather than unit by unit). Include the above components/assemblies within and attached to the building including ancillary spaces such as garages and balconies. Any products or materials that form part of the project that are not attached to the building such as separate garages, outbuildings and landscaping works may be excluded from the assessment.

System Boundary

Pre-requisite and for an initial point: a cradle-to-cradle assessment must be undertaken, including all life cycle modules except modules B1, B3, B5, B6 and B7 as detailed in EN 15978. Further points are then awarded for demonstrating a reduction in emissions from modules A1-A5 (products and material manufacturing and construction). This reflects the

importance of reducing "upfront" emissions, and the higher certainty over these emissions compared with later life stages.

Life cycle stage	Module from EN15978
Product stage	A1 – A3
Construction process stage	A4 – A5
Use stage	B2 and B4
End of life stage	C1 – C4
Benefits and loads beyond the system boundary	D

Functional Unit

The whole-of-life embodied carbon emissions of the building should be assessed and reported on a per metre (m^2) project Gross Floor Area (GFA) basis divided by the service life of the building (see below). For mixed-use and apartment buildings therefore, it would include all other areas of the building and should be assessed across the whole building rather than unit by unit.

Service Life

The home or building should be assumed to have an estimated service life of 90 years. An alternative service life may be considered in exceptional circumstances – please submit this as a Technical Question for NZGBC approval.

Carbon Footprint Data

Carbon footprint data used to calculate whole-of-life embodied carbon impacts should be taken from datasets in compliance with EN 15804 and geographically relevant, if possible. Currently, available tools that may be used for such a calculation include:

- Homestar Embodied Carbon Calculator
- Greenstar Embodied Carbon Calculator
- LCAQuick
- ETool LCD
- One Click LCA

NZGBC will periodically update a list of acceptable tools on the Homestar website.

In addition, BRANZ publishes a dataset of embodied carbon for materials called BRANZ CO_2NSTRUCT (www.branz.co.nz/co2nstruct). This only includes the carbon footprint of manufacture (modules A1-A3) and therefore the other carbon footprint data for other modules would have to be sourced elsewhere - see below.

Bespoke carbon footprint calculation

Where a bespoke carbon footprint calculation is carried out and supplied for a dwelling in fulfilment of this credit, the following should be provided for carbon footprint data for each material used to calculate the whole-of-life embodied carbon footprint of materials:

- Source data e.g., an Environmental Product Declaration, carbon footprint study in academic literature.

- Source data used to inform life cycle stages beyond product manufacture, for example, transport distances, construction site waste rate, end-of-life route(s), maintenance requirements, and material service life. Defaults that can be used in the absence of product-specific data are available at www.branz.co.nz/buildinglca (and select "Data").

Biogenic carbon

For the calculation of A1-A5 (upfront) emissions, carbon sequestration (biogenic carbon) may not be included. However, carbon dioxide sequestration may be included in the calculation of the initial overall (modules A-D) lifecycle carbon footprint where timber or engineered wood products used in the home/building have achieved points for being sourced from sustainable forests (i.e., FSC or PEFC) in credit EN3. These may be considered to meet the conditions for carbon neutrality as defined in EN 16485: 2014. This means that carbon dioxide sequestration (biogenic carbon) can be included in the calculation of the carbon footprint. All other timber or engineered wood products must be assumed to not meet the conditions for carbon neutrality and must therefore exclude carbon dioxide sequestration in the calculation of the carbon footprint.

1. Homestar Embodied Carbon Calculator (HECC)

Where HECC is used for this credit, a peer review, or the use of a competent practitioner (see below for definition) is not required. Follow the guidance given on the tool to complete the assessment.

2. Calculation by Competent Practitioner/ Peer Reviewed Calculation

Whole of life embodied greenhouse gas emissions calculations submitted for this credit must be demonstrated to be accurate and when not calculated using the Homestar Embodied Carbon Calculator, must be carried out or peer reviewed by a competent LCA Practitioner.

Competent LCA Practitioner

For the purpose of this credit, a competent practitioner is either:

1. An individual or organisation who has produced, co-produced and/or independently peer reviewed at least five LCA studies in the past three years; or
2. A person who is qualified as an "LCA Certified Practitioner" (LCACP) through ALCAS, LCANZ or ACLCA.

Projects are required to submit competency statements or LCACP qualifications from the practitioner. A competency statement shall include reference to the five previous studies; any building, product or service LCA study is acceptable.

REVISION AND AMENDMENTS

Revision No.	Type/Date	Description
v5.1	Revision	Mandatory Minimum Updated.
		Further guidance was provided for credit criteria.
	New	Alternative (table) for homes falling outside the limitations of NZS3604. Definition of reference building for building outside NZS3604.
	New	Updated list to include "Greenstar Embodied Carbon Calculator" under Carbon Footprint Data.

EN3: Sustainable Materials

Points Available	10		
Mandatory Minimums	None		
Aim	To encourage and recognise the specification and use of responsibly sourced materials that have lower environmental impacts over their lifetime.		
Project-wide	Yes	Calculator	Yes

Credit

Criteria

Up to 10 points are available where at least 50% of the material content is reused, eco-preferred or responsibly sourced materials (see Assessment section for definitions) for materials categories as follows:

One material category complies	Up to 1.5 points
Two material categories comply	Up to 3 points
Three material categories comply	Up to 4.5 points
Four material categories comply	Up to 6 points
Five material categories comply	Up to 7.5 points
Six material categories comply	Up to 9 points
Seven or more material categories comply	Up to 10 points

Evidence

Design Rating

	Provide **all** of the following for each targeted material category for each building:
All projects – materials selected	Completed Materials Calculator.
	Marked up drawings or specifications showing selected products.
	Product data sheet or certificate demonstrating compliance.
	Completed Materials Calculator.

All projects – materials not selected	Specification extract(s) stating requirements to be met.

Built Rating

All Projects	Provide **all** of the following for **each** targeted material category for each building:
	Completed Materials Calculator. *This may be waived where the project can demonstrate that the specification shows 100% of the material category.
	Invoices or supplier/installer confirmation letters clearly showing selected products.
	Product data sheet or certificate demonstrating compliance.

Assessment

Points are awarded for each of the following material categories only where at least 50% of the total material content is reused, eco-preferred or responsibly sourced. Up to 1.5 points can be awarded per material category depending on the means of compliance. The table below outlines each material type and the measurement unit used to establish that 50% of the content is compliant. These material categories consider materials that are typically used in large volumes in construction; contact NZGBC if your project uses a significant amount of a specific material that is not covered.

Material Category		Unit of Measurement
(1)	Concrete (any type of concrete cast on or off site e.g. foundation, floor slab, concrete blocks, precast panels, roof)	Tonnes/cubic metres
(2)	Solid structural and framing timber (e.g. frame, trusses, beams and non-structural framing such as cavity battens)	Lineal metres
(3)	Other solid timber (e.g. decking, flooring)	Lineal metres
(4)	Interior engineered wood (e.g. joinery, wall, ceiling and floor lining exposed to interior including cork, MDF and plywood)	Square metres
(5)	Other engineered wood (includes engineered wood framing, and any engineered wood used on the exterior within walls, floors, etc. that are not exposed to the interior such as structural insulated panels)	Square metres
(6)	Ceiling and interior wall	Square metres
(7)	Wall cladding (e.g. weatherboard, solid timber in log houses, long-run steel, etc.)	Square metres
(8)	Roof cladding (e.g. long-run steel, shingle roofing, etc.)	Square metres

(9)	Floor coverings (e.g. carpet, linoleum, floor tiles)	Square metres
(10)	Applied coatings (internal and external applications, whether it is exposed or concealed, but only that which is applied within the site boundary or in a prefabrication yard)	Square metres or litres
(11)	Structural Steel (excluding concrete reinforcing)	Lineal metres
(12)	Insulation (soft insulation including thermal and acoustic, and rigid insulation such as XPS and EPS). This excludes poly pods and cupolex.	Square metres

For projects that have multiple dwellings across one or several typologies, there are two acceptable approaches to quantify the material amounts used in each material category to establish whether the 50% threshold is met:

1. Whole Development Approach
2. Typology Approach

1. Whole Development Approach

The amount of material in each category across the whole development is used to establish whether the threshold is met. For example, in a development of 100 dwellings and 10 typologies the total FSC certified structural timber amount across all 100 dwellings may be considered to establish the 50% threshold is met for 1.5 points under the Structural Timber materials category. In this case, all homes in the development will achieve the same points for this credit. While this may mean that in some cases an individual dwelling is rewarded for a material not actually present in its construction, the environmental impact of the development depends on the total amount of material used. In cases where a development is completed in stages, a whole development approach is not possible, and a typology approach should be used.

2. Typology Approach

In this case, the total amount of material in each category across a whole typology is used to establish whether the threshold is met, rather than quantifying material used on an individual dwelling. For an example, in a development of 100 homes and 10 typologies where typology 1 consist of 5 dwellings, the amount in lineal metres of structural timber with FSC certification across all 5 dwellings will be considered to establish whether points can be achieved. In this instance, dwellings of different typologies may achieve different points for this credit. In cases where a development is completed in stages, this is the only allowable approach.

Establishing Eligibility and Calculating Points

For a Design Rating, review the plans or specifications to confirm what products are specified and check the datasheets and/or materials' third-party verification scheme certificates to determine if points can be awarded.

For a Built Rating, review the invoices/receipts demonstrating the materials used in the house and check the datasheets and/or materials' third-party verification scheme certificates to determine if points can be awarded.

For each material category that may be eligible for points, list the amount of each material provided in the Materials Calculator. While some material categories listed contain a single material (e.g. concrete) that may be used for multiple building components, some material categories may contain more than one material. For example, non-timber wall cladding may include any veneer brick as well as metal or plasterboard cladding. Additionally, the same material may have been obtained from different suppliers who have different means of compliance. Therefore, many of the material categories may have multiple line items in the Materials Calculator.

Once each material and their amounts are entered, select the compliance method, which may be recycled content, eco-labels, and other certifications recognised by NZGBC. A full list is available on the NZGBC website. Note that some products qualify for multiple compliance methods, so it is important to ensure that the one with the most points is selected as evidence.

Means of compliance with EN3: Sustainable Materials			
Type	Points Available	Definition	Materials Categories Included
Approved eco-labels as per NZGBC website	Level A eco-label or RPV ≥ 10: 1.5 points. Level B eco-label or RPV 7-9 : 1 point. Level C eco-label or RPV 5-6: 0.75 point.	'Eco-labelling' is a voluntary method of environmental performance certification and labelling that is practised around the world. An 'eco-label' is a label that identifies overall environmental preference of a product or service within a specific product/service category based on life cycle considerations. An eco-label is awarded by an impartial third-party in relation to certain products or services that are independently determined to meet environmental leadership specifications. The list of approved schemes is available on the NZGBC website. Third Party	All Products that are identical in manufacture and recipe to Eco-Choice Aotearoa licensed products except for their R-value (and thickness and weight related to R-value), may be recognized and awarded points. Confirmation must be provided from the manufacturer that the products are identical (i.e. same ingredients, manufactured at same location, manufactured using same process, etc).

Means of compliance with EN3: Sustainable Materials			
Type	Points Available	Definition	Materials Categories Included
		Certification levels (A, B & C) are defined in the GBCA's Framework for Product Certification Scheme.	
Forest Stewardship Council (FSC)	1.5	Three types of FSC are recognised: FSC Mix, FSC 100%, and FSC Recycled.	Structural and framing timber, other solid timber, engineered wood, timber cladding, flooring
Programme for the Endorsement of Forest Certification (PEFC)	1.5	1.5 points are awarded per material category, where material is PEFC certified.	Structural and framing timber, other solid timber, engineered wood, timber cladding, flooring
Recycled Content Product	Points are calculated as 1.5 times the fraction of product content that is recycled.	Product contains materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer). Pre-consumer material does not include materials normally re-used by industry within the original manufacturing process and is also termed 'post-industrial'.	Engineered wood, steel, timber cladding, floor coverings, insulation. Any timber product that is reused from another project in solid wood form should be counted as reused material rather than as recycled content.

Means of compliance with EN3: Sustainable Materials			
Type	Points Available	Definition	Materials Categories Included
Dematerialisation	1.5	When no product or material is installed/applied where these are typically expected.	Floor coverings, applied coatings and interior linings.
Reused material	1.5	Reuse of existing products provides the strongest environmental benefit; therefore, reused items (including purchased second-hand) are awarded 1.5 points.	
Environmental Product Declaration	Product specific EPD: 1.25 points Industry-wide EPD: 0.75 point	Environmental Product Declarations (EPD) detail the life cycle environmental footprint of a product. EPDs published through an independently verified scheme that, as a minimum consider a cradle-to-gate scope will achieve points based on the EPD format as follows. See additional guidance for further compliance requirements for each EPD format.	
ISO 14001	0.75	An international standard published by the International Organisation for Standardisation (ISO) which specifies a set of management standards that help organisations administer and control a company's environmental impact and compliance with regulations. Where the manufacturer in question operates both ISO14001 certified and non-certified plants, only products where the 146 main production process is carried out in certified plants can be counted (i.e. raw materials and minor individual components may come from non-certified suppliers).	
End-of-Life Stewardship Programme	0.75	Product stewardship programs encourage projects and suppliers to share responsibility for the effective reduction, reuse, recycling, or recovery of products. Product stewardship also helps manage environmental harm arising from the product when it becomes waste. Products stewardship programs must be demonstrated with a product stewardship contract or product stewardship accreditation from the Ministry for the Environment. There are two types of Product Stewardship Contracts, for a leased item and a purchased item.	

Means of compliance with EN3: Sustainable Materials			
Type	Points Available	Definition	Materials Categories Included
CarboNZero product certification	0.75	Independent verification and certification that a product's carbon footprint has been calculated in accordance with the internationally recognised and agreed PAS 2050:2011 standards. Organisations with CarboNZero certified products have taken measures to manage, reduce and mitigate the product's net greenhouse gas emissions to zero. They have made a commitment to manage and reduce their greenhouse gas emissions by working to an emissions management and reduction plan. Any remaining unavoidable emissions are offset by purchasing verified carbon credits.	
Enviro-Mark NZ Gold or above	0.25	This is a New Zealand-based certification programme that provides member organisations with the tools and resources necessary to implement an environmental management system.	
Declare	0.25	The Declare labelled products have declared their ingredients, source, and manufacturing locations. Manufacturers of the products included in the Declare database have voluntarily disclosed their ingredients list and a company head has personally ensured this information is true.	
CEMARS product certification	0.25	Independent verification and certification that a product's carbon footprint has been calculated in accordance with the internationally recognised and agreed PAS 2050:2011 standards. Organisations with CEMARS certified products have measured the emissions resulting from the lifecycle of the product. The product's lifecycle greenhouse gas emissions have been measured so they understand its associated greenhouse gas emissions. They then make a commitment to manage and reduce the greenhouse gas emissions of the product by working to an emissions management and reduction plan.	

Additional Guidance on Environmental Product Declarations

Products with a product-specific, third-party verified EPD must meet the following minimum requirements:

- issued in conformance with ISO 14025 or EN15804
- independently audited
- based on a cradle-to-gate scope as a minimum

Products with an industry-wide, third-party verified EPD must meet the following minimum requirements:

- issued in conformance with ISO 14025 or EN15804
- independently audited
- based on a cradle-to-gate scope as a minimum
- the product manufacturer must be recognised as a participant in the EPD

Responsible Products Value

The Responsible Products Value (RPV) is calculated according to the Responsible Products Framework developed by the Green Building Council of Australia.

The Responsible Products Value (RPV) for a product is calculated by GBCA based on which of the relevant ecolabels their product complies with. To assist them in demonstrating compliance, a number of third-party certification (ecolabel) schemes and independent verification methods have been pre-approved as compliant with the many initiatives in the Responsible Products Framework.

The list of compliant schemes and verification methods that can be used to demonstrate compliance is available on the GBCA website.

REVISION AND AMENDMENTS

Revision No.	Category	Description
v5.1	Update	Assessment| Material Category| No. 12 || Added further guidance for insulation.
	Update	Approved Ecolabel|| Added RPV as an option.
	New	Definition & more information for Responsible Product Value.

EN4: Construction Waste

Points Available	6		
Mandatory Minimums	None		
Aim	To encourage and recognise effective strategies that reduce the environmental impact of construction waste.		
Project-wide	Yes	Calculator	No

Credit Criteria

Design Rating

Site Waste Management Plan

Pre-requisite when any points are being targeted in this credit:

Where the contractor is required to prepare and implement a site waste management plan (SWMP) for the entire duration of the project. This should include minimising waste, onsite sorting, and waste diversion targets as applicable.	Required

Minimising Waste

Produce a plan using design, product selection, procurement and/or contractual requirements that targets major construction waste sources, including a maximum total waste target in kg/m^2 of GFA.	
Plan to generate less than 25kg/m^2 (GFA) of waste during the construction phase of the project.	1 point
Plan to generate less than 15kg/m^2 (GFA) of waste during the construction phase of the project.	2 points
Plan to generate less than 5kg/m^2 (GFA) of waste during the construction phase of the project.	3 points

For the purposes of this credit, land clearing, excavated materials, and hazardous materials should not contribute to the total amount of waste accounted for to claim the waste minimisation points for projects. However, any hazardous waste should be disposed of properly in accordance with the relevant legislation and local authority requirements and evidence of this should be provided.

Onsite Sorting

Where a project will implement onsite sorting of non-contaminated waste streams. This includes hardfill, concrete, metal, plasterboard, untreated timber, treated timber, MDF, and/or cardboard.	
A minimum of three waste streams are identified to be sorted onsite, including planned location(s) for sorting stations.	0.5 point
A minimum of four waste streams are identified to be sorted onsite including planned location(s) for sorting stations.	1 point

Waste Diversion

Where the SWMP targets that 50-69% of the total waste generated is reused and/or recycled and/or recovered for the whole construction/refurbishment project (off-site waste sorting is accepted).	1 point
Where the SWMP targets that 70% of the total waste generated is reused and/or recycled and/or recovered for the whole construction/refurbishment project (off-site waste sorting is accepted).	2 points

Built Rating

Minimising Waste

Where the total construction waste generated on site is:	
Less than 25kg/m^2 of GFA.	1 point
Less than 15kg/m^2 of GFA.	2 points
Less than 5kg/ m^2 of GFA.	3 points

Onsite Sorting

Where a project has implemented onsite sorting of non-contaminated waste streams. This includes hardfill, concrete, metal, plasterboard, untreated timber, treated timber, MDF, cardboard.	
Onsite sorting of three waste streams.	0.5 point
Onsite sorting of a minimum of four waste streams.	1 point

Waste Diversion

Where 50-69% of the total waste generated is reused and/or recycled and/or recovered for the whole construction/refurbishment project (off-site waste sorting is accepted).	1 point
Where 70% or more of the total waste generated is reused and/or recycled and/or recovered for the whole construction/refurbishment project (off-site waste sorting is accepted).	2 points

Evidence

Design Rating

Site waste management plan	Provide **one** of the following:
	Completed site waste management plan (SWMP) with any associated minimising waste, onsite sorting and waste diversion targets clearly stated.
	Specification extract requiring appointed main contractor to develop a SWMP, with any associated minimising waste, onsite sorting and waste diversion targets clearly stated.
Minimising waste	Waste minimisation strategy that uses design, product selection, procurement and/or contractual requirements to target major construction waste sources, including a maximum waste target in kg/m^2 of GFA.
Onsite sorting	Site plan showing proposed bin locations.
Waste diversion	Provide **one** of the following:
	Completed site waste management plan (SWMP) with clearly stated waste diversion targets.
	Specification extract requiring appointed main contractor to develop a SWMP, with waste diversion target clearly stated.

Built Rating

Minimising waste	Complete waste records for all construction waste generated onsite, demonstrating compliance with identified maximum waste target.
Onsite sorting	Provide **all** of the following:
	Photos of sorting areas for non-contaminated waste streams.
	Documentation from waste service provider of collection and disposal to a recycling source.
Waste diversion	Copy of the completed waste and/or RRR records demonstrating compliance with identified waste diversion targets.

Assessment

Site Waste Management Plan

When carrying out a Design Rating, a site waste management plan (SWMP) must be either completed or included in the specification in order to claim any points in this credit.

Minimising Waste

For a Design Rating, ensure that the project has outlined, via a marked-up plan or a separate document, strategies integrated into the project to design out waste from major sources of construction waste as per the list below. The plan must also include a maximum total waste

target in kg/m^2 of GFA and design, product selection, procurement strategies, or contractual requirements that focuses on minimising the following waste sources:

- Offcuts from plasterboard, plywood or other interior wall and ceiling linings.
- Offcuts from treated timber used for framing and cladding.
- Packaging and polystyrene waste from purchased product and materials.
- Any other major sources of waste particular to the project (e.g., masonry blocks).

For the Built Rating, you must provide all the waste records for construction waste generated on site, including the sum total of waste generated (in kilograms).

Onsite Sorting

For projects undergoing a Design Rating verify that the proposed location of sorting stations is clearly identified on the plans, including the type of waste stream being collected from the list below:

- hardfill
- concrete
- metal
- plasterboard
- untreated timber
- treated timber
- MDF
- cardboard

Photographs of waste sorting stations should be taken during the construction project for a Built Rating submission.

Some sites may be too small to have a minimum of 3 sorting stations at one time; in this instance, the waste streams can be staggered throughout the project, e.g., hardfill stream in early stages replaced by cardboard later in the project.

Waste Diversion

Verify that a waste diversion target has been stated in the SWMP or in the specification for the contractor to develop one, when assessing for a Design Rating.

RRR reports supporting the claimed waste diversion must be maintained for the entire project; this information should be provided when submitting for a Built Rating.

EN5: Site Water and Ecology

Points Available	4		
Mandatory Minimums	None		
Aim	To encourage a whole site approach that improves the ecological value of the site while reducing stormwater runoff, flooding, pollution, and erosion.		
Project-wide	Yes	Calculator	Yes

Credit Criteria

Pre-requisite: dwellings targeting any points in this credit may not use the following known heavy metal pollutants:

Known heavy metal polluting materials
Uncoated zinc galvanised roofing
Copper guttering and drainage pipes

Up to four points are available using one or more of the methodologies below:

Method	Approach	Points
(1)	Brownfield development	0.5 point
(2)	Stormwater management	Up to 1.5 points
(3)	Native planting	Up to 1 point
(4)	Holistic design	1 point

Evidence

Design Rating

(1) Brownfield development	An aerial photograph or Google Maps/Earth screenshot or Resource /Building Consent (RC/BC) showing previous development.
(2) Stormwater management –	Provide marked up drawings and/or specifications for all of the following:
	Completed Water Calculator (Part B and C)

retention/detention tanks or site permeability	Site plan clearly demonstrating the type and extent of compliant areas.
	Evidence that the system(s) will effectively manage the site's stormwater during 1/3 of a 1 in 2 year storm (permeable areas meet this by default).
	Evidence that the system(s) is able to retain the first 10mm of any storm event (permeable areas meet this by default).
	Confirmation that none of the known heavy metal pollution materials listed are to be used in the construction of the dwelling.
(2) Stormwater management – natural systems	Email or letter from a competent professional* confirming a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) management systems to be implemented and d) evidence that the systems will meet the calculated requirements.
(3) Native planting	Provide marked up drawings and/or specifications for **one** of the following:
	Site/landscape plan with calculation demonstrating the area of the site vegetated with appropriate native species.
	Specification extracts showing area of the site to be vegetated with appropriate native species.
(4) Holistic design	Provide marked up drawings and/or specifications for **all** of the following:
	Marked up site plan showing the designed system.
	Signed letter(s) or email(s) from a competent professional confirming which Water Sensitive Urban Design (WSUD) guidelines have been implemented.

Built Rating

(1) Brownfield development	An aerial photograph or Google Maps/Earth screenshot showing previous development.
(2) Stormwater – combined retention/detention tanks or site permeability	Provide marked up drawings and/or specifications for **all** of the following:
	Completed Water Calculator (Part B and C)
	Site plan clearly demonstrating the type and extent of compliant areas.
	Evidence that the system(s) will effectively manage the site's stormwater during 1/3 of a 1 in 2 year storm (permeable areas meet this by default).
	Evidence that the system(s) is able to retain the first 10mm of any storm event (permeable areas meet this by default).

	Confirmation that none of the known heavy metal pollution materials listed are to be used in the construction of the dwelling.
(2) Stormwater – other system	Email or letter from a competent professional* confirming a) they are suitably qualified, b) they referenced and followed the Homestar requirements c) management systems implemented and d) evidence that the systems meet the calculated requirements.
(3) Native planting	Provide marked up drawings and/or specifications for **all** of the following:
	Site/landscape plan with calculation demonstrating the percentage of the site vegetated with appropriate native species.
	Photographs clearly showing plantings as detailed on landscape plan.
(4) Holistic design	Provide marked up drawings and/or specifications for **all** of the following:
	Marked up site plan showing the designed system.
	Signed letter(s) or email(s) from competent professional confirming which WSUD guidelines have been implemented.

** Hydraulic or stormwater engineer or similarly qualified/experienced*

Assessment

Pre-requisite:

Before awarding any points for this credit, the Assessor must ensure that roofing and guttering products used in the dwelling are not heavy metal polluting materials.

For a Design Rating, check the specified roofing material or, if there is no specification for this, obtain confirmation from the main contractor or project owner that these products will not be used.

For a Built Rating, a site check can be sufficient. However, if any doubt exists, confirm the type of product using receipts, invoices, product datasheets and/or manufacturer data.

1. Brownfield Development

0.5 points will be awarded where the site has previously experienced development.

Use a website such as Google Earth to locate an aerial photograph of the site showing the most recent development on the site prior to the proposed dwelling(s) and/or Resource/Building Consent (RC/BC) showing previous development. This point may be assumed for existing dwellings. To be counted the following conditions must be met:

- The property being developed previously contained at least one building with permanent foundations within the previous legal boundary.

- If one or a number of dwellings are being replaced, the final number of independent dwellings onsite (with unique street addresses) is no less than the number on site prior to the development.
- If a proportion of the property was previously cultivated or pastoral farmland, no more than 50% of the total building footprint of the development is on this farmland section.

2. Stormwater

Up to 1.5 points are awarded based on the proportion of the development site that is shown to have effective onsite management of stormwater. Complete Part C of the Water Calculator to determine points.

Appropriate systems for managing stormwater vary according to whether the area is:

- roof (plan area covered by the roof including eaves)
- site (ground area not under roof)

Points are based on the percentage of the total site and roof area that is either permeable, a living roof, or otherwise has its stormwater run-off effectively managed as per the table below.

Method	Approach	Points
(1)	At least 50% of the site has an effective stormwater management system. Permeable areas (ground and roof) can contribute towards this percentage.	0.5 point
	OR	
	At least 50% of the site has an effective stormwater management system, AND Includes a retention capacity (i.e., retention tank) to manage the first 10 mm of 1 in 2 year, 24 hour duration storm event.	1 point
(2)	At least 90% of the site has an effective stormwater management system. Permeable areas (ground and roof) can contribute towards this percentage.	1 point
	OR	
	At least 90% of the site has an effective stormwater management system, AND Includes a retention capacity (i.e., retention tank) to manage the first 10 mm of 1 in 2 year, 24 hour duration storm event.	1.5 points

Permeable and Impermeable Areas

Permeable surfaces that allow infiltration of stormwater meet the 10mm retention requirement by default. Permeable surfaces include (but are not limited to):

- Vegetation
- Living roofs

- Permeable paving including porous above ground materials with a six-inch porous sub-base, e.g. open pavers, pebbles
- Onsite rain garden

Impermeable surfaces include

- Concreted driveways and car parks
- Concreted footpaths
- Decks (including wooden decks where there are no gaps between timber planks)
- Paved patio areas (refer to permeable paving in the section below)
- Swimming/spa pools
- Separate sheds, garages, and roofed car ports.

Calculating System Capacity Requirements

Where the site does not meet any of the permeability benchmarks, a stormwater management system must be implemented in order to meet the requirements.

The systems must be able to manage the site's (roof and impermeable ground) stormwater during one third of the one in two year storm, 24hr duration event (note: local authorities may require peak flow attenuation of larger storm events on some sites and this must be treated as an additional requirement).

If a manual calculation is required, Assessors can use the hirds.niwa.co.nz website to determine the amount of rainfall generated in one in two year storm, 24hr duration rainfall event at that location. To determine the volume of stormwater run-off, divide this figure by 3 then multiply by the roof area and the run-off coefficient of the roof.

Natural On-Site Stormwater Management Systems

Sustainable on-site stormwater management systems not only reduce run-off but also can help to improve water quality, limit the discharge of sediment, pollutants and contaminants into the stormwater system. It also minimises the impact of residential development and infrastructure on natural waterways. Natural onsite stormwater management systems help ensure the resilience of the natural ecosystem in managing stormwater. These systems includes the following:

- vegetated swale or flow paths
- on-site rain garden
- pond
- sand filter
- bioretention

For these types of systems, a report from a competent professional such as a stormwater engineer is required to confirm that the system(s) can effectively manage the site and roof stormwater runoff as required. Enter this information in Part C of the Water Calculator.

Stormwater Detention and/or Retention Tanks

For rainwater and stormwater detention tank systems, the calculation carried out by the Water Calculator (Parts B and C) will determine whether the tank(s) are of sufficient size.

The stormwater detention tank should be able to hold 1/3 of the one in two year storm 24hr duration rainfall event at the location.

Rainwater tanks may be used as detention tanks. However, they must be designed as specific dual-purpose tanks where the volume above the overflow is considered as the detention volume.

Retention of the First 10mm

Reducing peak flows from regular storm events (e.g. 1/3 of the 1:2yr) and overall volume reduction through retention (and infiltration or reuse) of stormwater on site is effective at reducing downstream erosion.

Points are awarded where sites retain the first 10mm of any storm event on site. This can be achieved by the following methods:

- Living roofs
- Permeable areas including permeable paving
- Swales incorporating gravel underdrains and dams
- Infiltration basins
- Soakage pits
- Dual purpose rainwater retention/detention tanks where the rainwater is used in the building in addition to garden watering.

Multi-Unit Developments

For any projects with multiple dwellings (such as apartments blocks or developments of several standalone or terraced dwellings), the roof coverage area considered is the total roof area of the development. Similarly, the ground area not under roof is the entire site area of the development excluding the total roof area; include driveways, footpaths and other landscaping areas that are within the development boundary. The resultant points will be allocated to all dwellings within the project.

Onsite Assessment Summary

1. Identify any overland flow paths on or adjacent to the site (also refer to building consent drainage plans if available as well as any stormwater engineering reports).
2. Assess the layout of the development in relation to any overland flow paths.
3. Calculate roof coverage area, and ground area not under roof (don't double count area under roof in ground area).
4. Identify the amount of impervious areas added to the site post-development, including the roof area, and enter this figure into the Water Calculator in Part C.
5. Identify the onsite stormwater management systems implemented.
6. Confirm the areas effectively managed by onsite stormwater systems and complete Part C of the Water Calculator to determine points.

3. Native Planting

Up to 1 point is awarded where site coverage targets are met with native planting appropriate to that site.

Method	Approach	Points
(1)	At least 25% of the land area	0.5 point
(2)	At least 50% of the land area	1 point

Percentage of planting = (area of native planting / ground area not under roof) x 100

Part C of the Water Calculator will help determine the required planting areas.

- Any driveways or other outdoor paved areas within the property boundary of each specific dwelling should be included in the total land area.
- Where plants are in a clearly designated garden bed that is predominantly planted with native plants, then the area of the entire garden bed may be counted.
- When plants are located in a standalone space that is not primarily planted with natives (e.g. a tree in a lawn), then use the drip line of the plant. For a Design Rating, the drip line of a plant is to be estimated as the size that the plant will be when the dwelling is being assessed for the Built Rating. For a Built Rating, the drip line is what is observed on site at the time of certification, not the size the plant may grow to at some time in the future.
- Permanently fixed pots and planters on balconies and terraces may be counted towards this credit using either the area within drip line or the area of the planter or pot.
- If an appropriate native specimen overhangs the subject site but its base resides in an adjoining property, the drip line of the specimen can contribute to the percentage of the land area covered by appropriate native species unless there are pest species within the drip line at ground level on the subject site. This is because the specimen is likely to be of a significant size, is more likely to remain in perpetuity and may also be protected by the local Council.

Plants considered as 'native planting' must be a native species and appropriate to the site, considering location and conditions. It is recommended that the Homestar Assessor refers to the planting guide of the local Council (if available) or one of the guides referred to in the further resources section below. Also consider:

Regional biodiversity: native planting should be appropriate to the region as local flora and fauna have evolved to be suited to local conditions and may not be present elsewhere, therefore should be encouraged. Refer to local Council planting guidelines if available. If these are not available, the Homestar Assessor should:

1. Determine the local climate:
    a. Sub-tropical: Warm summer. Mild winter with rare frost. Auckland, Northland, Coromandel and east coast areas to Tauranga and Mount Maunganui excluding inland areas which have frequent frosts.
    b. Temperate: Warm summer, cool wet winter. Occasional frosts. North Island - Hamilton and western coastal areas as far as Wellington. Rotorua and all east coast areas from Bay of Plenty south. South Island - Nelson and West Coast areas south to Greymouth, Picton and East Coast south through Christchurch, Dunedin to Invercargill.
    c. Semi-alpine: Warm summer. Cold winter with frosts. Taupo, parts of Waikato in shadow of the mountains, Wairarapa. Inland areas of Otago, Canterbury and all Southern Lakes areas.
2. Determine the appropriateness of each plant species, considering site conditions, soil, proximity to coast vs. inland.
    a. Water consumption: choose plants that will reduce water consumption, e.g. native ground cover and shrubs will consume less water than lawn.
    b. Shading: planting should avoid negatively impacting solar gain. For example, deciduous plants near north-facing windows can provide beneficial summer shading.

c. Damage to paint/walls of house: avoid placing large trees and shrubs too close to the house.
d. Ventilation: keep foundation vents clear.
e. Hardiness: plants adapted for local conditions tend to require less maintenance and watering to survive.

Multi-Unit Developments

For any projects with multiple dwellings (such as apartment blocks or developments of several standalone or terraced dwellings), the area considered is the total area of the development excluding the area under roofs, but including driveways, footpaths, etc. within the development boundary. The resultant points will be allocated to all dwellings of the project.

Useful Resources

Native species

- Refer to the local Council website for a list of commonly grown native species within the region.
- NZ Plant Conservation Network – plant ID resources (online)
- Department of Conservation. – Plant Me Instead resource (online)
- The Native Plant Centre – plant ID resources (online)
- NZ Biodiversity website (online)

Weed species

- Weedbusters NZ (online)
- Landcare Research – pest ID resources (online)

Climate zones

- National Institute of Water and Atmospheric – climate zone resources (online)

4. Holistic Design

1 point is available where a holistic design approach has been taken to stormwater and ecology, recognising water sensitive design interventions and biodiversity benefits from planting choices as a whole. The project must also have achieved at least 0.5 point for stormwater and 0.5 point for native planting.

Approach	Points
Water Sensitive Urban Design (WSUD) guidelines published by the local council/authority have been adhered to during the planning and design of the development. Where the local council/authority have not published specific WSUD guidelines, those published by another authority, such as Auckland Design Manual, Tauranga City Council or Wellington Water may be used.	1 point

One of the following members of the design team for the development must provide written confirmation identifying which WSUD guidelines were used and outlining key considerations integrated into the development as a result.

- Stormwater engineer/hydraulic engineer
- Landscape designer/architect
- Architect/ architectural designer
- Environmental engineer
- Ecologist/horticultural consultant

This is applicable for both Design and Built ratings and any written submission (including an email) signed off by one of the competent professionals listed above is acceptable to confirm compliance.

EN6: Responsible Contracting

Points Available	1		
Mandatory Minimums	None		
Aim	To encourage and recognise best environmental practice by contractors during construction and renovation.		
Project-wide	Yes	Calculator	No

Credit Criteria

Up to 1 point can be awarded where contractor on site hold a recognised accreditation or registration and/or an Environmental Management Plan is in place.

Contractor Accreditation

A contractor on site holds any one of the following accreditations or registrations from the list below:	0.25 point
A contractor(s) on site holds any two of the following accreditations or registrations from the list below:	0.5 point
Enviro-Mark NZ Gold Standard or above Resene Eco Decorator EcoSmart Electrician IAONZ accreditation Homestar Practitioner Homestar Assessor	

Environmental Management

An Environmental Management Plan (EMP) is in place for the construction or renovation works in accordance with the Homestar template.	0.5 point
OR	
The contractor holds ISO14001 certification that covers the construction of the dwelling.	0.5 point

Evidence

Design and Built Rating

Completed Pro forma of Credit Compliance OR evidence as listed in Pro forma.

Assessment

Contractor Accreditation

Verify that one or more contractors hold recognised accreditations or registrations. The contractors must be part of the onsite project team, either as an employee of the main contractor or as a sub-contractor. If the person holds a Homestar Assessor qualification, they also can be completing the assessment of the house in addition to their onsite role (but assessment role is not required).

Environmental Management

Check for a completed or specification to complete an Environmental Management Plan, or for ISO 14001 or specification to hold ISO 14001.

IN1: Innovations

Points Available	10		
Mandatory Minimums	None		
Aim	To recognise and encourage the uptake of building initiatives which significantly reduce the environmental impact of the dwelling.		
Project-wide	Depends on innovation	Calculator	No

Credit Criteria

Up to 10 points are available in total, at the discretion of the NZGBC, for innovations using one or both of the following pathways:

Method	Approach	Points
(1)	Completion of a published innovation challenge	Up to 10 points
(2)	A design feature, technology or strategy that results in a quantified environmental benefit which significantly exceeds an existing Homestar benchmark or which is currently not included in the Homestar tool.	

Evidence

Design Rating

To apply for an innovation	Completed Innovation Request Form (refer to NZGBC website).
	Drawings/diagrams/photos and other supporting documentation as appropriate.
At assessment submission	Drawings/diagrams/photos and other documentation outlined in the innovation award letter as being required at Design rating.

Built Rating

To apply for an innovation (if not done at Design rating)	Completed Innovation Request Form (refer to NZGBC website).
	Drawings/diagrams/photos and other supporting documentation as appropriate.
At assessment submission	Drawings/diagrams/photos and other documentation outlined in the innovation award letter as being required at Built rating.

Assessment

More than one innovative feature, technology or strategy per project can be rewarded innovation points. The number of points awarded per innovation is dependent on the significance of the innovation, which is at the discretion of the NZGBC.

1. Innovation Challenges

NZGBC will periodically publish Innovation Challenges that will address specific issues where NZGBC and industry have identified the potential or need for innovation. Innovation Challenges will also be issued to capture features that are outside the scope of the Homestar tool, but which are encouraged in residential developments. These will be published on the NZGBC website. Projects may target Innovation Challenges as long as they remain published.

2. Other Innovations (new and previously awarded to another project)

Each innovation will be assessed against the following criteria:

- The significance of the quantified environmental benefit
- Whether the delivery of the innovation included investigative and/or experimental activities

The NZGBC will not award innovation points unless it is demonstrated that the proposed environmental benefit is significant and realistic. The innovation must not have adverse effects on the resource use, environmental impact or health of the dwelling or occupants. Refer to the Innovations Register available on the NZGBC website under Homestar Innovations.

All innovations (as determined by the NZGBC) will be listed publicly on the Homestar website.

Where a design feature, technology or strategy is awarded an innovation point, and the initiative is not currently recognised within Homestar (i.e., a "new" innovation), up to 100 projects will be eligible for an innovation point if they incorporate the same initiative, unless the innovation is retired by the NZGBC or brought within the main framework of the Homestar tool beforehand.

Applying for an Innovation

The Innovation Submission Template can be downloaded from the NZGBC website. Innovations should be submitted for approval prior to project submission, regardless of whether you are targeting a new innovation, a previously awarded innovation, or an innovation challenge.

If you are targeting an existing innovation challenge or a previously awarded innovation, please state this clearly on the submission form and include the innovation number as per the summary on the NZGBC website.

You may include multiple previously awarded innovations in one submission form. Make sure to include a short description of what is provided (if appropriate, including a drawing/photo or specification extract to show what is included). You do not need to justify why it should get points as this is already established.

What to Include

Include the response letter from the NZGBC in the project submission with the evidence specified on the innovation challenge summary, previously awarded innovation summary, or the innovation response letter from the NZGBC.

Appendix A: Energy Modelling Protocol

Introduction

This document has been prepared to provide guidance for projects assessed under the Homestar rating tool who wish to undertake thermal modelling (dynamic simulation) as an alternative calculation approach to the ECCHO tool used for HC1: Winter Comfort and HC2: Summer Comfort. The process of carrying out the modelling to contribute to this credit, is described in this guide. Note that the same model may be used to assess the home under CIBSE TM59 for credit HC2: Summer Comfort. This must be undertaken following the guidance in CIBSE TM59 in addition to the guidance found in this appendix.

Modelling should be carried out by a trained and experienced professional and will be reviewed by the NZGBC during audit. The additional auditing carries an additional audit fee. Please refer to the NZGBC website for details.

For Design Rated projects, the energy modelling does not have to be redone for the Built Rating if no changes have been to the building design or equipment since that submission. However, the original documentation for this credit must be included in the Homestar Built audit documentation for reference, and a signed document must be provided stating that no changes were made from design stage.

The model that is produced by these guidelines is intended to be used for determining compliance with Homestar HC1 and HC2 only. Actual running energy will depend on design decisions, construction factors, and occupant behaviours.

Energy Modelling Protocol

Approach

Energy modelling should be carried out using the protocol described below. This report must clearly describe the modelling process for the building in accordance with the protocol, and include supporting documentation as described below.

Modelling must be undertaken for each individual dwelling unit; any adjacent units shall also be modelled for thermal effects in the case of attached dwellings.

Modelling Requirements

The following table lists the input variables and the requirements and parameters for modelling. Also listed is the supporting data which must be provided with the report to demonstrate that the modelled building (as summarised in the energy modelling report) is the submitted documented design.

Variable	Variable Requirements	Documentation Required
Modelling Software	The software must be of the dynamic thermal modelling type or per ISO13790 with the ability to model thermal mass effects. AND Software must be able to either calculate ground temperatures from slab geometry or use ISO13370 to estimate ground impacts on heat loss. AND Must be capable of modelling representative building attributes, building elements. AND Must be capable of modelling all inputs described in this guide. AND Must have been validated to BESTEST AND/OR ANSI/ASHRAE Standard 140-2004 AND/OR ISO13798	Confirmation that the software meets either BESTEST or ANSI/ASHRAE Standard 140-2004 performance criteria or ISO 13790. Brief description of the software package. Including thermal calculation method. If building has slab on ground in conditioned space software must be able to either calculate ground temperatures from slab geometry and climate / ground data or use ISO13370 to estimate ground impacts on heat loss.
Weather File	Must be hourly or monthly weather data for the site based on either IWEC or NIWA climate region data. Where no IWEC weather file is available for the region this should be highlighted to the NZGBC during project registration. If the site differs from the weather station by more than 100m adjust temperatures by reducing them proportionally by 0.6°C for each 100m of altitude gain.	Hourly weather or processed monthly file used. Weather station location. If weather station is not site location, justification as to how the weather file used is representative of the local climate for the building (to be checked by NZGBC during audit). Note 100m of altitude gain typically results in 0.6°C decrease in average temperature.
Site Orientation	The building must be modelled in the same orientation as shown on site plan drawings.	Relevant drawings showing building orientation. Details of how this was represented in the model.
Building overshadowing	Include the effect of overshadowing from the surrounding environment.	Drawings showing elements of the surrounding

		environment causing overshadowing (buildings, trees), with heights marked. Details of how this was represented in the model.
Building Geometry	The model geometry must accurately represent the building geometry. Use the exterior of the building thermal envelope as the surface geometry.	Plan and Elevation drawings Details of how this was represented in the model.
Thermal Bridges	For simplification if the exterior dimensions of the thermal envelope are used to calculate the energy consumption of the building and no thermally conductive (L>0.3 W/mK) elements penetrate the insulation layer, an allowance for thermal bridges of 5 kWh/m^2 per year is to be added to the heating energy calculation based on the useful or Treated Floor Area(TFA). Alternately thermal bridges in excess of 0.01 W/mK can be modelled in a 2D heat transfer package and accounted for per ISO10211:2007.	Details of how this was represented in the model.
Modelled spaces	Must account for the entire conditioned space in the dwelling unit. Surfaces adjacent to conditioned spaces outside the unit can be modelled as adiabatic or not included in the model; surfaces adjacent to unconditioned spaces benefit can be taken into account per ISO6496 calculator for unconditioned spaces, or the unconditioned space can be modelled. Note that unconditioned spaces must be modelled with realistic ventilation rates. Ventilated spaces must be modelled with a ventilation rate of at least 3 air changes. The volume under a suspended timber floor should be modelled as external air.	Details of the modelled (conditioned) building area and zoning also describing the dwellings conditioned area.

Building thermal Envelope and construction	The model must reflect the constructions of the building. Include any floor coverings. Account for thermal mass where it is exposed to the zone. Where any simplifications have been made provide details of these and justification. Timber framing must use 30% timber fraction unless framing is designed to reduce timber content and verification is provided.	Drawings, materials schedule or specification extracts showing all thermal envelope materials and location. Calculations of overall R-values for constructions. Details of how the building thermal envelope has been modelled.
External Surface Solar Reflectance	Use 0.3 as solar reflectance or Exterior absorptivity of 0.7 or optionally as specified.	How solar reflectance has been obtained for each surface material. Details of how this was represented in the model.
Windows, Glazed Doors and Skylights	The model must accurately reflect the glass and frame area of the building. If non-rectangular windows are specified they may be changed to rectangles provided the glass area is kept constant. The opening area of windows should also be entered into the model, where applicable.	Elevation drawings showing all glazing to the above grade perimeter external wall area. These must include sufficient detail to show opening area. Details of how this was represented in the model.
Glazing and Skylight G-value	Glass suppliers data sheet with g-value or (centre of glass) SHGC (or Shading Coefficient converted to g-value using g-value=0.87*SC)	Materials schedule or specification extracts listing glazing Shading Coefficient, Solar Heat Gain Coefficient or Solar Factor and the resulting glazing G-value Details of how this was represented in the model.
Natural ventilation openings	During the cooling season please refer to the natural ventilation assumptions set out in CIBSE TM59.	Specification extracts listing window opening sizes and control mechanism. Details of how this was represented in the model.
Fixed Shading	The model must accurately reflect the building shading.	Relevant drawings showing all fixed external shading devices. Details of how this was represented in the model.

Conditioned Spaces	Heating to all spaces inside the thermal envelope. See below. Cooling only where the home (or parts of the home) do/does not meet the requirements of TM59.	Floorplan showing thermal envelope. The entire conditioned space is assumed to be heated.
Designspace temperature during the heating season	Heating set point 20°C. Note this matches the Heating Energy definition in the H1 Acceptable Solution / Verification Method by MBIE 2017 version. No cooling demand needs to be explicitly modelled unless the home fails TM59 (see below). When homes fail TM59, cooling demand to maintain temperature below a set point of 25°C must be included in the model.	Details of how this was represented in the model.
Heating and Cooling operating schedule	For heating: 24 hours per day, 7 days per week. For cooling: Assumptions as set out in CIBSE TM59.	Details of how this was represented in the model.
General Infiltration	If measured air leakage is to be used it should be tested per ISO 13829 Method B. The measured air leakage via a blower door at 50Pa can be converted to a general infiltration rate by dividing by 20. For example, this means that a building measured at 6 ACH at 50Pa would have general infiltration of 0f 0.3 ACH throughout the year. Note that although the 1/20th rule is an estimate it is accepted as a reasonable approximation internationally. Buildings not subject to air leakage testing should be assumed to have a general infiltration rate of 0.3 ACH ***in addition to purpose provided ventilation either from opening windows or mechanical ventilation.***	Details of how this was represented in the model.
Metal Flued Heater Infiltration	Include airflow for infiltration from metal flued heaters.	Details of how this was represented in the model.

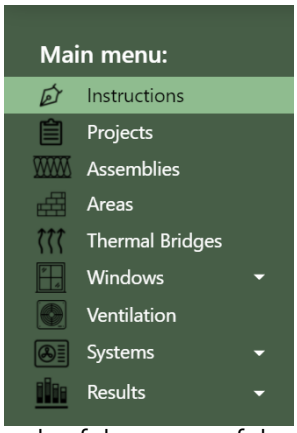
	None/1/2/3/4 flued heaters to be considered as 0/20/40/60 m^3 /hr of infiltration continuously. For simplification the infiltration can be modelled by conversion to an air change rate, to be included with the infiltration rate.	
Passive Vents or Trickle Vents in Windows	Model these explicitly as openings in the façade if they exist.	Specification extracts listing opening sizes and control mechanisms. Details of how this was represented in the model.
Bathroom and Kitchen Exhaust	For continuous extract or MVHR systems model the design/ commissioned flow rates	Documentation of fan flow rates if actual data is used. Details of how this was represented in the model.
Mechanical Supply Ventilation	Where mechanical ventilation has been provided, e.g., through a central supply air system to an apartment building, model this air rate and supply temperature. Use commissioned data if available.	Specifications showing air rate supplied. Details of how this was represented in the model.
MVHR	Where balanced mechanical ventilation with heat (or enthalpy) recovery has been installed model the typical flow rate and manufacturer-supplied efficiency. Include fan power measured at commissioning if available.	Specifications showing heat (or enthalpy) recovery efficiency. The unit must be installed indoors unless the manufacturer has provided efficiencies with the outdoor install. Commissioning data including fan power measured if available. Ventilation design diagram showing air distribution through the dwelling with supply/extract locations and flow rates planned.
Internal Loads (Plug, Lighting, and Occupancy)	For dwellings with internal floor area: less than $25m^2$ use IHG=4.1 W/m^2 as a constant internal load; more than $25m^2$ use IHG=(2.1 W/m^2 x Internal Floor Area+50 W)/(Internal Floor Area in m^2). For multi-unit dwellings, the formula may be applied across the building	Details of how this was represented in the model.

	(i.e., living areas) as a whole rather than each individual dwelling.	

Appendix B: Guide to Operational Energy Modelling in ECCHO

Introduction to Operational Energy Modelling in ECCHO

Homestar's energy analysis tool, ECCHO (Energy and Carbon Calculator for Homes), is a Web App that allows users to calculate the heating and cooling demand, energy consumption, overheating risk, and carbon emissions of a home.



Once logged in, the various parts of the app can be accessed through the menu in the left-hand navigation bar. Each page allows users to create, edit, delete and review different aspects of a home's design including the ***assemblies*** used (wall, roof, and floor build-ups), the ***areas*** of walls, roofs and floors, the type and areas of ***windows*** and the ***ventilation***, lighting, and space and hot water heating ***systems***.

As the tool is completed, the headline heating and electricity demand figures are updated on the top navigation bar. These are the primary metrics for Homestar compliance. The next page shows each of the parts of the main parts of ECCHO.

Once complete, a dwelling's energy, carbon, and overheating results can be found by navigating to the results page. This page also shows the final points achieved for credits HC1, HC2, EF,4 and EN1, and the maximum Homestar rating as follows:

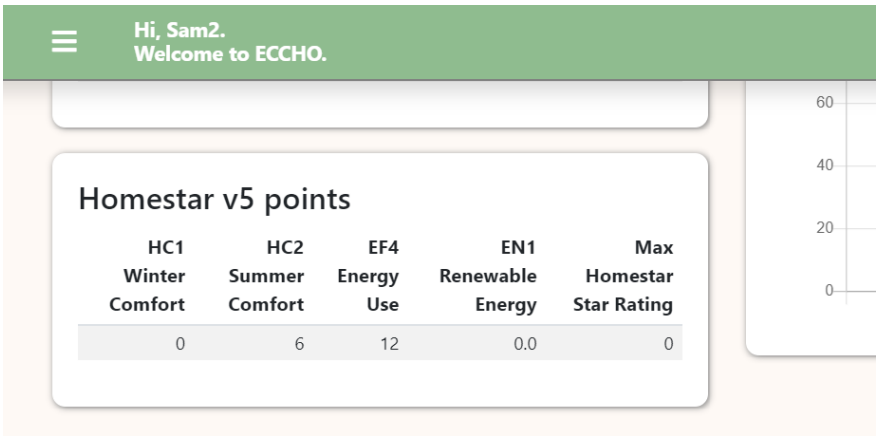


Figure 1: A summary page showing Homestar points

As can be seen, ECCHO provides a pathway for showing compliance with credits HC1, HC2, EF4, and EN1 in Homestar using the calculation pathway. Respectively these cover winter heating demand, risk of overheating in summer, overall energy use and carbon emissions and on-site renewable energy generation.

Use of ECCHO for these credits is not compulsory. Each credit allows alternative pathways such as thermal modelling or use of the full PHPP package (e.g. as part of Passive House compliance). Where these alternative pathways are used, the results must be entered into

the Excel version of ECCHO. Details on how to do to this can be found in Appendix A which covers the Homestar energy modelling guide.

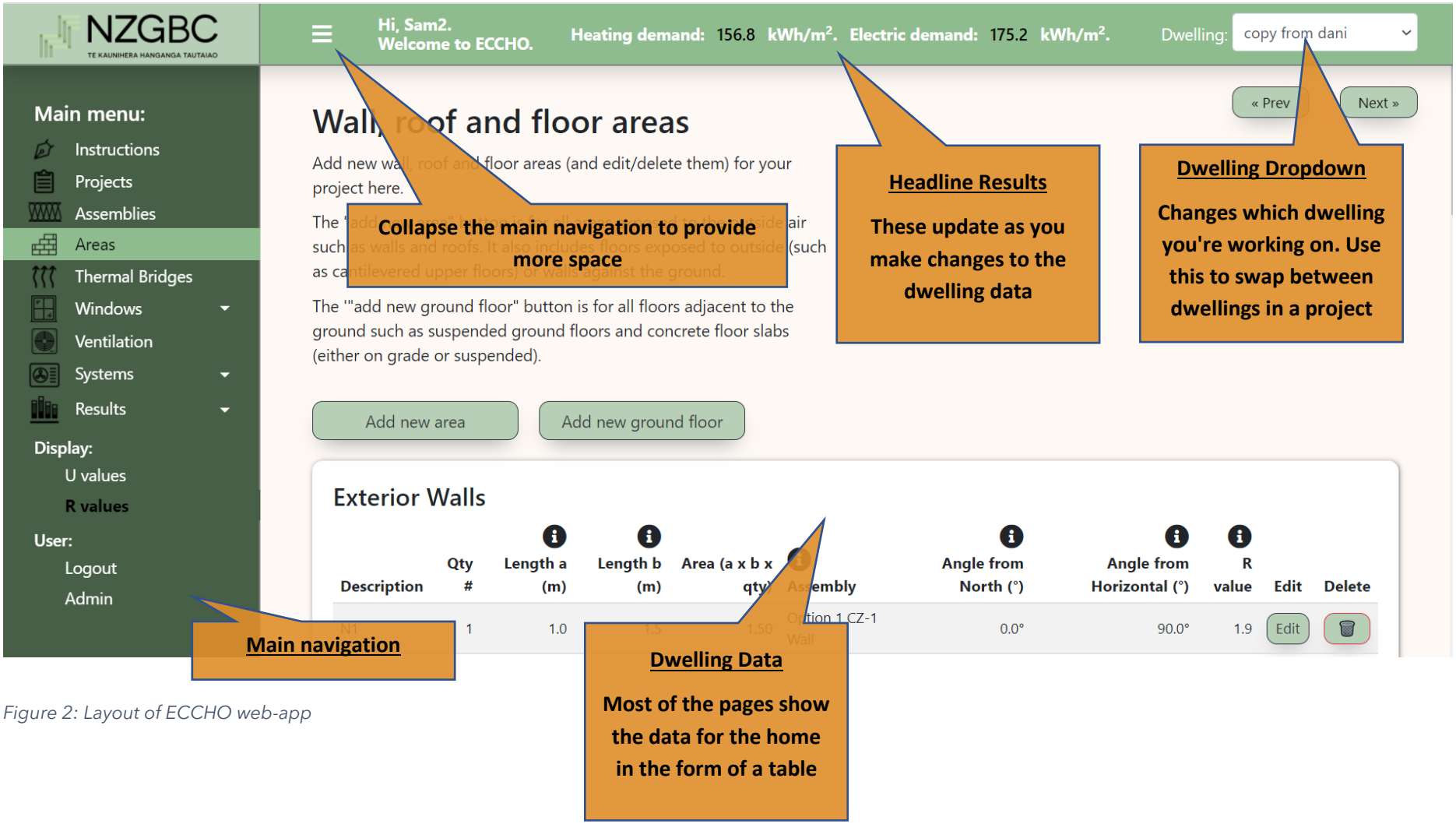


Figure 2: Layout of ECCHO web-app

Use of ECCHO for Homestar

For the purpose of submitting for a Homestar certification, users of ECCHO must either be a qualified Homestar Designer or Passive House Designer. Those undertaking a Homestar designer course will be issued with a 1 year ECCHO license as part of the course. Passive House designers wanting to use ECCHO should email homestar@nzgbc.org.nz requesting a license. Licensing fees can be found on the NZGBC website.

Once you've been informed your email has been lodged with ECCHO you can navigate to the registration page where you'll be asked to enter a username and password.

Compliance by Energy Modelling or Passive House certification

Note that ECCHO Online may not be used if demonstrating compliance following the energy modelling or Passive House pathways. For this, the excel version of ECCHO must be used. This has fields to enter results data from energy models.

In this case, only the Summary, Systems, lights and appliances and Refrigerants worksheets need to be filled in. The Summary worksheet allows for the input (cell L30) of space heating demand calculated using either dynamic simulation or PHPP. Those using dynamic simulation must carry out this energy modelling following the requirements of the Energy Modelling Protocol in Appendix A.

Overview of ECCHO pages

Most of the pages in ECCHO need to be filled in to get the correct result for a Homestar submission following the calculation methodology. The following gives an overview of what each of the 5 compulsory pages does.

Projects	Register a new project and dwellings within that project. Set basic project and dwellings details such as address, floor area and climate zone.
Assemblies	This is where the R-values for each of the different wall, roof and floor constructions are entered and/or calculated.
Areas	This is where the areas of walls, ceilings and floors are entered, together with what they are made of (taken from the “R-values” worksheet) and their orientation.
Thermal Bridges	At least one thermal bridge for the slab edge must be defined on this page if the home has as a ground floor.
Windows	This is where windows and skylights (and doors) are defined and positioned (i.e. which wall or roof they are in).
Systems	Use these pages to input the space heating and hot water systems, shower flow rate(s), hot water storage (or not) and lighting and appliance efficiencies.

Important Basics

ECCHO requires data to be entered in ways that are different to how users might have input them before in other thermal modelling tools. The following sets out some important things to note before you get started.

Homestar rates an individual home

For the purposes of Homestar, ECCHO should be used to model an individual dwelling such as a standalone home or individual apartment or unit. If a dwelling is part of a building (such as an individual apartment within a larger apartment building) the tool must NOT be used to assess the overall building. For more details of how to assess homes that have similar layouts (typologies) please refer to Typology section.

Ground floor R-value

Ground floors are dealt with differently to other thermal analysis programmes. The construction R-values of any ground floors are input in the same way as walls and roofs (i.e. ignoring the benefit of the ground). This means that the R-value for the ground floor is entered as the sum of the individual R-values of the components making up the ground floor such as the concrete slab and any underslab insulation. Calculated in this way, the R-value of a standard 100mm uninsulated slab is R0.18 (rather than R1.3 as assumed in the New Zealand Building Code).

This might seem very low, however ECCHO automatically calculates the benefit of the ground for you based on the ground floor dimensions and the climate zone (colder climates have colder ground). ***R-values for ground floors should not be calculated using NZS4214, nor taken from catalogues of standard R-values such as those found in the BRANZ House Insulation Guide.***

Ground floor edge heat loss

The heat loss from the edge of a ground floor (either concrete slab or suspended floor) is calculated separately on the thermal bridges pages. This is where the benefit of slab edge insulation can be entered.

Use external measurements

NZS4218 (and tools based on this such as BRANZ ALF) asks for the internal measurements of walls, floors and roofs. ECCHO requires ***external*** measurements to be used: this means, for example, that the height of a wall is measured from the bottom of the ground floor insulation (or concrete slab if there is no insulation) to the top of the roof insulation. The area of a concrete slab or roof is measured using the external plan dimensions of the home.

Note that the one ***exception*** to this rule is the Conditioned Floor Area. This is the measure of ***internal*** area within the thermal envelope.

Windows

The overall R-value of a window is calculated from the dimensions of the window and the separate R-values of the glazing and window frame. This means that, if the window system

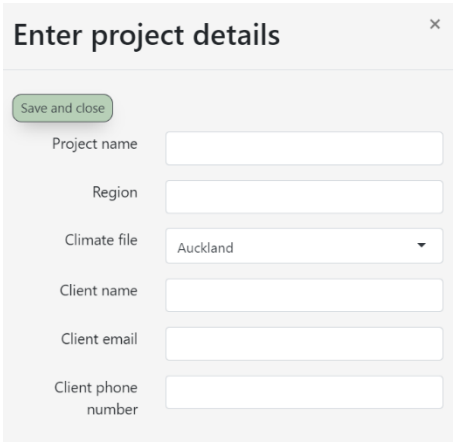
you are using is not in ECCHO (many are defined), you will have to get this information from your window supplier. In addition, each pane in a window is entered separately.

Projects

Use this page to start a new project and then define dwellings within that project. A project can be a multi-unit development or a single home. Each dwelling within the project could be a different home or variations of the same home you wish to test.

Creating a New Project

Begin by clicking on 'Start new project'. This will bring up a form asking for details of the project. Only the project name and climate file are compulsory.



Climate File

ECCHO has 19 sets of climate data (generally) based on the climate of the biggest city in that area. The climate data is automatically selected based on the Local Authority that the project is based in. ECCHO automatically adjusts this climate data based the height (altitude) of the project relative to the height of the climate zone data above sea level (see next).

Assigning a New Dwelling to a Project

Next, click on 'Add new dwelling'.

The following information must be provided:

Conditioned Floor Area (CFA)

This is the ***internal*** area of the building (measured along the line of the final finish, e.g. internal linings) that falls ***within the thermal envelope***. It therefore excludes any unconditioned areas such as garages. See 'Area Definitions' for more details in the opening chapter of the Technical Manual.

Altitude

This is the height of the building (in metres) above sea level. This can be found easily on Google Earth (bottom right-hand corner when you hover over the building site).

Winter and Summer interior temperature

The winter temperature defaults to 20℃. This is the temperature the home is assumed to be heated to 24/7 throughout the year.

The summer temperature defaults to 25℃. For Homestar compliance ECCHO calculates the percentage of the year the home is predicted to exceed this temperature. ECCHO also calculates the amount of cooling energy needed to maintain this temperature.

As we will see later when we cover the Results pages, ECCHO is able to provide either 'Homestar' results or 'Custom' results. The Homestar results fix the heating and cooling set

point at 20℃ and 25℃ respectively. The custom results allow users to examine the effect of different assumed setpoints.

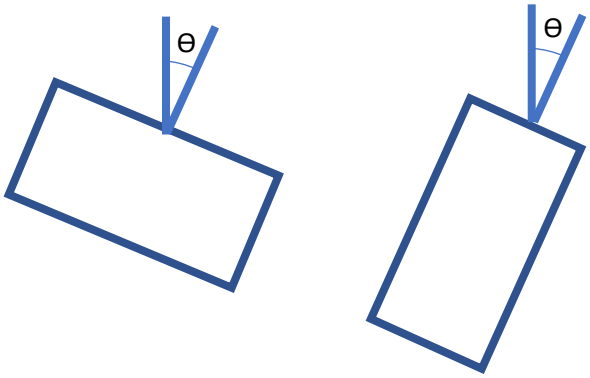
Thermal mass type

This is a simplified definition of the dwelling's thermal mass based on the number of storeys and construction type. If you wish to enter a custom thermal mass, click 'user defined' and then enter the total thermal mass of the dwelling in Wh/K /m2.

Orientation

The orientation of each wall and roof will be entered later in the Area page. At a higher level, on the Project page, ECCHO offers the opportunity to vary the overall orientation of the dwelling allowing users to test different orientations.

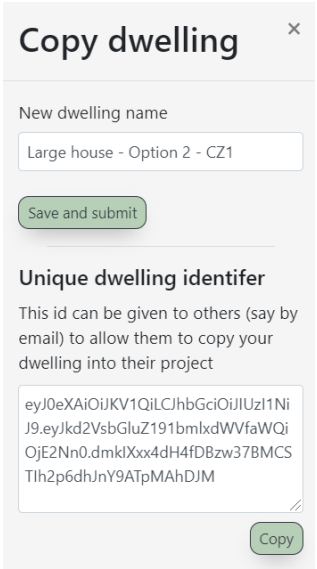
The angle entered here (ϴ), measured clockwise from solar North, adjusts the orientation of each wall and roof by that number of degrees.



This facility also allows users to enter all walls and roofs at the cardinal angles (0° for North, 90° for East, 180° for South and 270° for West) and then alter the orientation of the whole dwelling from solar North.

Copying Existing Dwellings

Dwellings can be copied within a project (to test variations) or copied from other projects. To copy dwellings *within* a project, click on the 'copy' button associated with the dwelling you wish to copy. Give the copied dwelling a new name. All dwelling names within a project must be unique.



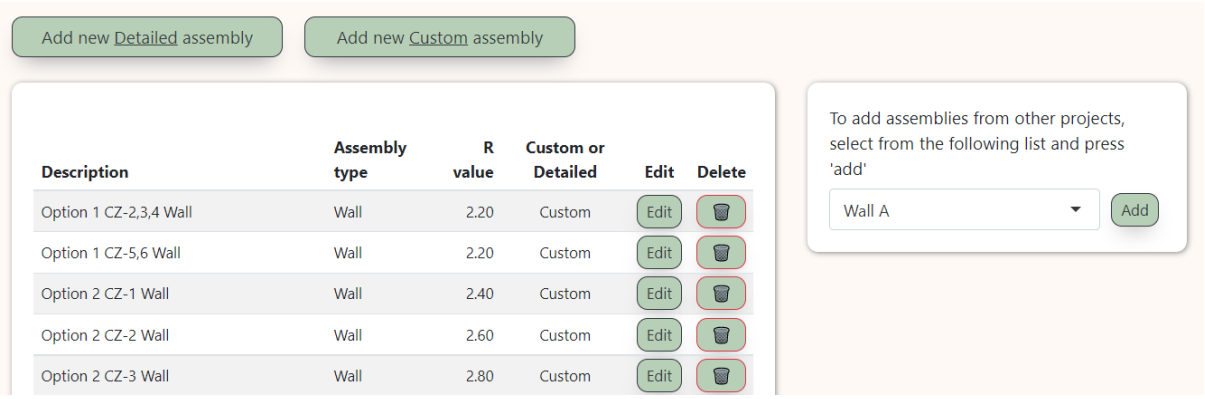
Each dwelling has a unique ID. This ID can be found by clicking on the copy dwelling button. It can be emailed to other ECCHO users to allow them to copy the dwelling into their project.

Please submit this unique ID for any ECCHO model submitted for Homestar certification. This is to allow the NZGBC admin team to confirm the dwelling has been entered on the system.

To use the unique ID to copy a dwelling into your project click on 'Copy dwelling from unique ID' at the top of the page.

Assemblies

The Assemblies page is where the R-values for each of the different wall, roof and floor constructions are entered and/or calculated. ECCHO stores a discrete set of assemblies for each project. These are shared across all dwellings in the project. Assemblies may also be copied from other projects.



Introduction

For each assembly type, it is possible to enter either custom R-values (e.g., taken from the BRANZ Home Insulation Guide or Design Navigator) or detailed R-values calculated using the thicknesses and thermal conductivity values of each of the layers of that construction.

Custom R-value

For custom R-values, simply enter the construction name (description), R-value and assembly type (i.e. wall, roof or floor). Make sure you use a sensible name for your assembly so you can find it when you enter the building geometry in the Areas page.

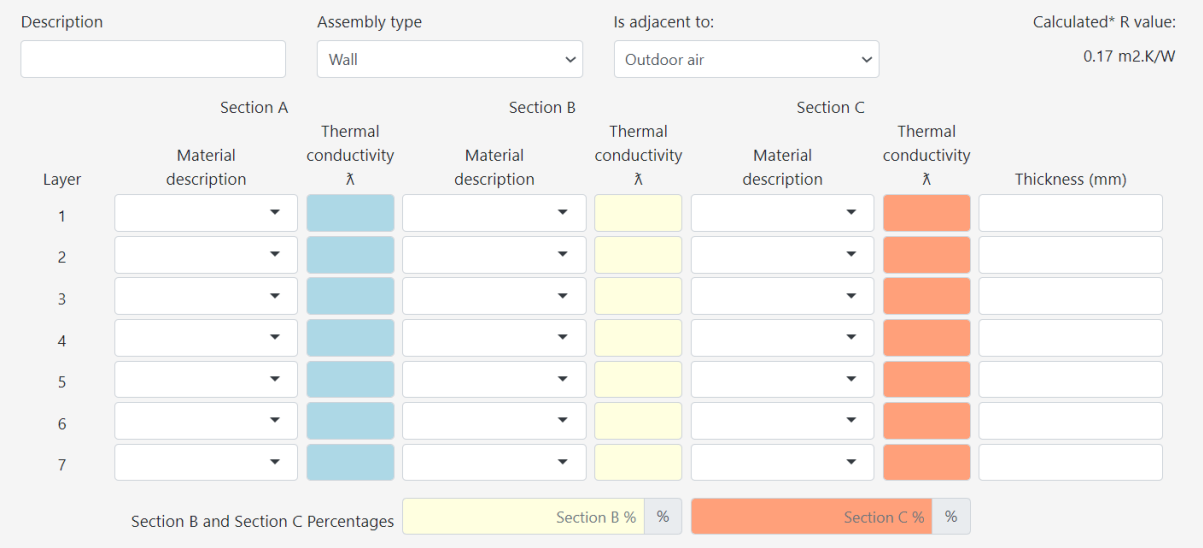
Detailed R-value

For detailed R-values, enter the assembly name (as with custom R-value), its type (either wall, floor or roof), and then enter each of the components that make up that assembly. For each layer you'll need to enter the material name, its thermal conductivity (λ W/(mK)) and its thickness in millimetres. ECCHO includes default materials and thermal conductivity values from NZS4214, but also allows user-defined materials. The default values can be searched by typing keywords into the respective input boxes, e.g. typing 'insulation' will bring up all of the default insulation materials in the tool.

As you enter values the calculated R-value is updated on the top right-hand corner of the form.

Please note: R values are calculated in ECCHO according to the international standard, ISO 6946. The current version of the NZ Building Code references NZS4214, which follows a different (more conservative) calculation method, and therefore R-values calculated on this sheet may not be submitted for Building Consent under the Schedule method. ECCHO may be used, however, to submit for Building Consent following the modelling method.

Figure 3: Detailed R-value calculation in ECCHO



The tool allows for up to 3 pathways (sections A, B and C) for heat to flow through the build-up. In a timber wall, for example, heat can flow through the insulation, but also through the studs that are bridging that insulation. Enter the proportion (as a percentage) of the assembly taken up by each section.

Unless evidence is provided to the contrary, any timber framed walls should be assumed to have a 30% timber fraction. This is in line with a study for BRANZ carried out by Beacon Pathway.

If a layer only has one material, this only needs to be entered once in section A, and will automatically be carried through to sections B and C.

In the section titled "Adjacent to" enter whether the construction is next to the outdoor air, is ventilated or is adjacent to the ground.

This is what this means:

Outdoor air	Use this for any constructions where heat flows direct to outside, but that do not have a ventilated cavity (see below).
Ventilated	Use this for typical build ups that have an external ventilated cavity. This would include the standard New Zealand wall comprising timber frame and weatherboard cladding over a ventilated cavity, a ventilated roof or suspended timber ground floor. Note that the thermal resistance of any constructions exterior to the ventilated cavity should be ignored.
Ground	Use this for build-ups that are directly on the ground.

Important Note About Floor R-values

When entering floor R-values – especially custom ones – the value to be entered is simply the R-value of the construction ***ignoring the benefit of the ground***: This ground benefit is calculated within ECCHO. As an example, the R-value of a 100mm concrete slab with 25mm of full cover EPS is calculated to be R0.88 in ECCHO. The R-value of an uninsulated 100mm concrete slab is R0.18.

Under no circumstances can slab or suspended floor R-values be sourced from the BRANZ Home Insulation Guide or Design Navigator.

Slab-edge Insulation

The benefit of slab-edge insulation is calculated separately. See next section on thermal bridging for details.

Areas Adjacent to Unconditioned Spaces

Areas of wall that lose their heat to unconditioned spaces such as garages and unheated corridors, may have their R-values increased to account for the reduction in heat lost through the unconditioned space.

For custom R-values this can be achieved simply by adding an appropriate thermal resistance (R_u) to the overall value sourced from, say, the BRANZ Housing Insulation Guide.

For detailed R-values ECCHO has a dedicated field for entering the additional R-value. Give this a description that makes it obvious to the Homestar assessor what the layer relates to.

Unheated garages

Figure 4: Thermal resistances of unheated garages below has a range of thermal resistances for different configurations of unheated adjacent garage. The table is sourced from the UK Standard Assessment Procedure (SAP) that governs energy calculations for the UK Building Code.

Communal Corridors and Stairwells

Any walls between a dwelling and a communal corridor heated to a minimum of 16°C can be excluded (i.e. deemed adiabatic). Stairwells are to be deemed unconditioned, unless it can be proven that they are open to the corridors (e.g. no door separation, or fire door held permanently open on magnets which would only shut if a fire alarm is triggered).

For clarification, lift shafts shall always be deemed unconditioned.

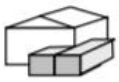
Walls adjacent to an unheated/unconditioned corridor should have an additional thermal resistance added as per Figure 5.

Figure 4: Thermal resistances of unheated garages

Table 3.1 R_u for integral single garages (single garage is a garage for one car)

Garage type	Elements between garage and dwelling	R_u for a single garage	
		Inside[1]	Outside[2]
Single fully integral 	Side wall, end wall and floor	0.68	0.33
Single fully integral 	One wall and floor	0.54	0.25
Single, partially integral displaced forward 	Side wall, end wall and floor	0.56	0.26

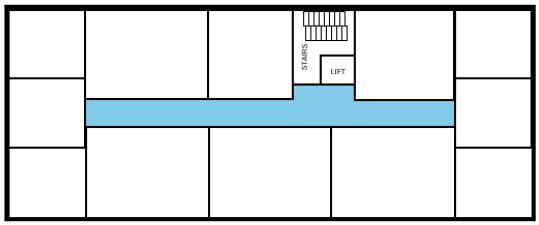
Table 3.2 R_u for integral double garages (double garage is a garage for two cars)

Garage type	Element between garage and dwelling	R_u for a double garage	
		Inside[1]	Outside[2]
Double garage fully integral 	Side wall, end wall and floor	0.59	0.28
Double, half integral 	Side wall, halves of the garage end wall and floor	0.34	n/a
Double, partially integral displaced forward 	Part of the garage side wall, end wall and some floor	0.28	n/a

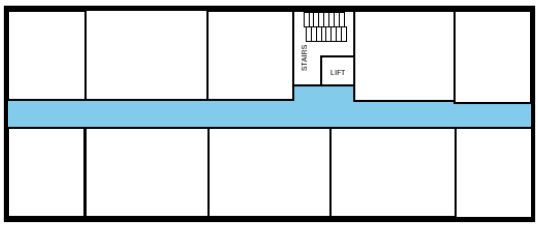
[1] *inside garage* – when the insulated envelope of the dwelling goes round the outside of the garage
[2] *outside garage* – when the walls separating the garage from the dwelling are the external walls

Figure 5: Thermal resistance of unconditioned corridors and stairwells

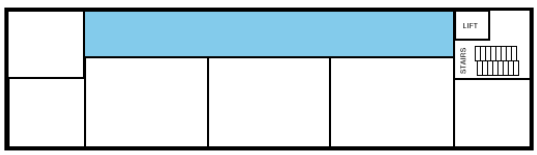
Corridor with internal facing wall. Ru = 0.4



Corridor with internal facing wall, but small exposed end walls. Ru = 0.4



Corridor with exposed facing wall. Ru = 0.3

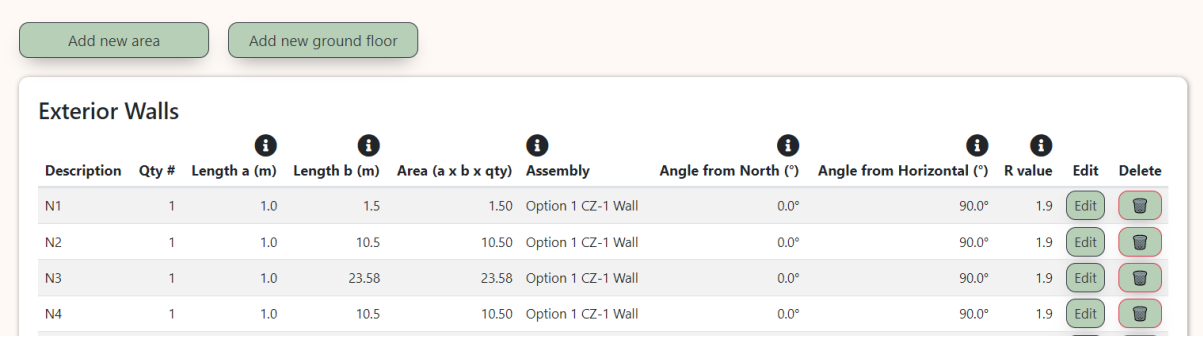


Areas

The Areas page is where the areas of walls, ceilings and floors are entered, together with what they are made of (taken from the Assemblies page) and their orientation.

Introduction

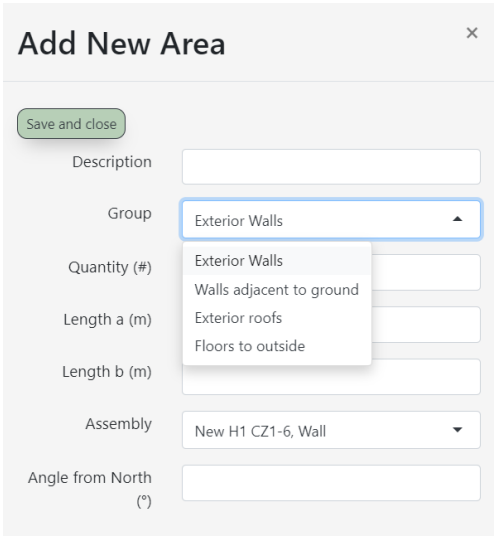
For each area of roof and wall it is necessary to enter information on the name, area type, area (expressed as length a x length b), assembly type, orientation, and angle from horizontal as follows:



Description

Enter an appropriate name for the area of roof or wall. This will be used on the Windows page when you allocate windows to particular walls and roofs.

Group



Set the type of area here. This can be exterior wall, exterior roof, wall adjacent to ground or floor to outside.

Floors to outside are for floors that are open to the air such as cantilevered upper floors. Note that this does not include suspended ground floors. These should be entered by clicking 'Add new ground floor'.

Length a(m), b(m) and Area

Enter the dimensions of the wall, roof or floor *using external dimensions. Either enter the dimensions as (length a) x (length b) or, if the element area is known, enter '1' for (length a) and then (length b) becomes the area in* m^2*. There is also a quantity field: the calculated area is therefore:*

length a x length b x qty.

Assembly

This is the type of wall, roof or floor that you defined in the Assemblies page. This pulls through the calculated R-value for that element.

Angle CW (clockwise) from Primary Elevation

This is the direction the element of wall, roof, or floor faces relative to the primary elevation set on the Projects page. The angle entered here (θ) is measured clockwise from the primary elevation. For example, a perfectly East facing wall would be entered as 90° assuming that the primary elevation faces North. For roofs this has little impact on the results unless that part of the roof has rooflights.

Angle from Horizontal

This is entered by default when you create a new area as 0° for flat roofs, 180° for floors and 90° for upright walls. Once created, the angle from horizontal can be edited for roofs and walls. Floors may not be edited and will always have a value of 180°.

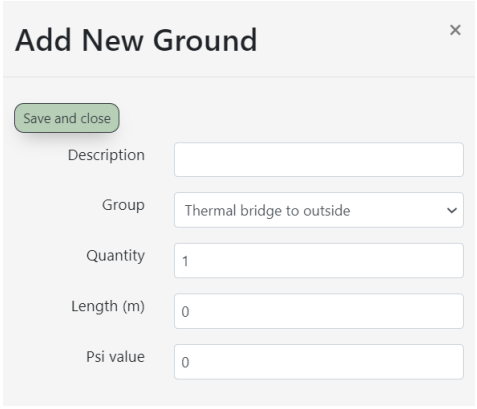
Ground Floors

Areas of concrete floor slabs or suspended timber (or concrete) floors are entered separately by clicking on 'Add new ground floor'. A floor is considered to be adjacent to the ground if it is less than 500mm above the ground.

When entering these ground areas you will be asked whether the area is a suspended floor or slab on grade. You will also be asked for the perimeter length. This is the length of the perimeter that loses heat to outside and therefore excludes perimeter shared with an adjacent dwelling. It does however include lengths of perimeter adjacent to unheated spaces such as garages.

Thermal Bridges

The Thermal Bridges page is where you enter details on the heat lost through junctions such as the junction of the wall with roofs and floors. These are expressed as psi values; the heat lost for each metre length of junction.



As a minimum, for a Homestar submission, the psi values for the slab (or suspended floor) edge must be included. If the psi value for the slab or suspended floor is not known, it should be input by default as 1.0 W/(m.K). The length of this is the length of the slab or suspended floor that loses heat to the outside: it excludes intertenancy walls but includes junctions with an unheated space such as a garage.

In addition, where junctions are exempt from the fRSI requirements of HC4 (deemed to satisfy junctions such as balcony edges in apartments) these must also be included with a default psi value of 1.0 W/(m.K) unless the psi value is known.

The psi value for any junction that is bridged with high thermal conductivity material (such as non-thermally broken concrete or steel) must be included in the model. Psi values for lengths of thermal bridge that are between the dwelling and a heated corridor may be excluded as per the section on calculating R-values.

Additional thermal bridges may be added, and this may be beneficial where details are known to be high performing. Psi values for high performing junctions can be negative meaning that they reduce the estimated annual energy demand.

Psi values for common New Zealand residential construction details can be found here[4]. This includes concrete slabs with edge insulation.

For each thermal bridge enter a description, the boundary condition, the quantity, the length and the psi value. The 'group' dropdown with the following meanings:

Thermal bridges to outside	These are thermal bridges direct to the outside air, such as the junction of a midfloor or eaves with the outside walls.
Ground perimeter thermal bridge	These are thermal bridges where the perimeter of the thermal envelope meets the ground. A slab edge is an example of a perimeter thermal bridge.
Thermal bridges FS/BC	Thermal bridges FS/BC. This stands for Floor Slab / Basement Ceiling. It refers to thermal bridges through the floor of the home to the ground such as where a slab has been thickened (at the expense of insulation) to support a load-bearing wall.

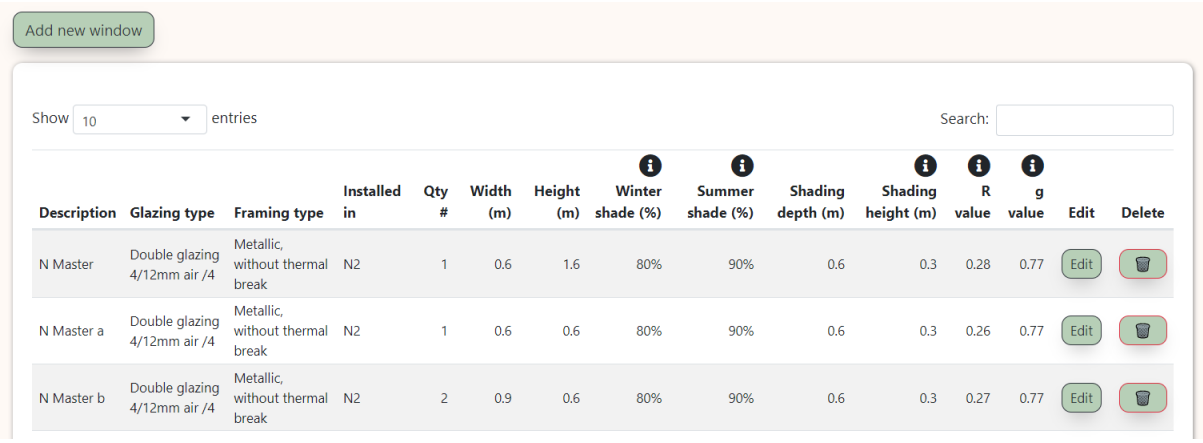
[4] https://passivehouse.nz/hpcd-handbook/

Calculation of psi values

Psi (and fRSI) values can be modelled in various software packages including Therm and Flixo. Where junctions are between the home and an unheated internal space such as a garage or corridor, the additional R-value of the space may be included in the model – see Areas Adjacent to Unconditioned Spaces section above.

Windows

The Windows pages are where the R-values, thermal performance, position and orientation of windows and skylights are defined.



Description	Glazing type	Framing type	Installed in	Qty #	Width (m)	Height (m)	Winter shade (%)	Summer shade (%)	Shading depth (m)	Shading height (m)	R value	g value	Edit	Delete
N Master	Double glazing 4/12mm air /4	Metallic, without thermal break	N2	1	0.6	1.6	80%	90%	0.6	0.3	0.28	0.77	Edit	
N Master a	Double glazing 4/12mm air /4	Metallic, without thermal break	N2	1	0.6	0.6	80%	90%	0.6	0.3	0.26	0.77	Edit	
N Master b	Double glazing 4/12mm air /4	Metallic, without thermal break	N2	2	0.9	0.6	80%	90%	0.6	0.3	0.27	0.77	Edit	

Each row in the table defines an individual pane of glass/glazing in your dwelling. Enter the quantity, a description, the width and height and which wall/roof the window(s) and/or skylight(s) are installed in. The wall or roof element is taken from the Areas page.

Note that a window with multiple panes and mullions can be entered in one row. As an example, the window in Figure 6 can be entered with the dimensions of one of the panes and 6 entered for the quantity.

Figure 6: Entering multiple panes of glass

Next enter the glazing type and frame type from the dropdown. ECCHO has a wide selection of predetermined glazing units from a selection of suppliers, however custom glazing can be defined by navigating to the Glazing and Frames pages.

Note that ECCHO automatically calculates the overall R-value of the window or skylight (R_{window}) from the dimensions of the window, the centre pane R-value and the frame performance. It is not possible to enter a standard overall window R-value (R_{window}) from other sources (e.g supplier catalogues), so if the window system is not already in the dropdown menu, it is necessary to source data from your supplier on centre pane R-values and frame performance.

Finally, please define the level of window shading. This can be entered both as a percentage and/or by defining the dimensions of any horizontal shading devices.

Winter and Summer Sun Admitted

The percentage shading (winter and summer sun admitted) is most useful for external obstructions such as self-shading (i.e. L shaped building), nearby buildings or vegetation (such as trees).

This percentage can be calculated for each façade/window using raytracing software. Alternatively, it is acceptable to use the values in the tables below. These must be applied on a façade-by-façade basis dependent on the actual level of complexity or overshading for each façade. The values from each table are multiplied together, so medium site shading with L-shaped form would result in 80% x 90% = 72% winter sun admitted.

Site shading							
Light		Medium		Heavy		Very heavy	
Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
90%	100%	80%	90%	70%	80%	60%	70%
Typical cases: - Houses in an open field without large hill or dense bush around -Upper storey apartments with the surrounding building being the same height or lower. All rooflights		Typical cases: - Houses or multi-unit dwellings in a neighbourhood with similar types of housing next door.- Middle storey apartments with other 3-storey apartments across the street		Typical cases: - Single story house with 2 storey neighbouring buildings or established trees around.-Ground floor apartment with other 3-storey apartments across the street		Typical cases: - House or ground floor apartment surrounded by taller buildings where the distance between the rated dwelling and the surrounding building(s) is less than the height of the surrounding building.	

Self shading			
Box form	L-shaped form	Complex form	Windows fully enclosed by the form of the building
100%	90%	80%	70%
Typical case: - Houses or multi-unit dwellings that are a simple, rectangular shape without additional shading	Typical cases: - Houses or multi-unit dwellings that are not in rectangular form.	Typical cases: - Houses with pavilions and links- Any building type with extensive use of shading screens	Typical cases: - apartment units with recessed balcony (balcony wing wall on both sides)

screen.-Most apartment units			

Ventilation

The ventilation page is where users define the mechanical ventilation systems used for both winter background ventilation and summer ventilation for avoidance of overheating. The page also defines the level of airtightness of the home.

The following outlines how to fill in each of the sections:

Input	What this means	Notes
Room height	This is the average ***internal*** room height in metres.	ECCHO multiplies this value by the conditioned floor area to give the overall conditioned volume of the home in m^3.
Infiltration	If the home is not going to be pressure tested leave this at the default 5 air changes per hour. If the building has been pressure tested (or is going to be pressure tested) input the appropriate pressure test result (or expected result) from the drop down.	Homes that have not been pressure tested will be assumed to have an air tightness of 5 air changes at 50Pa. This is the average air tightness of new homes tested by BRANZ[5]. If it is intended to pressure test the home, it is acceptable to select a target air-permeability at design submission. However, this will need to be updated for the built submission on the basis of the actual pressure test result.
Ventilation fans	Select the make and model of ventilation fans for whole-house ventilation. This could be a continuous extract system or MVHR (Mechanical Ventilation with Heat Recovery) system. If the home just has a intermittent ventilation (i.e. kitchen rangehood and bathroom fan on a switch) please select	Please contact the NZGBC if you have products or systems that you would like to be added to ECCHO.

[5] https://www.buildmagazine.org.nz/index.php/articles/show/airtightness-trends

	"intermittent kitchen and bathroom extract".	
Ventilation type	Natural	Opening windows in habitable rooms and intermittent mechanical ventilation in wet rooms (kitchens, bathrooms, laundry). Note that this form of ventilation is generally not permissible in Homestar v5.
	Extract only	Continuous extract ventilation
	Balanced	Mechanical ventilation with heat recovery, often referred to as MVHR.
Summer mechanical ventilation/bypass rate (ac/h)	Mechanical ventilation rate during the summer in air changes per hour.	This input is for any continuous whole-house mechanical ventilation that is being provided without heat recovery. This would either come from a continuous extract system or MVHR system with summer bypass. Please enter the whole-house air change rate being achieved by the system in air changes per hour.

Mechanical Ventilation with Heat Recovery

If you select a balanced system from the Ventilation Fans dropdown a further input form will appear asking for details of the location of the MVHR unit and the length and insulation properties of the ductwork.

Location

Location refers to the location of the supply and extract fans and/or MVHR unit. 'Inside' means that the MVHR system is within the thermal envelope. 'Outside' means that the MVHR system is outside the thermal envelope, e.g., within the loft space.

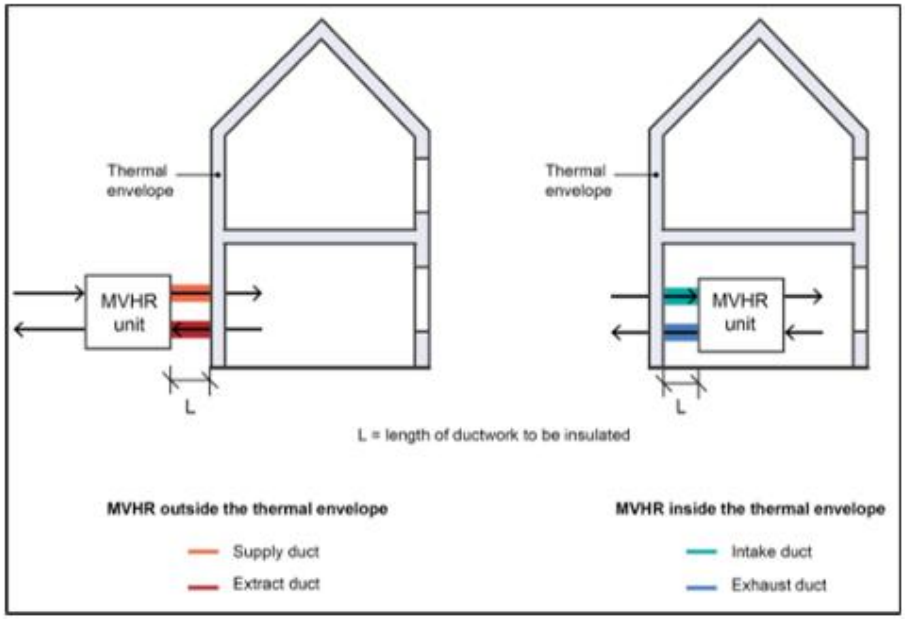
Insulation thickness

This is simply the thickness of the insulation in mm. For simplicity, ECCHO makes an informed assumption about the thermal conductivity of this insulation.

Duct Length

This is the length (m) of ductwork between the MVHR unit and the boundary of the thermal envelope. This means that it refers to different ductwork depending on whether the unit is located inside or outside the thermal envelope.

- Inside: this refers to the exhaust and fresh air intake ductwork. This is the blue ductwork in the diagram below.
- Outside: this refers to the extract and fresh air supply ductwork. This the red ductwork in the diagram below up to the point where it enters the thermal envelope (i.e. goes through the topmost ceiling.



In both cases the measurement is the average length, i.e. total length of supply and extract ductwork divided by 2.

Summer Natural Ventilation

The summer ventilation rates are calculated by entering the openable window areas on one or multiple sides of the home.

Begin by estimating how often windows can be left open. The openable window areas refer to times during which windows can be left open safely and without fear of intruder entry.

There are 3 options available for window security as follows:

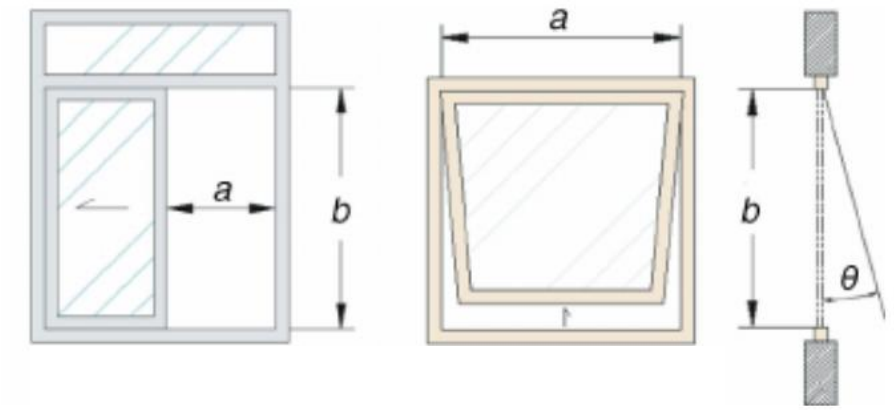
Window opening option	What this means
Cannot be opened for reasons of noise, security or pollution	Choose this option where in normal circumstances occupants are unlikely to use windows for reasons of noise, security, or pollution. This would typically be where homes are near a noisy road or airport. If this is ticked ECCHO assumes that no ventilation is provided via the window. In these circumstances it is probable that summer ventilation is being provided mechanically - see below.

Can be opened during occupied hours	Choose this option if most windows in the home can be opened while occupants are at home, but unlikely to be opened during unoccupied hours for reasons, say, of risk of intruders.
Can be opened at all times	Choose this option if most windows can be left open at all times. This would typically be where windows have security restrictors, or high level clerestory windows that allow them to be left open when occupants are not at home.

Window opening areas

Enter the total length and height of window openings on one side (single sided ventilation) and the other side (if double sided ventilation). Which of the walls are on "one side" or the "other side" of the home are at the discretion of the assessor, but the following diagram gives an example with one side and opposite side walls marked in red and blue.

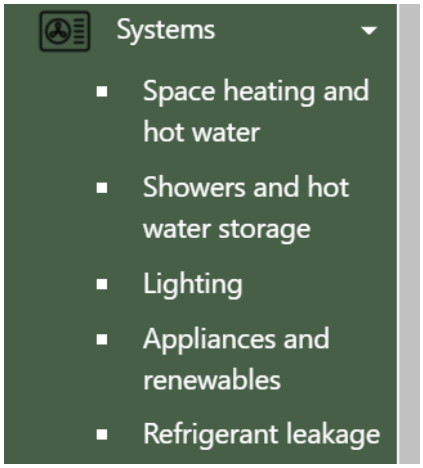
The window opening area is the opening free area. This is NOT the face area of the opening window (as New Zealand Building Code clause G4). This is the area of the opening perpendicular to the window being opened and needs to be calculated based on the extent to which the window can be securely opened (i.e. on 100mm restrictors for safety or security).



As an example, the free area of the sash window (left) would be a x b (assuming that this area can be left open securely or without excessive noise), however the free area of the casement window (right) is **NOT** a x b since the opening is limited to the area at the bottom of the window. The height of a casement window such as this on a 100mm restrictor can simply be entered as 0.1 (i.e. 100mm), so the opening area would be length 'a' x 0.1.

Systems

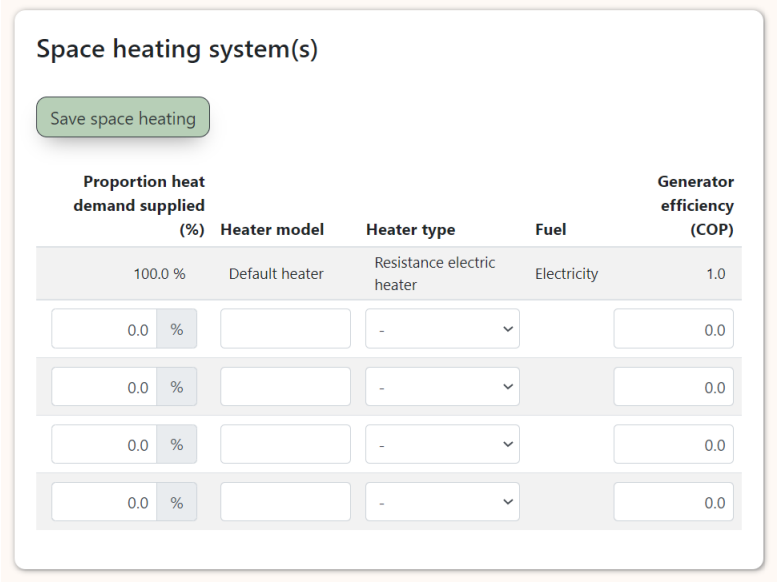
The space heating, hot water, lighting, appliances and refrigerant systems can be accessed from the 'Systems' tab in the main navigation.



Space and Hot Water Heating

Up to two (4) systems each can be entered here for space heating and hot water. For space heating, this will usually be the main space heating system used in the living areas and any supplementary heating used in the rest of the home. For hot water, a typical New Zealand home will have one hot water system (e.g. an electric cylinder or gas califont), but the tool offers the opportunity to enter a second system (e.g. a separate electric shower).

Homestar requires a fixed heating system to be present in at least the main living areas. If no fixed space heating systems are present elsewhere in the home (such as in bedrooms) the first space heating system defaults to electric portable heater, with a COP of 1.0.



Please enter the fuel type for each of the systems and an efficiency (Coefficient of Performance, COP). The COP must be obtained from manufacturer/supplier data. For heat pumps the COP data must be based on climate data appropriate to the project site. In most New Zealand locations (except the far North and Alpine regions) the H1 performance data (based on an assumed outdoor temperature of 7°C) would be appropriate as a seasonal temperature. This Is the standard temperature at which heat pump performance data is supplied In New Zealand. However, we understand that EECA (and the NZ heat pump industry) is working on methodologies for supplying more accurate seasonal COPs and these will be preferred once they become available.

If the manufacturer/supplier cannot give you the correct COP data, please enter a default COP as follows. Note that these values can also be used at early stages of design when you may not have selected a particular make and model. However, they are very conservative and will hence make compliance more difficult.

System type	Default COP
Electric panel heater	1.0
High wall (split) heat pump	2.5
Ducted heat pump	2.5
Gas boiler	0.8
Gas fire	0.7
Wood stove	0.7
Wood pellet boiler	0.8

System type	Default COP
Electric (immersion) cylinder	1.0
Electric heat pump (Separate condenser)	2.0

Electric heat pump (integral condenser)	2.0
Gas califont	0.8
Gas boiler	0.8

Percentage heating met by system

Please enter the percentage of heat demand met by each space heating and hot water system.

Where zones of the home are heated by different systems, divide the conditioned floor area of the dwelling into approximate heating zones according to space heater type. In the case of non-centrally heated homes which have a large heater that heats more than the room/space it is in (typically a wood burner or large heat pump), only account for rooms/spaces which are:

- situated a storey higher than the heater itself, AND have a clear air pathway for the heat to get there (e.g. a stairwell), OR
- attached to the room/space through a heat transfer system, OR
- an adjoining hallway (i.e. the hallway space open to the room/space containing the heater can be counted).

The Assessor must verify the ability of this large heater to heat more than the room/space that it is in by reviewing the manufacturer's data.

Hot Water

Shower flow rates

Use this section to enter the measured flow rate or WELS rating of all showers used in the home. Up to 3 different shower types may be entered.

ECCHO assumes that each occupant takes 0.9 showers per day with a duration of 6 minutes. This is broadly based on the BRANZ WEEP study. The remaining hot water (in addition to shower hot water) is assumed to be 15.1 litres per day per occupant plus a fixed amount of 7.5 litres per dwelling.

Hot water storage and pipework insulation

Use this section to enter whether the home has any hot water storage such as an electric immersion cylinder (by far the most common hot water system in New Zealand). ECCHO assumes standard heat losses for A-grade cylinders:

This section requires input of the cylinder size, its location (indoors or outdoors) and the quality of the insulation of the first 2m of hot water distribution pipework from the cylinder. The following is a guide:

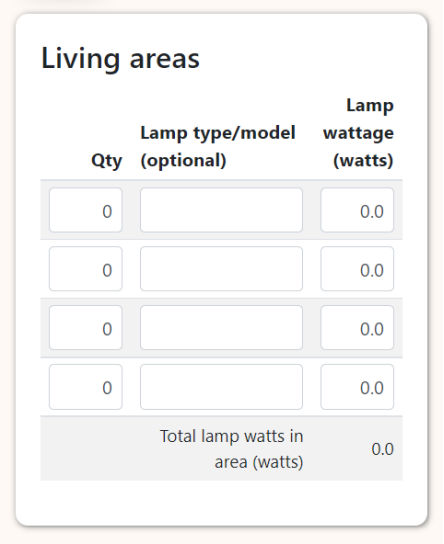
Quality	Description
Excellent	All exposed pipework and fittings insulated continuously under the clamps with insulation thickness twice the diameter of the pipework. Insulation on fittings carefully glued and fitted.

Medium	All exposed pipework and fittings insulated continuously under the clamps (or non-metallic clamps over-insulated) with 13mm insulation. Insulation on fittings carefully glued and fitted or fitted and taped with designed for this application
Normal	All exposed pipework and fittings insulated reasonably with very few gaps with 13mm insulation
Uninsulated	Completely exposed metal piping or fittings within 1.5 meters of tank on hot water lines/vent and cold water line completely uninsulated

Finally, enter outdoors for any cylinder that is located outside of the thermal envelope of the dwelling. This would include unheated garages or unheated roof spaces.

Lighting

Overall energy used for lighting is calculated in ECCHO from the total installed lighting load in the main living areas, bedrooms and all remaining areas. A table is provided for each area. Please enter the total number of lamps (bulbs) for each areas of the home and their respective wattage.



ECCHO assumes that each lamp is on for an average of 2.2 hours, 1.2 hours and 0.7 hours per day respectively in the main living areas, bedrooms and all remaining areas. This is an average of summer and winter daily hours of use taken from the BRANZ HEEP work. Note that whole rooms may be lit for longer than this in practice, but this is the average for all lamps in each room taking into account that not all lamps may be lit in larger rooms with multiple circuits such as living/dining areas.

Appliances and Renewables

Use this page to enter details on:

- custom occupancy
- custom energy used for electronic devices such as televisions and computers
- whiteware supplied with the dwelling (if any)
- the type of fuel used for cooking
- on-site renewable energy generation

Note that data entered on this page does not impact credits HC1 or EF4. However, the contribution of on-site PV (if installed) to reducing the overall carbon emissions use of the home (credit EN1) is calculated based on the inclusion of appliances. This means that the installation of energy efficient appliances will help increase the home's score in EN1.

The occupancy and appliance data also contributes to the assumed heat gain in HC2 for summertime overheating. Appropriate occupancy and appliance data must be entered here if known to be different from typical NZ occupancy.

Occupancy

ECCHO has a default number of occupants it assumes to be living in the dwelling when calculating the energy used for space-heating, overall energy consumption and for estimating overheating. This number is calculated from the conditioned floor area you define on the Projects page.

The default number of occupants can be changed where the home is known to be occupied differently from the average in New Zealand. Note that the outdoor air assumed for the ventilation system is the greater of 0.35 air changes per hour and 7.5 litres per person as per NZS4303.

Please use the default allowance for occupancy if there is no evidence that the home will be used differently from the norm in New Zealand.

Consumer Electronics

This is the total installed load of items such as televisions, laptops and gaming consoles. The total load is assumed to be used on average for 1.5 hours per day. Please use the default allowance for consumer electronics if there is no evidence that the home is to be used differently from the norm in New Zealand.

Whiteware

This part of the worksheet includes a table of common appliances found in homes. Where homes have appliances installed at the time of assessment the energy label star rating must be indicated against the relevant appliance. This gives an opportunity to include the energy savings of higher rated appliances.

Where homes are not supplied with all, or some, of the whiteware listed in the table below, these must be left at the default 2 Star rating.

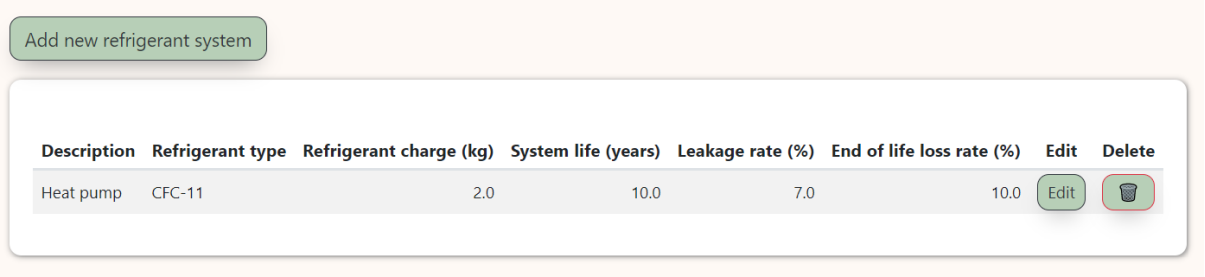
Appliance	Assumed size	Assumed use profile
Dishwasher	15 place setting	65 cycles per year per occupant
Washing Machine	8 kg capacity	57 cycles per year per occupant
Clothes Dryer	8 kg capacity	25 cycles per year per occupant
Fridge	400 litre capacity	On all year
Freezer	200 litre capacity	On all year
Fridge Freezer	400/200 litre capacity	On all year

Renewable Generation

Enter information here on any on-site renewable energy generation systems such as rooftop PV. Please see credit EN1 in the Homestar manual for details on how to estimate annual generation.

Refrigerants

This page must be filled in where the home includes refrigerants for space heating/cooling and/or hot water, i.e. heat pumps.



Each row represents a system used in the home such as a hi-wall heat pump. Enter a description of the system, the type of refrigerant used and the total refrigerant charge in kg. Note that HFC-32 is the most common refrigerant used in domestic heat pumps in New Zealand and is also known as R32.

There are other editable fields, however they should be entered as the following defaults unless evidence can be found to the contrary:

Field	Default
System life, years	This should be entered as 10 years unless evidence is provided to use another figure
Leakage rate, %	This should be entered as 7% unless evidence is provided to use another figure
End-of-life loss rate, %	This should be entered as 10% unless evidence is provided to use another figure

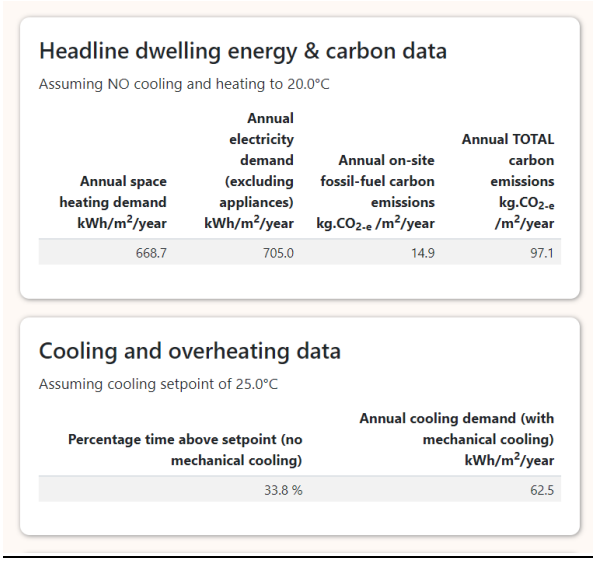
Results

ECCHO offers an overall detailed results page (ECCHO results) and, separately, results for Building Code compliance (NZS4218 results). Click on the Results dropdown in the navigation for these options.

Homestar/PHPP Results

These pages display the results in several tables including the headline dwelling energy and carbon data and the cooling and overheating data.

The headline dwelling energy and carbon data excludes any energy associated with cooling. This is consistent with Homestar v5, provided that the home has less than 7% of year below 25°C as indicated in the Cooling and overheating data



Headline dwelling energy & carbon data

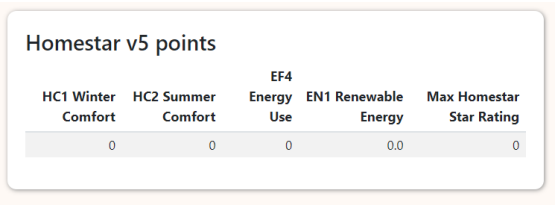
Assuming NO cooling and heating to 20.0°C

Annual space heating demand kWh/m²/year	Annual electricity demand (excluding appliances) kWh/m²/year	Annual on-site fossil-fuel carbon emissions kg.CO_{2-e} /m²/year	Annual TOTAL carbon emissions kg.CO_{2-e} /m²/year
668.7	705.0	14.9	97.1

Cooling and overheating data

Assuming cooling setpoint of 25.0°C

Percentage time above setpoint (no mechanical cooling)	Annual cooling demand (with mechanical cooling) kWh/m²/year
33.8 %	62.5



Homestar v5 points

HC1 Winter Comfort	HC2 Summer Comfort	EF4 Energy Use	EN1 Renewable Energy	Max Homestar Star Rating
0	0	0	0.0	0

The Homestar points are displayed in a separate table for credits HC1, HC2, EF4 and EN1. The table also shows the maximum permitted Star rating based on the minimum expectations in each of the credits.

Heat balance chart

The results include a heat balance chart. This has two bar graphs. The first one shows all the heat losses in the home, broken down by walls, windows, roofs, thermal bridges etc. The second one shows heat gains from windows and internal loads (people and appliances). The balance is then the additional heat needed to maintain the required set point temperature.

The chart is useful for determining where the majority of heat losses are coming from.

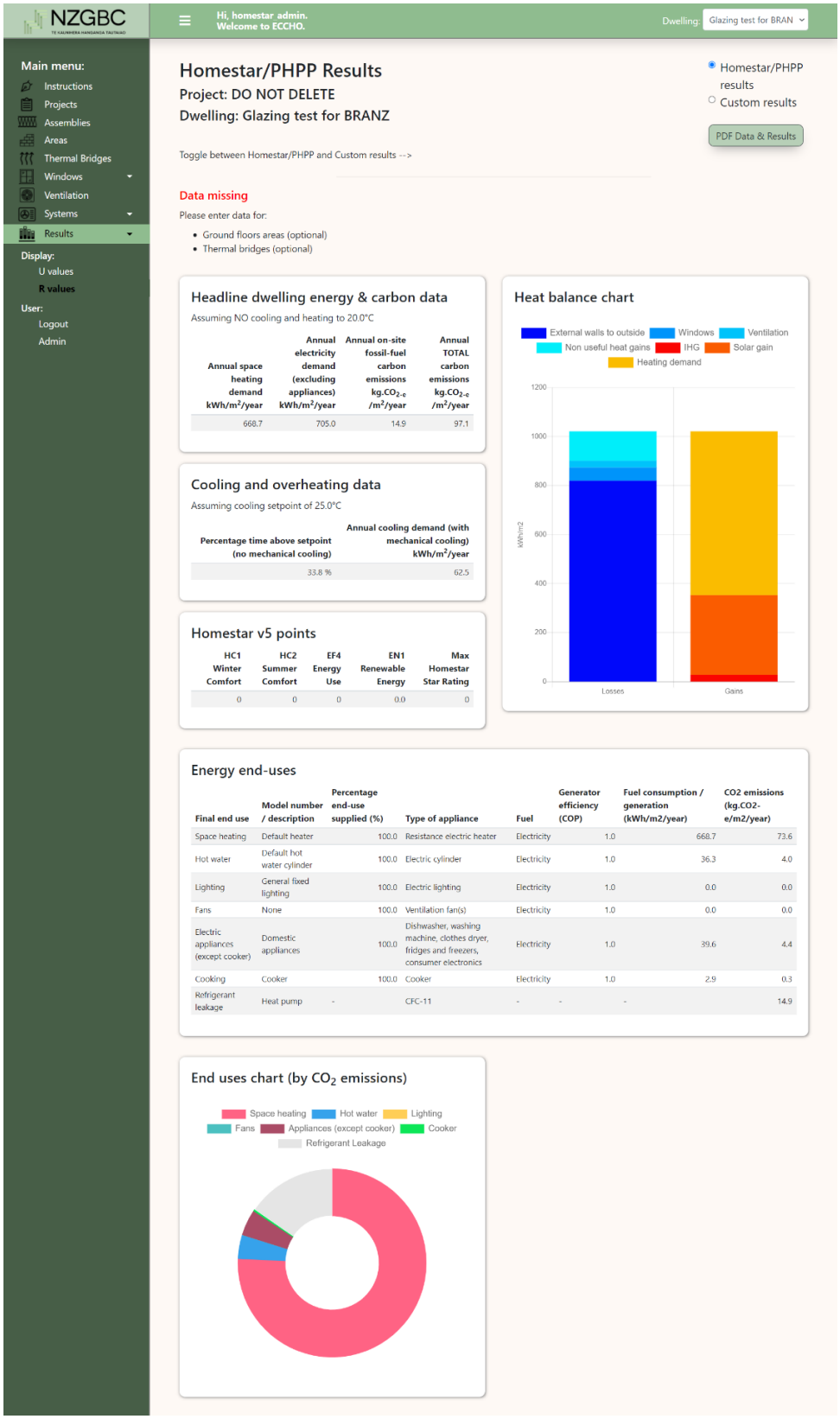
Custom Results

At the top right-hand corner of the results page are radio buttons to allow the results pages to toggle between Homestar results and custom results. The Custom results include custom occupancy and appliance heat gains in the overall heating demand, electricity consumption and carbon emissions. Please note that custom results must not be used for Homestar compliance.

PDF Results

The results page also includes a button to pdf the results together with a summary of all the dwelling data. The PDF opens in a new window where it can be downloaded for your records. Please submit a pdf of the results for any home submitted for Homestar.

Figure 7: Main results pages



Appendix C: Guide to Embodied Carbon Modelling in ECCHO

Introduction to Embodied Carbon Modelling in ECCHO

Since the early release of Homestar version 5, users have had the ability to calculate the embodied impacts of a new home using our Homestar Embodied Carbon Calculator. This spreadsheet is a great, simple, introduction to embodied carbon in homes since it has a big library of embodied impacts for typical roof, wall and floor assemblies meaning designers just need to enter areas of each of these to get a result. This spreadsheet will remain in use for projects for the foreseeable future.

HECC has some limitations however:

1. The embodied impacts of the layers making up an assembly are "hardcoded" meaning that it is not possible to customise layers, for example swapping out a lower carbon form of insulation or plasterboard from a particular supplier.
2. It is not possible to build completely new custom assemblies for types that are not currently in HECC, for example SIPS.
3. Users must enter the areas of walls, floor, roofs and windows in ECCHO and then re-enter these areas in HECC.

To address these issues, ECCHO now includes the ability to calculate embodied (including upfront) emissions in accordance with credit EN2 in Homestar. This means that it is no longer required to enter building dimensions twice, once in ECCHO and then separately in an embodied carbon calculator such as the Homestar Embodied Carbon Calculator spreadsheet.

The following is an outline of how to enter embodied carbon data into ECCHO. It is not intended as a primer on Embodied Carbon or Life Cycle Analysis as a general subject. For users new to embodied carbon NZGBC has an embodied carbon masterclass (typically run 4 times a year) and there are various online introductions to embodied carbon, including MBIE resources available here.

Structure of Embodied Carbon Calculations in ECCHO

There are 4 fundamental embodied carbon pages in ECCHO as follows:

Assemblies	Create new wall, floor and roof assemblies. Edit thermal and embodied carbon properties.
Glazing and Framing	Create new glazing and frame types. Edit their thermal and embodied carbon properties.
Miscellaneous Embodied Elements	Add embodied carbon for elements not covered by assemblies or windows/doors. This includes, for example, rooftop PV.
User Embodied Carbon Database	Add your own embodied carbon data for products or materials not already in NZGBC's database.

Assemblies

The *assemblies* page is where internal and external wall, roof and floor assemblies are defined. These assemblies are the building blocks of ECCHO. In the operational calculator they are used to calculate and define the thermal properties. In the embodied calculator this page is used to calculate the embodied impact of 1m^2 of assembly. This is then multiplied by the total area of each assembly to calculate the overall embodied impact.

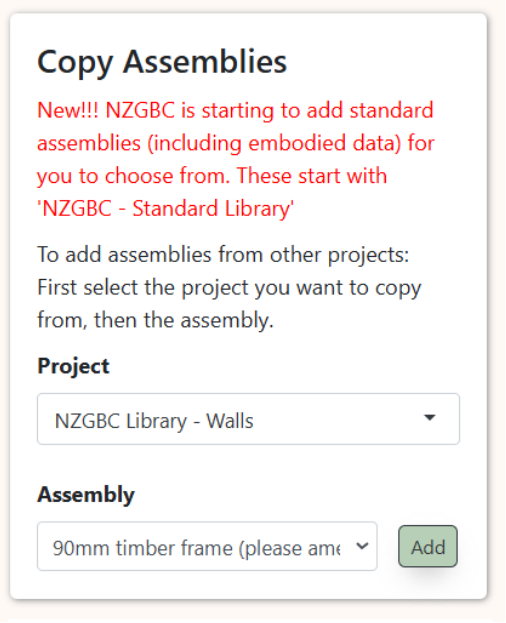


Figure 8: Standard assemblies can be imported from NZGBC's library.

NZGBC library

One great advantage of HECC is that it has a comprehensive library of standard assemblies. NZGBC will be adding the HECC library of assemblies to ECCHO in the early part of 2025. This will substantially reduce the time required to do embodied carbon analysis for Homestar.

Standard NZGBC assemblies are available from the 'copy assemblies' box. Pick projects beginning with 'NZGBC library' to find the assembly you'd like to copy into your project.

Creating a new assembly

Start by creating a new assembly as you would for the operational energy calculation. Assemblies can be custom or detailed.

Once an assembly has been created, you can then click on 'edit embodied' to define all the layers that make up that assembly.

The screenshot below shows a typical assembly built up in the Assembly Embodied Emissions page. The example shown is a 90mm standard timber stud wall, consisting of interior paint. plasterboard (GIB), insulation, framing timber, cavity battens and painted exterior weatherboards.

The quantities that have been entered represent the amount of that material in 1m^2 of that assembly on average. So 1m^2 of 90mm wall would contain 1m^2 of plasterboard and 0.027m^3 of timber frame assuming an average timber content on 30%, i.e. 30% x 1m^2 x 0.09 (90mm).

The embodied impacts of 1m^2 of this assembly (as calculated in the assembly page) is then multiplied by the total area of that assembly in the dwelling.

Assembly name

90mm timber frame (please amend cladding to suit)

New layer from database | Update layer from database | Delete

Layer description	Quantity in each m^2 of assembly	Quantity basis	(Modules A1-A5) Upfront Carbon excluding biogenic (kg CO2e)	(Modules A1-A3) Manufacturing (kg CO2e)	(Modules A4-A5) Transport & installation (kg CO2e)
Interior paint (2 layers)	1	m2	0.45	0.38	0.07
Plasterboard	1	m2	2.56	1.05	1.52
R2.8 fibrous insulation	0.7	m2	2.17	1.63	0.53
90mm timber frame	0.027	m3	2.51	-19.55	0.38
Cavity battens	0.0021	m3	0.2	-1.52	0.03
Bevel back weatherboard	0.02	m3	2.55	-13.49	0.34
Exterior paint (2 layers)	2	m2	0.52	0.42	0.1
	Total, per m^2 of 90mm timber frame (please amend cladding to suit):		**10.96**	**-31.08**	**2.97**

Figure 9: Typical embodied carbon layers of an assembly.

NB: For now, any layers that are defined in the detailed R-value page are not copied across to the embodied page so these will need to be added again. We may link these in a future update.

Elements that must be included in an Assembly

Note that a typical 90mm wall would include many more detailed components such as nails, glues and fasteners. These minor components can be excluded. The table below sets out the level of detail that is required for a Homestar submission.

Must Include			
Walls	**Roofs**	**Suspended Timber Floors**	**Concrete Floor Slabs**
• Cladding • Structural framing • Internal linings (e.g., GIB) • External paint (e.g., applied to weatherboards, if included) • Internal paint	• Cladding • Structural framing • Ceiling lining • Internal paint • Insulation	• Flooring • Structural framing (joists, bearers, piles) • Pile footings • Subfloor linings. • Insulation	• Concrete (slab and footings) • Reinforcing steel • Basecourse/fill • Underslab insulation (e.g., EPS)

• Cavity Battens • Insulation	• Purlins		• Edge protection • Membranes (e.g., DPC)
May Exclude			
• Internal paint applied to cornice and skirting. • Exterior primer • Cornice • Interior primer • Cavity vent strips • Building wrap • Skirting • Fixing straps • Adhesives • Fixings	• Interior primer • Building wrap • Adhesives • Fixings	• Membranes • Adhesives • Fixings	• Sand blinding • Flashings • Edge insulation • Formwork • Accessories to slab (e.g., bar chairs, wire) • Adhesives

*This Is a broad guideline for materials that MUST be included or may be excluded in the embodied carbon analysis so that at least 95% of the total embodied carbon of the dwelling/project is accounted for.

Components outside the thermal envelope

For an R-value calculation only elements *inside* the thermal envelope are included. For example, cladding *outside* the ventilated cavity would typically be excluded, as would all elements above the insulation line in a vented roof cavity (e.g. roof cladding, purlins and trusses).

For embodied carbon ALL major elements must be included. The diagram below shows the scope of the R-value calculation compared with the scope of the embodied calculation for a typical truss roof. Note how the elements above the insulation like are included in the assessment.,

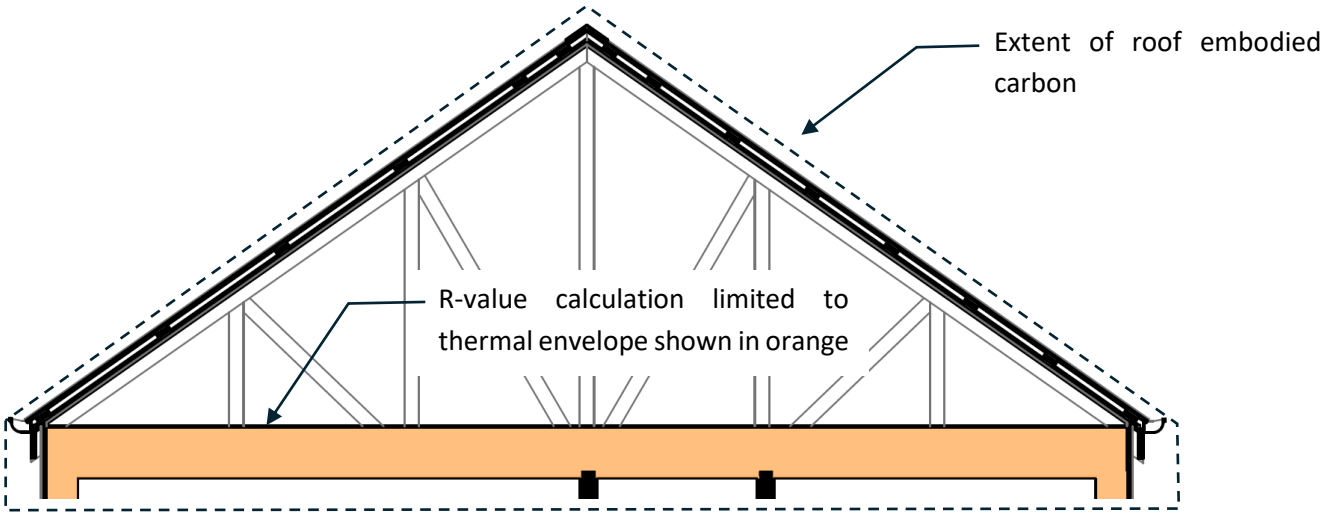


Figure 10: Scope of embodied carbon includes layers outside the thermal envelope.

Adding layers

The screenshot below shows the dialogue box for adding new layers to an assembly. The left side (inputs) is where you select the product or material making up the layer. The right side (outputs) shows the embodied carbon impact of that product or material from the database. The units are kg.CO2e ***per kg*** of that product or material.

The following summarises what each of the inputs does:

Layer description	Give your layer a name. This could be, for example, 10mm plasterboard. There is a button at the bottom of the page. This will copy the full text of the database entry into your project should you wish to use this as your layer name.
Data source	Data can come from the comprehensive database or your own database. Note that user-supplied data must be backed up with evidence (e.g. EPD) for Homestar certification.
Category/sub-category	The materials database is classified into categories and sub-categories. Use this to find your data.
Database material description	Final detailed description of the data on which the embodied impacts is based.
Building element type	Where in the building is this element located. The embodied carbon database sets different life rates for products and materials based on where they are located. For example, timber used as part of the enclosure is assumed to have a 60 year life, whereas it is assumed to last 100 years when part of a structure.
Source	Where is the product or material being sourced from. Note that EPD data will usually be from raw material extraction to factory gate, so the location is where the final product is made. This means for example, that even if a glazing unit is imported from abroad, an EPD for a New Zealand made window will already include transport impacts for the imported glazing unit and the 'location' is therefore the location of the New Zealand window factory.
Quantity	How much of this product or material is in 1m^2 of the assembly. Note that some quantities will be variable across an actual area of assembly. For example, the quantity of truss is clearly greater in the centre of the roof than at the edges. In this case, take a roof area for an exemplar house, calculate the total quantity of this element in the entire roof area and then divide by the plan area of that roof (within the thermal envelope). For this reason, the quantity of roof cladding in 1m^2 of roof will generally be greater than 1m^2 because of the pitch of the roof and any eaves.
Quantity basis	What are the units for the quantity you have entered. This will generally be m^2 for products and materials in an assembly, but not always. Timber frames will generally be expressed volumetrically.
Notes	These notes are pulled in from the database but can be overridden or supplemented with extra data to support your Homestar submission.

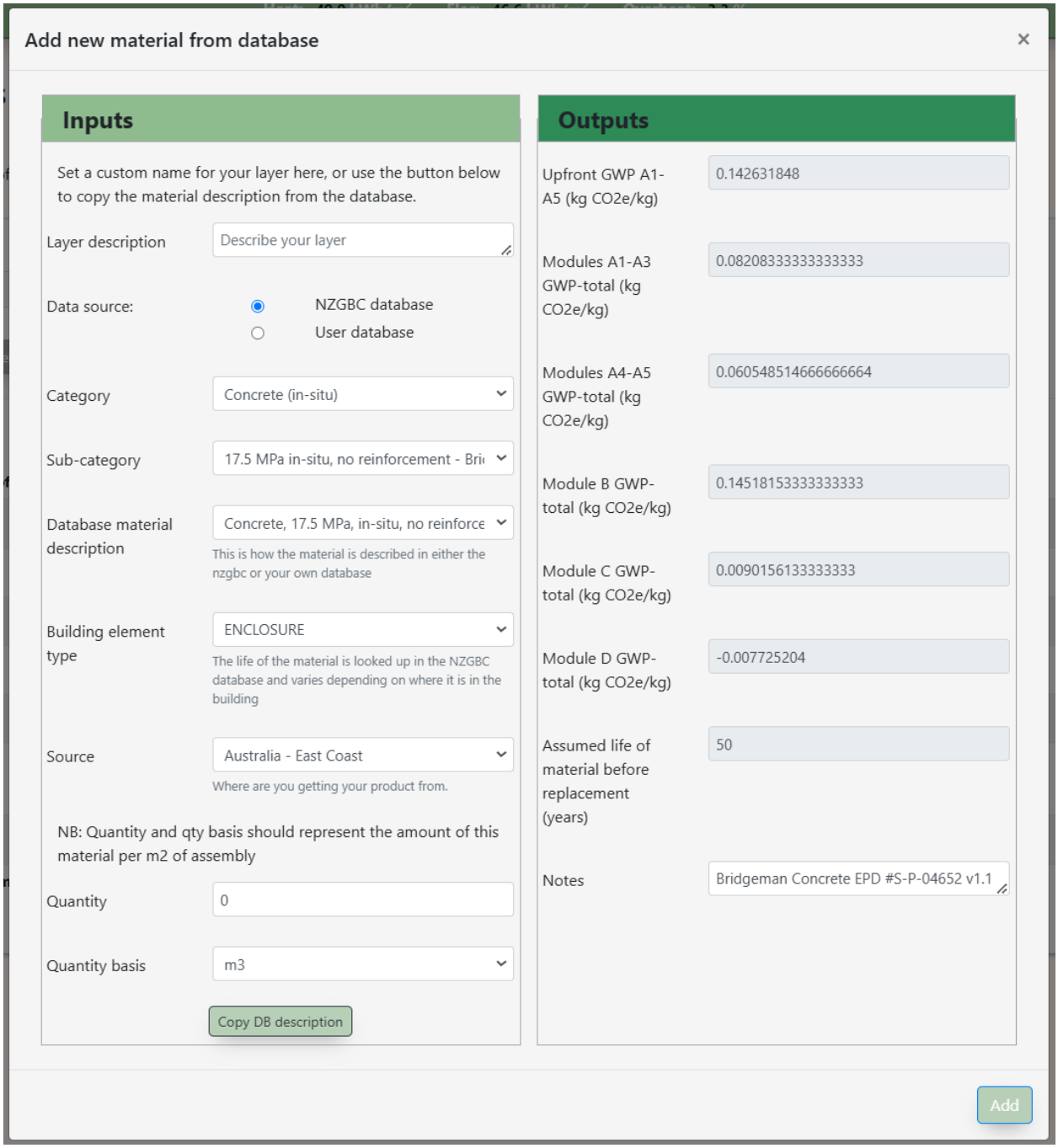


Figure 11: Screenshot of layer entry dialogue.

Glazing and Frames

As with assemblies, ECCHO allows users to define glazing and frame types, before going on to build windows using those glazing and frame types in the Window and Door areas page. The Glazing and Frames page now includes the ability to define the embodied impact of each glazing and frame *type*. This is then multiplied by the area of glazing and framing in the project to calculate the total embodied impact of windows and doors.

ECCHO includes a number of standard glazing and frames types. These have embodied carbon data pre-entered.

As with assemblies, the data entered into the glazing and framing pages represents the amount of that material in 1m^2 of glazing or frame.

The NZGBC database has some generic glazing and frame data that can be used in most cases. On the right is an example of embodied impacts for a generic aluminium window frame from the database.

Some window suppliers in New Zealand have Environmental Product Declarations (EPDs) for their windows (glazing + frame). This data may be used. Simply specify the same data for both the window and frame. This way ECCHO will apply this across the full area of the window.

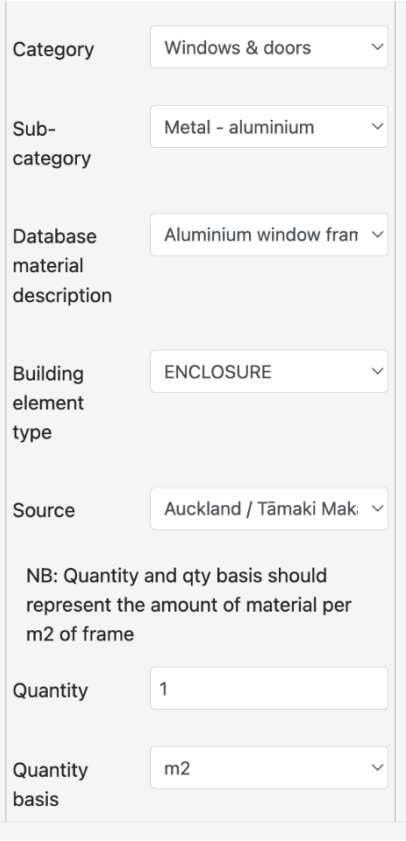


Figure 12: NZGBC database has standard data for aluminum, uPVC and timber frames.

If the window supplier data does not yet exist in the NZGBC database simply enter it into your own personal database (see below) and then import it into your glazing and framing. Don't forget to provide the supplier EPD in your Homestar evidence pack.

Miscellaneous embodied elements

This page allows users to add additional embodied impacts from elements of the dwelling that are not part of an assembly or window. This would include:

- Renewable energy generation such as rooftop PV
- Floor finishes such as carpet (this is reported separately)
- Slab edge insulation

Users are invited to specify a "grouping" for the data. For Homestar projects we would expect to see floor finishes and (if present) renewable energy generation.

The standard groupings also include walls, floors and roofs. Extra data can be added to these where embodied impacts aren't a function of the area of these. Examples of this would be slab edge insulation or some unusual roof element.

User Embodied Carbon Database

ECCHO draws on NZGBC's own embodied carbon database (available here). This is a collection of well over 1,000 products and materials with their embodied impacts drawn from Environmental Product Declarations among other sources. The origin of this database is the BRANZ CO2NSTRUCT data.

However, no database can be comprehensive so we recognise that users should have the ability to add their own data. The User Embodied Carbon Database page is therefore provided to allow users to add products and materials that have not yet been added to NZGBC's own dataset. Note that for Homestar submissions any data used needs to be evidenced, for example by including the pdf of the EPD for that product or material.

EPDs often include embodied carbon impacts from cradle-to-grave (i.e. they include the end of life impacts) or even cradle-to-cradle (including module D).

In order to standardise how the data for these later life stages is calculated (it is highly variable in EPDs, unfortunately) ECCHO calculates this lifecycle data for you based on the basic material type. For this reason, it is only necessary to provide the cradle-to-factory-gate data, i.e. modules A1-A3 as shown on the right. This data is broken up into fossil carbon, biogenic carbon, land-use-and-land-use change and carbon stored.

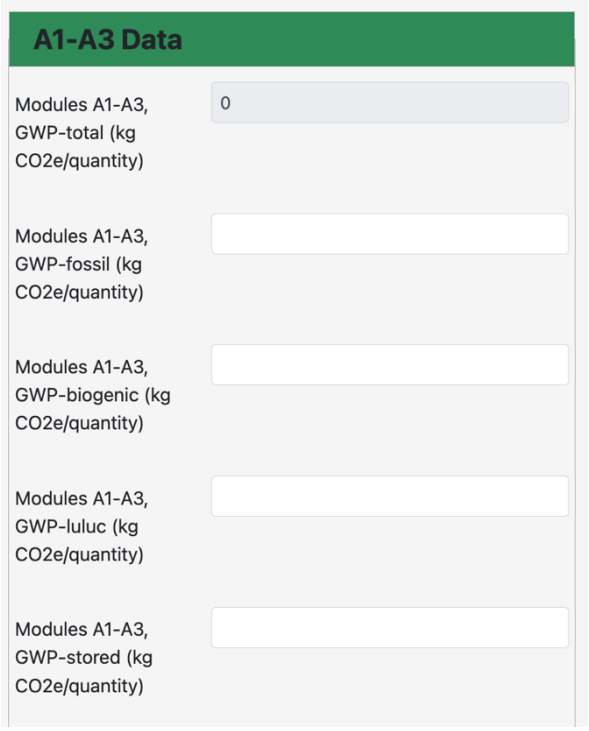


Figure 13: Only A1-A3 data is required for user-defined materials.

Apart from stored carbon, EDPs generally show this data clearly in tables. See example for GIB plasterboard below. Note that EPDs often show the data with exponentials (i.e. 1.20E+00). This may be copied and pasted directly into the input and ECCHO will know how to convert this into a normal number.

Stored carbon is not measured in Homestar or used (yet) in ECCHO so may be left blank. For expert users please refer to the NZGBC embodied carbon methodology for more details on stored carbon. For long-lived timber based products stored carbon is essentially identical to biogenic carbon.

GROUP 1: 1M² OF GIB® STANDARD 10MM

		Production
Environmental impact – EN15804+A2	**Unit**	**A1-A3**
Global warming potential	kg CO_2-eq.	1.20E+00
Global warming potential (fossil)	kg CO_2-eq.	1.87E+00
Global warming potential (biogenic)	kg CO_2-eq.	-6.69E-01
Global warming potential (land use change)	kg CO_2-eq.	8.36E-04

Figure 14: Example EPD data showing total, fossil, biogenic and luluc impacts.

In addition to the embodied carbon impacts please also provide:

Product description	Give your product or material a name.
Category/sub-category	Classify your data so you can find it again.
Quantity basis	What quantity is your embodied carbon data based on? This will typically be clearly set out in an EPD. For example, for windows, the emissions will be for 1m^2 of window area, so your quantity basis will be m^2.
Waste and life material type	The NZGBC database has a table of typical end-of-life scenarios for different material types. This is used to calculate the end-of-life carbon for your product or material. Please select the most appropriate material type, e.g. uPVC would come under 'plastic'.
Density	Life cycle carbon assessments are generally carried out 'under the hood' based on the total weight (kg) of product. This is because end-of-life and transport impacts are based on this. For example, trucking and shipping the product to site is calculated based on the average carbon emissions per tonne of product transported per km. For this reason, ECCHO needs to be able to convert your units into kg and therefore needs a corresponding density. ECCHO has density inputs for volumetric density (kg/m^3), area density (kg/m^2), linear density (kg/m) and unit density (kg/unit). As a minimum you must provide a density corresponding to your quantity basis. So if the quantity basis is m^2 (as the window example above) you must provide an area density. You may provide other densities, if known, and this will allow users to enter data for your product based on these other units.
Custom recycled content	What fraction of your product's content is made from recycled material? Generally this is zero and can be left blank.
Data validity dates	This data is optional, but does help you remember if the EPD on which the data is based is about to expire.

Results

The summarised Embodied Carbon results can be found at the bottom of the Homestar/Custom results page. This shows the embodied carbon grouped into the different areas (roofs, walls, floors) and any additional groupings you have provided in the Miscellaneous Embodied Carbon page.

The first column of results is Upfront Carbon (modules A1-A5). This is the carbon associated with products and materials from raw material abstraction to practical completion and is the basis on which points are awarded in credit EN2 in Homestar.

Embodied Carbon Results

Based on a building life of 90 years

Area Type	Modules A1-A5 Upfront Carbon (kg CO2e)	Modules A1-A3 Manufacturing (kg CO2e)	Modules A4-A5 Transport & installation (kg CO2e)	Module B Maintenance & replacement (kg CO2e)	Module C End of life (kg CO2e)	Modules D Potential benefits/loads beyond the building lifecycle (kg CO2e)
External Walls	30524.7	19503.0	11021.7	31260.2	2142.4	-1835.5
External Roofs	535.0	-2067.0	194.0	1326.0	2447.0	-284.0
External Floors	28365.0	9850.0	18515.0	0.0	1082.0	-464.0
Intertenancy Walls	0.0	0.0	0.0	0.0	0.0	0.0
Internal Walls or Floors	0.0	0.0	0.0	0.0	0.0	0.0
Windows	28.5	9.0	2.1	28.3	17.8	-4.1
Floor Finishes	1152.9	910.8	242.1	10764.5	539.1	-150.1
Totals	**60,606**	**28,206**	**29,975**	**43,379**	**6,228**	**-2,738**

Figure 15: Results page. In Homestar credit EN2 points are based on total upfront carbon (kg.CO2e/m2).

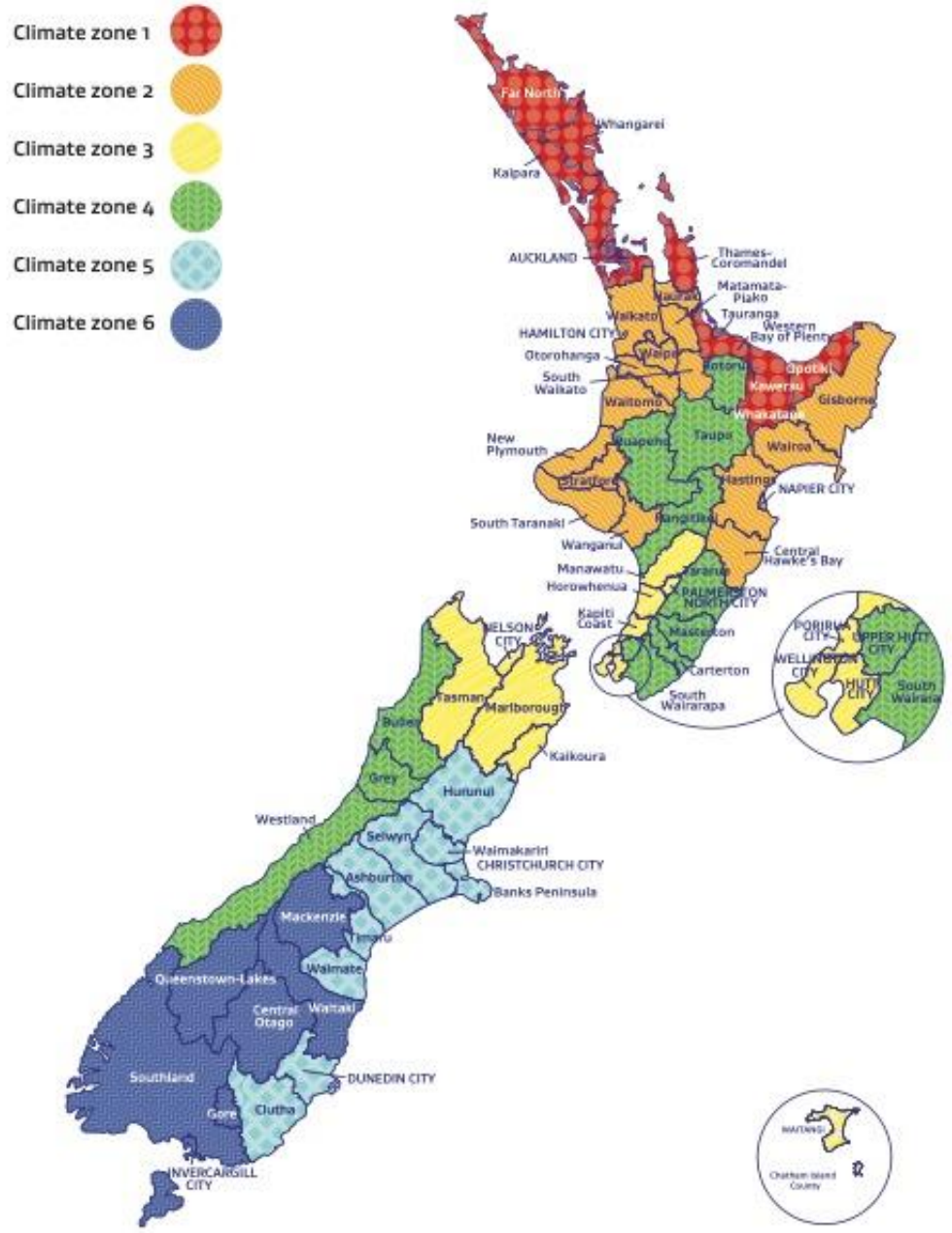
Distribution of climate zones and districts

Homestar v5 divides Aotearoa New Zealand into six climate zones. These are aligned with climate zones outlined in the New Zealand Building Code Clause H1 update proposed in 2021.

The table below sets out the climate zones on which benchmarks are based for credits EF4, HC1, and HC4. The districts within each zone are listed after:

Zone	Includes the following districts	Representative location(s) in ECCHO
1	Far North, Whangarei, Kaipara, Rodney, Auckland, Papakura, Franklin, Thames-Coromandel, Western Bay of Plenty, Tauranga, Whakatane, Kawerau, Opotiki	Auckland, Kaitaia, Tauranga
2	Gisborne, Wairoa, Hastings, Napier City, Central Hawkes Bay, New Plymouth, South Taranaki, Whanganui, Hauraki, Waikato, Matamata-Piako, Hamilton City, Waipa, Otorohanga, South Waikato, Waitomo, Stratford	Napier, New Plymouth, Hamilton/Ruakura, Paraparaumu
3	Manawatu, Palmerston North City, Horowhenua, Kapiti Coast, Porirua City, Hutt City, Wellington City, Tasman, Nelson City, Marlborough, Kaikoura	Nelson, Wellington, Chatham Islands
4	Taupo, Rotorua, Ruapehu, Rangitikei, Tararua, Masterton, Carterton, South Wairarapa, Buller, Grey, Westland, Upper Hutt City	Rotorua, Hokitika, Masterton, Turangi
5	Hurunui, Waimakariri, Christchurch City, Selwyn, Ashburton, Timaru, Waimate, Dunedin City, Clutha, Banks Peninsula	Christchurch, Dunedin
6	Mackenzie, Waitaki, Central Otago, Queenstown Lakes, Southland, Gore, Invercargill City	Invercargill, Lauder, Queenstown

This is visualized on the map on the following page.


Climate zone 1
Climate zone 2
Climate zone 3
Climate zone 4
Climate zone 5
Climate zone 6
Far North
Whangarei
Kaipara
AUCKLAND
Thames-Coromandel
Matamata-Piako
Waikato
Tauranga
Western Bay of Plenty
HAMILTON CITY
Otorohanga
Waipa
Rotorua
Opotiki
Kawerau
South Waikato
Waitomo
Whakatane
Gisborne
New Plymouth
Ruapehu
Taupo
Wairoa
Stratford
Hastings
NAPIER CITY
South Taranaki
Rangitikei
Wanganui
Central Hawke's Bay
Manawatu
Tararua
Horowhenua
PALMERSTON NORTH CITY
Kapiti Coast
NELSON CITY
Masterton
PORIRUA CITY
UPPER HUTT CITY
WELLINGTON CITY
HUTT CITY
South Wairarapa
Carterton
South Wairarapa
Tasman
Marlborough
Buller
Kaikoura
Grey
Hurunui
Westland
Selwyn
Waimakariri
CHRISTCHURCH CITY
Ashburton
Banks Peninsula
Mackenzie
Timaru
Waimate
Queenstown-Lakes
Central Otago
Waitaki
Southland
DUNEDIN CITY
Gore
Clutha
INVERCARGILL CITY
WAITANGI
Chatham Island County

Appendix D: Homestar Calculation Tool

Completing the Tool

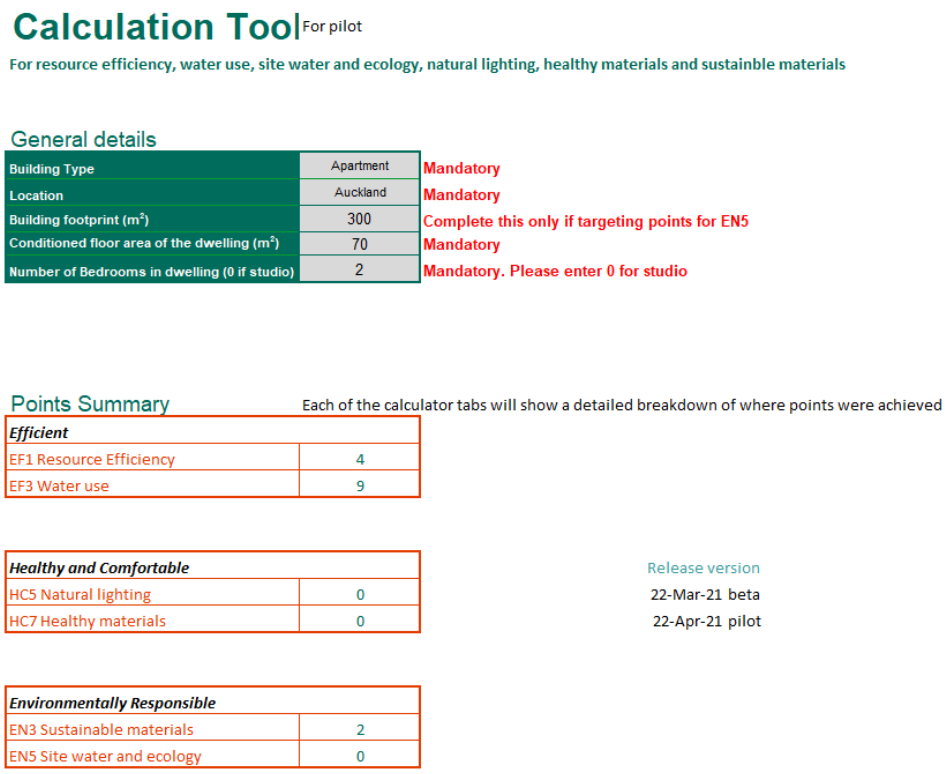
The Homestar Calculation Tool contains the following sections:

- Coversheet (general information, and points calculation for EF1, a typology-based credit)
- Water Calculator (for EF3, a typology-based credit, and EN5, a project-wide credit)
- Daylight Calculator (for HC5, a typology-based credit)
- Materials Calculator (for HC7 and EN3, both project-wide credits)

One calculation tool file should be completed and submitted for each typology, however the Materials Calculator and part C of the Water Calculator which relates specifically to EN5 only needs to be completed for one of the typologies (as these credits are project-wide and apply to the whole project) where these credits are targeted. Please note the typology in which the Materials Calculator and part C of the Water Calculator are completed in the 'Project overview and Auditor guidance' file or the Homestar scorecard, for the benefit of the Auditor. The following sections provide guidance on how various calculators are to be completed. They must be read along with the relevant credit sections of the manual, which outlines points in each credit criteria.

Coversheet

The general details section of the Homestar calculation tool coversheet has fields to enter dwelling type, dwelling location, conditioned floor area and number of bedrooms.



Calculation Tool For pilot

For resource efficiency, water use, site water and ecology, natural lighting, healthy materials and sustainble materials

General details

Building Type	Apartment	Mandatory
Location	Auckland	Mandatory
Building footprint (m^2)	300	Complete this only if targeting points for EN5
Conditioned floor area of the dwelling (m^2)	70	Mandatory
Number of Bedrooms in dwelling (0 if studio)	2	Mandatory. Please enter 0 for studio

Points Summary — Each of the calculator tabs will show a detailed breakdown of where points were achieved

Efficient	
EF1 Resource Efficiency	4
EF3 Water use	9

Healthy and Comfortable	
HC5 Natural lighting	0
HC7 Healthy materials	0

Release version
22-Mar-21 beta
22-Apr-21 pilot

Environmentally Responsible	
EN3 Sustainable materials	2
EN5 Site water and ecology	0

- The conditioned floor area and the number of bedrooms are used to calculate points for EF1 Resource Efficiency.

- The building type, footprint, location, and number of bedrooms are used in the Water Calculator.
- The number of bedrooms is used in the Lighting Calculator.

The points summary section outputs the total points calculated based on inputs for each of the credits that the tool is used for. For a breakdown of points achieved for individual credit criteria, please refer to the relevant calculator tabs.

In all calculators, the calculated points are displayed in orange formatted tables at the top of each calculator.

Total Points

EF3	Water efficiency	7
	Rainwater	2.0
EN5	Brownfield	0.0
	Stormwater	0.0
	Native Planting	0.0
	WSUD	0.0

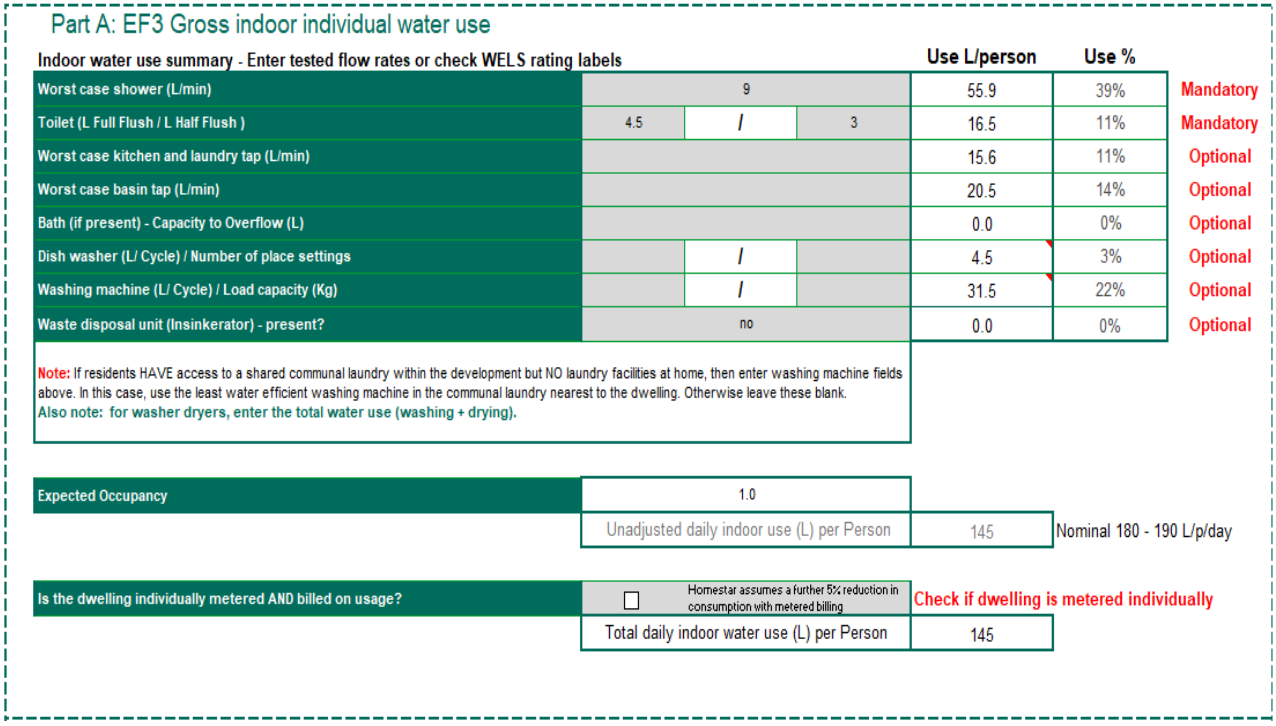
Water Calculator

The Water calculator tab is divided into several parts.

Part A (EF3 Water use)

Completing this section is mandatory. In this section, the Assessor inputs water use information for various fixtures, fittings and appliances to estimate the per person daily indoor water use demand (in litres per person per day). It is used for calculating points in EF3 Water Use for *indoor water use* (points out of 10), and the resulting water demand estimate is also used for calculating points for *rainwater harvesting* (points out of 2). Please note the expected occupancy is only impacts rainwater offset calculations.

Several entries in part A are mandatory, while any field marked as 'optional' may be left out (note that in this case the calculator assumes conservative default water use values). Complete all the mandatory fields and as many 'optional' fields in 'General Details' and 'Part A' as possible.



Part A: EF3 Gross indoor individual water use

Indoor water use summary - Enter tested flow rates or check WELS rating labels				Use L/person	Use %	
Worst case shower (L/min)	9			55.9	39%	Mandatory
Toilet (L Full Flush / L Half Flush)	4.5	/	3	16.5	11%	Mandatory
Worst case kitchen and laundry tap (L/min)				15.6	11%	Optional
Worst case basin tap (L/min)				20.5	14%	Optional
Bath (if present) - Capacity to Overflow (L)				0.0	0%	Optional
Dish washer (L/ Cycle) / Number of place settings		/		4.5	3%	Optional
Washing machine (L/ Cycle) / Load capacity (Kg)		/		31.5	22%	Optional
Waste disposal unit (Insinkerator) - present?	no			0.0	0%	Optional

Note: If residents HAVE access to a shared communal laundry within the development but NO laundry facilities at home, then enter washing machine fields above. In this case, use the least water efficient washing machine in the communal laundry nearest to the dwelling. Otherwise leave these blank.
Also note: for washer dryers, enter the total water use (washing + drying).

Expected Occupancy	1.0		
	Unadjusted daily indoor use (L) per Person	145	Nominal 180 - 190 L/p/day
Is the dwelling individually metered AND billed on usage?	☐ Homestar assumes a further 5% reduction in consumption with metered billing	Check if dwelling is metered individually	
	Total daily indoor water use (L) per Person	145	

For Design Ratings, inspect drawings and specification to determine the make and model of specified fixtures, fittings and appliances, and their relevant water use data, then enter in part A. For Built Ratings, follow the onsite compliance schedule (Appendix F) as each dwelling is inspected. The schedule requires photos be taken in some instances, and for a sample of dwellings in each typology to be tested - 30% up to 10 dwellings, then 10% of any additional dwellings (e.g.- 3 out of 5, 3 0ut of 10, 4 out of 11, 6 out of 35).

Fixture/fitting /appliance	Compliance checking methodology	Additional requirements (as per onsite compliance schedule)
Showers and taps	Run the tap at full flow for 1 minute and measure flow. For mixtures, keep the tap in middle position (between hot and cold. Use the average across all tested examples of each fitting type (shower, kitchen tap, etc.).	None.
Toilets, dishwasher and washing machines	Visually check WELS rating sticker on unit or manufacturer data to determine water use. The worst performing example of each appliance type in each typology is to be used in the calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of toilet, dishwasher and washing machine installed in the dwellings inspected in each typology.
Bathtub	Visually check if one is present. Check manufacturer data to determine capacity. If any dwellings of the typology have one installed, include in calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of bathtub installed in the dwellings inspected in each typology.
Waste disposal units (Insinkerators)	Visually check if one is present. If any dwellings of the typology have one installed, include in calculator.	None.

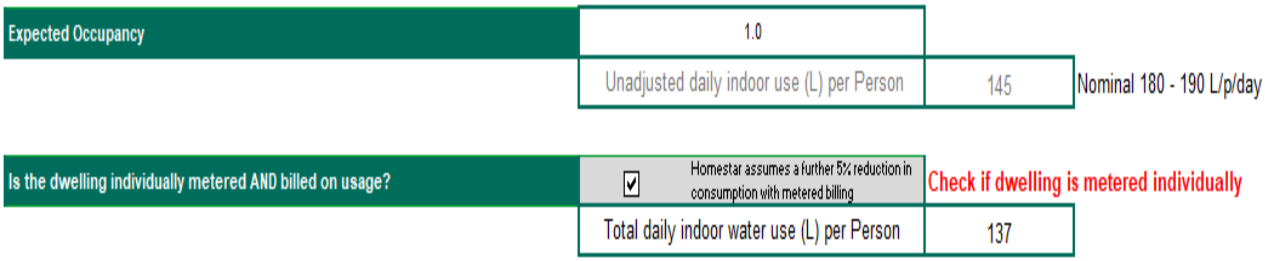
Once a sufficient number of dwellings have been inspected and the onsite compliance schedule completed, enter the water flow data into part A, complete all mandatory fields and any optional fields that can be completed, leaving others blank (the calculator will assign defaults in the background).

Points are based on estimated daily indoor water use per person. This is calculated based on the following usage estimates.

Item	Usage (per person per day unless stated)	Default usage assumptions (if no water use data entered)
Showers	1 x 6.21-minute shower	12 L/min flow rate
Toilets	4 half flushes and 1 full flush	6L full flush, 3 L half flush

Bathroom vanity tap	(Flowrate x 1.58) + 1.58L	12 L/min flow rate
Kitchen sink tap	(Flowrate x 0.44) + 10.36L	12 L/min flow rate
Dishwasher	3.6 x L per cycle / no. of place settings	30L per household added to kitchen tap daily use
Washing Machine	2.1 x L per cycle / load capacity (kg)	15 L per cycle per kg load
Laundry tub tap	(Flowrate x 0.44) + 10.36L	12 L/min flow rate IF present
Bathtub	Capacity to overflow (L) x 0.11	No bathtub assumed
Insinkerator	If present, 3.08 L	None

Studies show that individual metering AND billing may result in up to 5% reduction in daily water use, so calculated daily water use is reduced by a further 5% where the dwelling is metered and billed on usage.

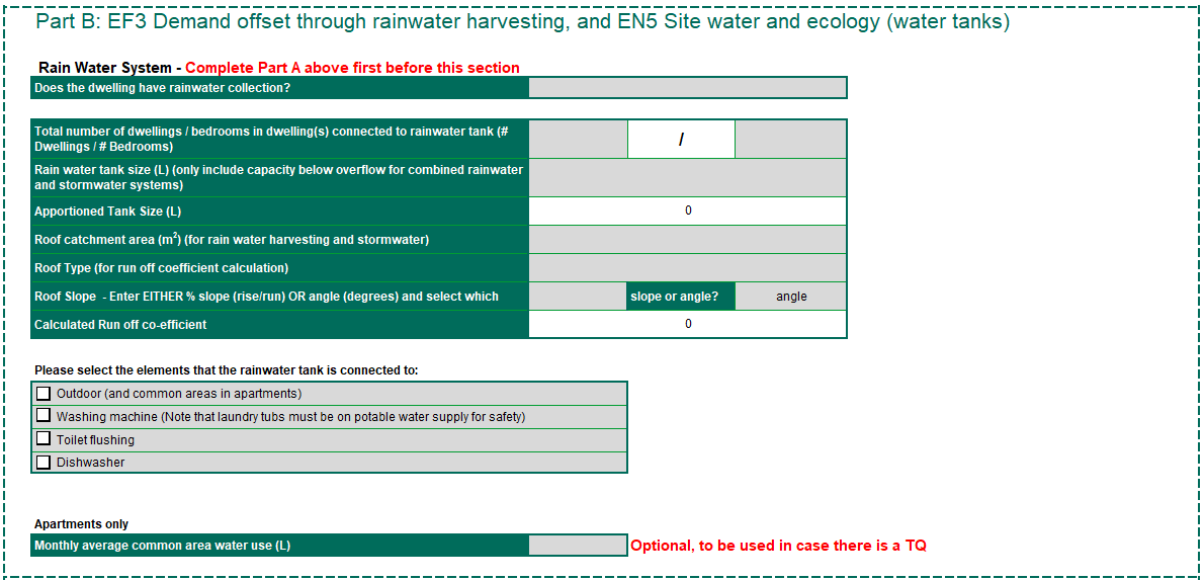


Part B (EF3: Water Use – rainwater harvesting, and EN5: Site Water and Ecology)

For all house types, complete Part B (as well as Part A) when:

- Rainwater is harvested through tanks for reuse on site for outdoor uses, laundry, dishwashing or toilet flushing, and/or
- Some onsite stormwater management is through the use of stormwater detention tanks

Complete this section after confirming compliance using drawings, rainwater tank manufacturer data, etc. (for Design or Built Ratings) AND a site inspection (required for Built Rating only).



Part B: EF3 Demand offset through rainwater harvesting, and EN5 Site water and ecology (water tanks)

Rain Water System - Complete Part A above first before this section

Does the dwelling have rainwater collection?			
Total number of dwellings / bedrooms in dwelling(s) connected to rainwater tank (# Dwellings / # Bedrooms)		/	
Rain water tank size (L) (only include capacity below overflow for combined rainwater and stormwater systems)			
Apportioned Tank Size (L)	0		
Roof catchment area (m^2) (for rain water harvesting and stormwater)			
Roof Type (for run off coefficient calculation)			
Roof Slope - Enter EITHER % slope (rise/run) OR angle (degrees) and select which		slope or angle?	angle
Calculated Run off co-efficient	0		

Please select the elements that the rainwater tank is connected to:

- ☐ Outdoor (and common areas in apartments)
- ☐ Washing machine (Note that laundry tubs must be on potable water supply for safety)
- ☐ Toilet flushing
- ☐ Dishwasher

Apartments only

Monthly average common area water use (L)		Optional, to be used in case there is a TQ

The first section in Part B consists of information about the rainwater harvesting system.

The Assessor has to confirm whether a rainwater harvesting system is provided AND complete the following:

- Total number of dwellings connected to this rainwater system and total bedrooms across those dwellings – this is used to calculate the total occupancy of the development, which in turn is used to calculate the apportioned rainwater tank capacity (allocated to each dwelling of this typology). Leave these two cells blank or enter 1 / no. bedrooms if the tank is serving a single dwelling.
- Rainwater tank size (in litres) – if several tanks are linked together in a single connected network, it will be the total capacity across all the tanks. If different tanks are serving different dwellings, then treat these as different systems.
- Roof catchment area (m^2) – this is not the actual surface area, but rather the plan area, measured across all catchments feeding into the tanks system.
- Roof type – select the roof type closest to what is on the dwelling. This is used to calculate the run-off coefficient.
- Roof slope – this is the angle of the roof, and can be entered in terms of an angle in degrees or percentage gradient (rise/run). If the gradient is entered rather than an angle, ensure to change the type of input from "angle" to "slope" on the drop down (cell F43) on the right.

The calculator uses this information to deduce:

- Apportioned tank size (in litres) – Where a rainwater harvesting system is shared between several dwellings (e.g. in an apartment bloc), the available rainwater capacity is apportioned among these dwellings based on occupancy based on the following formula:

Portion = (No. bedrooms in dwelling +1)/(number of dwellings+ No. bedrooms across all dwellings) (Apportioned and total tank capacities will be the same if the system is only serving one dwelling)

- Run-off coefficient – this is a measure of how much of the water landing on the roof will actually flow off it

Then the Assessor is required to tick which 'uses' of rainwater – outdoor (and common areas in apartments), toilet flushing, washing machine and dishwasher – are actually connected to be fed by the rainwater tank.

The calculator estimates annual rainfall using NIWA rainfall data, and the indoor demand from washing machines, dishwasher and toilet flushing using information entered in Part A. It then uses the information in Part B to determine rainwater system capacity, the demand from outdoor uses, and how much of that total indoor and outdoor demand is likely met.

A default outdoor water use of 25L per day is assumed for the summer months (none for the winter months). However, if projects complete the 'Ground coverage type' table in part C (see below), the indicated landscaped (native and exotic) and vegetable garden areas will be used to estimate outdoor water demand.

Ground coverage type	Area (m^2)
Non-permeable paving, decks, pools, etc. (**exclude** area under roof)	
Native trees, grass, tussock and other bush (**including** under roof)	
Exotic trees, grass, tussock and lawn (**including** under roof)	
Vegetable garden	
Total permeable area	0

For apartments, if rainwater is also used in any common areas, the estimated average monthly common area demand (L) is to be entered at the bottom of part B. Like tank capacity, outdoor and apartment common area water demands will be apportioned to each dwelling where multiple dwellings share a single rainwater system.
Points are based on the percentage of demand from washing machines, toilet flushing, dishwashing and outdoor uses for all dwelling types, as well as common area demand for apartments, that can be met during any two-week period of the year by the rainwater harvesting system. Given the inherent limitations of rainwater harvesting systems installed on apartments, such as the limited available catchment area compared to the number of dwellings, there are lower thresholds for apartments than for other house types (Please refer to EF3 credit for these thresholds).

Part C (EF3: Water Use – rainwater harvesting, and EN5: Site Water and Ecology)

Part C is used mainly for ascertaining points in EN5, apart from feeding into the outdoor water use demand calculation as mentioned above.

Total site area (m^2)	400
Total roof coverage area (incl. eaves, and outbuildings) (m^2)	320
Ground area excluding building footprint (m^2)	100
Ground area not under roof (m^2)	80
Brownfield site?	☑
Water sensitive urban design process carried out?	☐

Ground coverage type	Area (m^2)
Non-permeable paving, decks, pools, etc. (**exclude** area under roof)	
Native trees, grass, tussock and other bush (**including** under roof)	
Exotic trees, grass, tussock and lawn (**including** under roof)	
Vegetable garden	
Total permeable area	80

First enter the total site area, roof coverage area and areas covered by non-permeable paving, native and exotic planting, and vegetable gardens. Take care that the roof area includes eaves, so non-permeable areas should not include any paved area under eaves, as there is no stormwater management requirement for these areas (since their shielded by the eaves from rain). However, planted areas used to calculate the level of native planting, so the Assessor should include any planting areas beneath eaves. The calculator works out the total area not under roof which is the basis for determining points for stormwater management, and the area excluding footprint which is used to determine points in native planting.

Tick the check boxes for brownfield site and water sensitive urban design if these apply to the project.

Points in EN5 for onsite stormwater management is based on the total percentage of site effectively served by an onsite stormwater management system during one third of a 1:2-year, 24-hour storm event, and on whether the first 10mm from any rain event can also be retained. Permeable surfaces and living roofs are compliant with both requirements by default, and the remainder can be served by several systems (e.g. a detention tank may serve the roof, while a rain garden may capture storm water flows from impermeable ground).

The total amount of stormwater that needs to be managed onsite to meet the 50% and 90% points benchmarks (calculated by site area, roof area and location) are shown on the table (yellow) below:

Capacity required	50% compliance	90% compliance
SW Detention	Manage 4114 L	Manage 7405 L
SW Retention	Manage 1520 L	Manage 2736 L

For all other systems except stormwater detention (including detention/retention) tanks, the area effectively served by each accepted onsite stormwater management system is

confirmed using stormwater engineering reports (or council documentation where applicable) and entered in relevant cells of the following table.

Type of storm water management on site

Onsite stormwater management system (must be sized to serve all of the allocated catchment area)	Catchment area served (m^2)
Rain garden	
Swales incorporating gravel under drains and dams	
Sand filter	
Pond (must allow infiltration), soakage pit or infiltration basin	
Stormwater detention tanks (connected GROUND catchment area only)	
Stormwater detention tanks (actual TOTAL catchment area calculated)	0.00
Other onsite infiltration system (submit TQ)	
Living Roof	
Town stormwater system, or not managed	400.00

Additional volume information for stormwater tanks

Detention (L)		Complete
Separate SW retention tank	☐	Complete
Total retention (L)		Leave blank

*As a site-wide approach is taken for EN-5 Detention (L) and Retention (L) volumes entered shall be total volumes above and below the overflow of the stormwater tanks rather than an apportioned volume as in EF-3

For storm water detention tanks, enter capacity of the available detention volume in the box on the right for 'Detention (L)'. Note that this could be a separate detention tank, or detention volume provided within a rainwater 'retention' tank (which could also be used for rainwater harvesting and reuse). If detention and retention is combined within one tank, the capacity above the overflow is the available detention volume.

Additional volume information for stormwater tanks

Detention (L)		Complete
Separate SW retention tank	☐	Complete
Total retention (L)		Leave blank

*As a site-wide approach is taken for EN-5 Detention (L) and Retention (L) volumes entered shall be total volumes above and below the overflow of the stormwater tanks rather than an apportioned volume as in EF-3

If the project is also targeting points for retaining the first 10mm of any rain event onsite, and at least part of this is retained via tanks, this can be the same tank used for rainwater harvesting and reuse, and/or a tank dedicated for retaining the first 10 mm (which would have an outlet, but which may not have been sized to meet rainwater harvesting demand).

If the project wishes to claim points for retaining the first 10mm AND at least part of it is through a different tank, then tick the 'Separate SW retention tank' checkbox and enter the total retention capacity (of both the separate retention tank and rainwater tank). The calculator only considers the volume entered in this cell in this case. IF the checkbox is not ticked, the rainwater tank alone is considered to be used for retaining the first 10 mm.

The calculator works out the area that is actually served effectively by stormwater detention and retention tanks and adds this to that served by other systems. The compliance summary is show in the orange box on the right side of part C and the points are shown on the aforementioned table at the top of the calculator.

EN5 Compliance results	
Brownfield	Yes
Native planting	0%
WSUD	No
Site	
Permeable	20%
Onsite system	0%
Total managed	20%
10mm retained?	90%

Daylight Calculator

HC5 Natural Lighting allows for compliance to be confirmed using one of three methods:

1. A window to floor area ratio (WFA) calculation
2. An Average daylight factor (ADF) calculation (manual calculation and computer modelling pathways are available)
3. Spatial daylight Autonomy (sDA) modelling

Two of these methods are available on the daylight calculator tab, as well as a section where schedules of spaces and windows can be set up which then feeds into both calculation methods.

- Method one – Window to floor area ratio
- Method two – Average daylight factor (manual calculation pathway)

Note that ADF can also be calculated using one of the accepted computer /web tools that are listed in the HC5 credit. sDA calculations have to be done by a competent professional using appropriate modelling software.

Follow the steps below to complete the Daylight Calculator.

1. Initially set out the schedule information at the top of the page. If there is a standard wall height across the project input here, otherwise leave blank. Enter a number value for number of stories. For calculation method, select the relevant information from the provided dropdown menu.

Schedule Information

Standard wall height		Dwelling Type	Studio
Number of Stories		Calculation Method	

2. Fill out information across the row for each space type. Spaces can only be selected from the provided list.

Space Name	Wall Height (m)	Floor Width (m)	Floor Length (m)	Story	Surface Reflectance
Living Room One	2.5	10	10	Ground	Medium
-					

3. **Optional**: generate a window schedule if generic windows are used multiple times by filling out the width, height, and visible transmittance.

Window Label	Width (m)	Height (m)	Visible Transmittance	Area (m^2)
Window 1	2	0.8	0.7	1.6
Window 2				0

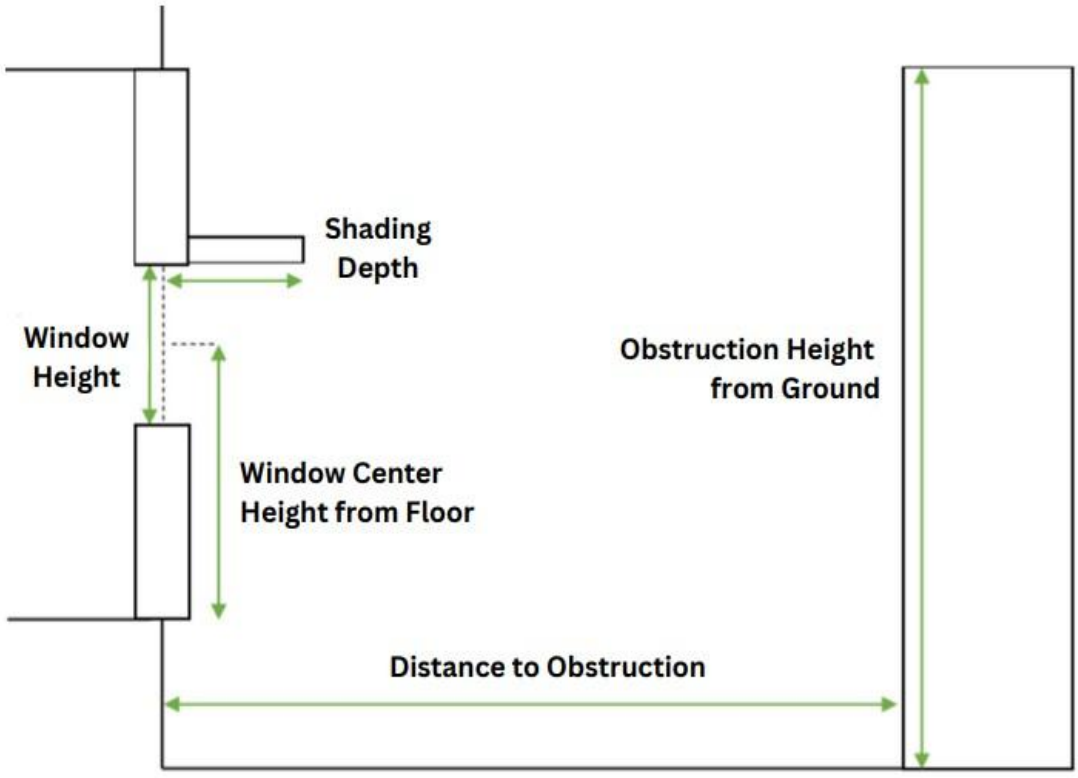
4. Method one – Provide the relevant information in each cell across from the space name. Either the total window area or a window from the schedule can be used.

	Step One	Step One Alternative		Step Two	Result	
Space Name	Total Window Area	Window Type from Schedule	Number of Type in Room	Overall Shading for Windows	WFA%	Comply?
Living Room One		Window 1	4	Some Shading	6%	No

5. Method two – Fill out the row with relevant information relating to the image at the end of this document. Two window options are available, they can both be used in conjunction.

	Step One		Step Two		Step Three			Step Three Alternative		Result	
Space Name	Distance to Obstruction (m)	Obstruction Height from Ground (m)	Shading Distance from Top of Window (m)	Window Centre Height from Floor (m)	Window Height (m)	Window Width (m)	Visible Transmittance	Window Type from Schedule	Number of Type in Room	Daylight Factor	Comply?
Living Room One	5.0	3.0	0.2	1.5	1.5	0.5	0.8	Window 1	2	2.3%	Yes

6. The values used in Option Two can be referenced to the image below.



7. Total points achieved are displayed at the top of the page.

Total Points HC - 5

Natural Lighting	0.0

Materials Calculator

There are two parts to the Materials Calculator that ascertain points achieved for their respective credits:

- Part A: EN3 Sustainable Materials
- Part B: HC7 Healthy Materials

Part A: EN3 Sustainable Materials

Points in this credit is based on the points that can be achieved across several product categories. Each relevant product is entered into the 'Sustainable Material Inputs' table (green). Based on the product category that each is assigned to, the pathway that points are claimed under and their percentage contribution to the total amount of products used in that product category, the calculator ascertains how many points are achieved by which product category and summarises this on the 'Sustainable Materials Points' table (orange).

Summary of EN - 3 Sustainable Materials Points

Product Category	Final Points	% Compliant
Structural Timber	1.5	100%
Other Engineered Wood	1.25	100%
Interior Wall and Ceiling Linings	1.5	100%
Timber Cladding	1.5	100%
Applied Coatings	1.5	100%
Insulation	1.5	100%
Structural Steel	1.5	100%
-		

Note that for recycled content, the final points awarded are rounded to the highest 0.5 point benchmark met. Points awarded are thus 0, 0.5, 1, 1.5, or 2

EN - 3 Sustainable Material Inputs

Select '-' and determine product type to insert a new row. Fill in Product Name and Company. Determine quantity used in the units provided. Select means of compliance. If recycled, input percentage. Points are automatically calculated. Max 30 rows, contact NZGBC if more are required.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Structural Timber			50	Lineal Meters	FSC/PEFC		1.5
2	Other Engineered Wood			60	m2	Product specific EPD		1.25
3	Interior Wall and Ceiling Linings			56	m2	Eco Label Level A		1.5
4	Timber Cladding			45	m2	Reused		1.5
5	Applied Coatings			56	m2 or L	Eco Label Level A		1.5
6	Insulation			100	m2	Eco Label Level A		1.5
7	Structural Steel			45	Lineal Meters	Eco Label Level A		1.5
8	-							
9	-							
10	-							
11	-							
12	-							
13	-							
14	-							
15	-							

Follow the steps below to record each product used within the categories that the points are claimed for in EN3. Note this credit is not mandatory for a Homestar rating.

1. Click the gray cell below 'Product Category' and select relevant type from the drop-down list that appears. This assigns the record to the correct product category, so materials/products do not need to be listed in order of category when the table is filled, but this will assist the Auditor.

EN - 3 Sustainable Material Inputs

Select "-" and determine product type to insert a new row. Fill in Product Name and Company. Determine quantity used in the units provided. Select means of compliance. If recycled, input percentage. Points are automatically calculated. Max 30 rows, contact NZGBC if more are required.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	-							
2	-							

2. Once a 'Product Category' is selected, the row will become editable. Fill out the 'Product Name' and 'Company' cells. These have no impact on the calculation process but help identify and keep track of different materials.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Concrete				Tonnes/m3			0
2	-							

3. Fill in the 'Quantity' cell in the units provided to the right of the cell.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Concrete	Conc-1001-a	Jack's Concrete		Tonnes/m3			0
2	-							

4. Select a means of compliance from the drop-down list provided in the 'Means of Compliance' cell. Only relevant means of compliance are shown.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Concrete	Conc-1001-a	Jack's Concrete	10	Tonnes/m3			0
2	-							

5. Achievable points are now generated on the right side. These are not the final points scored.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Concrete	conc-1001-a	Jack's concrete	10	Tonnes/m3	Eco Label Level A		1.5
2	-							

6. **IF** 'Recycled Content' is selected as the means of compliance, the 'Recycled %' cell will become editable and is required to be filled out to show achievable points.

	Product Category	Product Name	Company	Quantity		Means of Compliance	Recycled %	Raw Points
1	Concrete	conc-1001-a	Jack's concrete	10	Tonnes/m3	Recycled Content	80%	1.2
2	-							

7. Once multiple product types have been entered, the summary table will show the number of credits gained and percentage compliant for each product type.

Summary of EN - 3 Sustainable Materials Points

Product Category	Final Points	% Compliant
Concrete	1	100%
Structural Timber	1.5	100%
Floor Coverings	1.25	100%

8. The total points achieved for EN3: Sustainable Materials is shown at the top of the page.

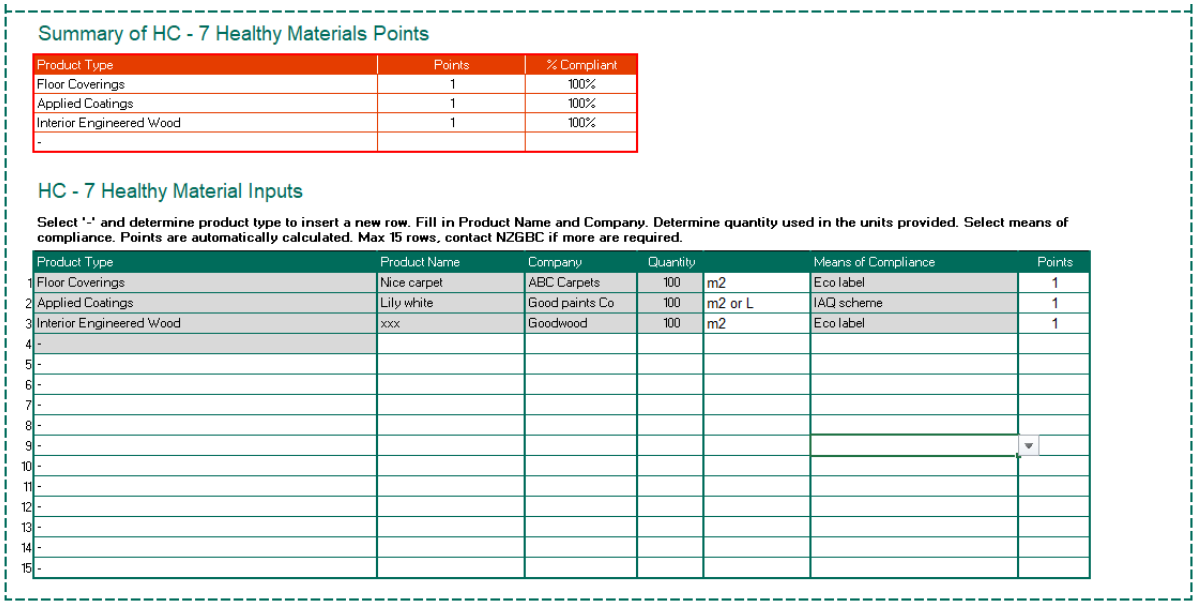
Total Points EN - 3	
Sustainable Materials	3.75

Part B: HC7 Healthy Materials

Points in this credit is awarded across four categories:

1. Applied coatings
2. Floor coverings
3. Adhesives and sealants
4. Engineered wood used in the interior

Each relevant product is entered into the 'Healthy Material Inputs' table (green). Based on the product category that each is assigned to, the pathway that points are claimed under and their percentage contribution to the total amount of products used in that product category, the calculator ascertains how many points are achieved by which product category and summarises this on the 'Healthy Materials Points' table (orange).



Summary of HC - 7 Healthy Materials Points

Product Type	Points	% Compliant
Floor Coverings	1	100%
Applied Coatings	1	100%
Interior Engineered Wood	1	100%
-		

HC - 7 Healthy Material Inputs

Select '-' and determine product type to insert a new row. Fill in Product Name and Company. Determine quantity used in the units provided. Select means of compliance. Points are automatically calculated. Max 15 rows, contact NZGBC if more are required.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	Floor Coverings	Nice carpet	ABC Carpets	100	m2	Eco label	1
2	Applied Coatings	Lily white	Good paints Co	100	m2 or L	IAQ scheme	1
3	Interior Engineered Wood	xxx	Goodwood	100	m2	Eco label	1
4	-						
5	-						
6	-						
7	-						
8	-						
9	-						
10	-						
11	-						
12	-						
13	-						
14	-						
15	-						

Follow the steps below to record each product used within the categories that the points are claimed for in HC7. Note this credit is not mandatory for a Homestar rating.

1. Select the cell below 'Product Type' and select relevant type from the drop-down list that appears. Product types can be selected from engineered wood shelves and cabinetry, interior surface areas, or adhesives and sealants.

HC - 7 Healthy Material Inputs

Select "-" and determine product type to insert a new row. Fill in Product Name and Company. Determine quantity used in the units provided. Select means of compliance. Points are automatically calculated. Max 15 rows, contact NZGBC if more are required.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	-						
2	-						

2. Once a 'Product Type' is selected, the row will become editable. Fill out the 'Product Name' and 'Company' cells. These have no impact on the calculation process but help identify and keep track of different materials.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	Interior Engineered Wood						0
2	-						

3. Fill in the 'Quantity' cell in the units provided to the right of the cell.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	Interior Engineered Wood	Int-W-06	Good Wood				0
2	-						

4. Select a means of compliance from the drop-down list provided in the 'Means of Compliance' cell. Only relevant means of compliance are shown.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	Interior Engineered Wood	Int-W-06	Good Wood	80	m2		0
2	-						

5. Achievable points are now generated on the right side. These are not the final points scored.

	Product Type	Product Name	Company	Quantity		Means of Compliance	Points
1	Interior Engineered Wood	Int-W-06	Good Wood	80	m2	Eco label	1
2	-						

6. Once multiple product types have been entered, the summary table at the top of the section will show the number of credits gained and percentage compliant for each product type.

Total Points HC - 7

Healthy Materials	3.0

Appendix E: Pro forma of Credit Compliance

Applicable Credits

This Pro forma refers to (project code) _____ Built Rating / Design Rating (circle one).

For EF3: Water Use, listed in the 'Mandatory' section below, the Assessor is to confirm through this pro forma that onsite water efficiency testing has been done in accordance with Appendix G: Onsite Compliance Schedule, and the correct value as per the schedule and EF3 credit is used to claim points via the water calculator. Onsite testing of water fixtures is only required for a Built Rating. Therefore, this pro forma is ONLY required to be completed to confirm EF3 compliance for Built Ratings.

For credits listed in the 'optional' section below, the Assessor may declare through this pro forma that compliance requirements for points claimed for these credits are met by the project. Once they have confirmed which credits are to be targeted and the number of points that are achieved for each, the Assessor is to:

- enter these points into the Homestar scorecard
- tick the relevant credits that this pro forma is being used to confirm compliance for
- sign the confirmation at the end

For HC6, LV2, LV3, LV4, EN1, EN6, this pro forma can be used at both Design and Built rating stage. If points are being claimed for any of these credits but the Assessor does not wish to declare compliance through this pro forma, they can alternatively submit the evidence listed for the relevant credit and rating stage in the table below.

Mandatory (EF3: Water Use)

Assessor has carried out onsite flow testing of the following fittings for an appropriate number of dwellings as per Appendix G: Onsite compliance schedule:

- Showers
- Kitchen taps
- Bathroom and WC basin taps

In addition, WELS ratings have been verified onsite as per Appendix G: Onsite Compliance schedule for the following items:

- Toilets
- Dishwasher
- Washing machine

Optional Credits

Apply	Credit code	Evidence sited for Design rating	Evidence sited for Built rating
ð	HC6	Evidence (e.g., specification extract, construction details, acoustic report) demonstrating:	Evidence (e.g., as built construction details, acoustic report) demonstrating

		• STC or Rw ratings for required building elements • Design target for ambient noise levels • Absorptive finishes in enclosed common hallways, lobbies, entranceways, and stairways	• STC or Rw ratings for required building elements • Design target for ambient noise levels • Absorptive finishes in enclosed common hallways, lobbies, entranceways, and stairways
ð	LV2	Assessor to confirm that: • Project owner commits to providing a compliant HUG • Several amenities exist within walkable distance (<800m) from the development entrance No paper/softcopy evidence required to be maintained.	Assessor to visually confirm that: • HUG complies with Homestar requirements • Claimed amenities are located within a walkable distance (<800m) of the development entrance No paper/softcopy evidence required to be maintained.
ð	LV3	Assessor to confirm using drawings that claimed features are present on the design or obtain confirmation from project owner that they will be provided. No evidence required to be submitted.	Assessor to visually confirm compliance on site. No evidence required to be submitted
ð	LV4	• Site plan • Google map images or photos of neighbouring area showing public transport terminals and cycleways	Assessor to visually confirm compliance on site, photographs and Google map images to be submitted if the Pro forma pathway is not used on the project
ð	EN1	• Proposed PV system specification • BRANZ PV Calculator results	• Installed PV system specification matches BRANZ PV calculator inputs • PV Calculator results
ð	EN6	Contract/tender documentation require: • EMP to be implemented for duration of project OR main contractor to hold ISO14001 certification • Contractors to hold approved accreditation	EMP implemented in project/main contractor ISO14001certification Approved contractor accreditation

Evidence to be Maintained

NZGBC does not require that copies of photographic or documentation evidence be kept for records. However, given the Assessor responsibilities as per this pro forma, consider holding a record until certification is confirmed.

Declaration

I, _____of _____ confirm that I have witnessed sufficient evidence to award points associated with the following credits (check al that apply). I confirm that I (or my firm as per the below) bear sole responsibility for claims made and absolve New Zealand Green Building Council of any responsibility in the event that the built state of the dwelling(s) differs from the claims made in this document, and where these differences are not a result of alterations made after confirmation of Built rating by NZGBC. Neither myself nor NZGBC is responsible for performance impacts of alterations done afterwards.

I understand that assessors completing their first Homestar v5 assessment are not eligible to use this pro forma to confirm compliance with Homestar credits and must instead submit evidence on this document outlined for each relevant credit to NZGBC. I confirm that I am eligible to use this pro forma.

I confirm that where I have undertaken the assessment on behalf of a firm, I am signing this pro forma in that capacity (and not personally).

Signed_____

Date_____

Appendix F: Onsite Compliance Schedule

Process

Follow the onsite compliance schedule below during the onsite assessment (for Built Ratings) to sample check the water use of a number of dwellings in each typology to ensure that they all meet the criteria for claimed points. Note that you will sometimes need to take photos, as per the schedule. Enter the results in a copy of the tables below or similar one of your own design, then sign and submit with the rest of the assessment to the NZGBC. Ensure that you also sign and submit the Pro forma of Credit Compliance (Appendix E).

Where there are multiple dwellings within a typology or typologies, a sample of dwellings within each typology must be tested: 30% up to 10 dwellings, then 10% of any additional dwellings (e.g. 2 out of 5 dwellings, 3 out of 10 dwellings, 4 out of 11 dwellings, 6 out of 35 dwellings).

Fixture/fitting /appliance	Compliance checking methodology	Additional requirements (as per onsite compliance schedule)
Showers and taps	Run the tap at full flow for 1 minute and measure flow. For mixers, keep the tap in middle position (between hot and cold). Use the average across all tested examples of each fitting type (shower, kitchen tap, etc.).	None
Toilets, dishwasher and washing machines	Visually check WELS rating sticker on unit or manufacturer data to determine water use. The worst performing example of each appliance type in each typology is to be used in the calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of toilet, dishwasher and washing machine installed in the dwellings inspected in each typology.
Bathtub	Visually check if one is present. Check manufacturer data to determine capacity. If any dwellings of the typology have one installed, include in calculator.	If a purchase invoice or receipt is not available, take a photo for each different model of bathtub installed in the dwellings inspected in each typology.
Waste disposal units (insinkerators)	Visually check if one is present. If any dwellings of the typology have one installed, include in calculator.	None

Note that town water supply pressures vary due to a number of factors, so, where a flow rate exceed the target, compliance can be considered if its within 10%. Do several tests if necessary.

Showers and Taps

If there are different products of the same fixture type (e.g. different brands of shower heads) in each dwelling, select the one likely to be worst performing in each dwelling. If they are all the same specification, select the one in each dwelling that is likely to be used the most.

Fixture	Flow Test results (L/min)																
Showers																	
Kitchen Tap																	
Bathroom tap																	

Toilet, Dishwasher and Washing Machine

If there are different products of the same fixture/appliance type (e.g. different types of toilets) in each dwelling, select the one likely to be worst performing in each dwelling. If they are all the same specification, select the one in each dwelling that is likely to be used the most.

Fixture	WELS rating check																
Toilet																	
Dishwasher																	
Washing Machine																	

Bathtubs

If there are multiple bathtubs in each dwelling, select the one likely to be used most often.

Fixture	Capacity to overflow (L)																
Bath tub																	

Waste Disposal Units

Fixture	Provided (y/n)?																
Waste disposal unit																	

Appendix G: Compiling a Submission

Homestar Assessments submitted for audit should be clear and well organised. Refer to the below checklist to ensure your assessment is ready for submission.

Filing	
The v5 Submission Template Folder has been downloaded from the Assessor Resources page on the NZGBC website and evidence is filed within relevant credit folders.	☐
Evidence folders for credits not targeted and un-used forms have been deleted.	☐
All evidence is provided within relevant folder for each credit targeted, as per the Technical Manual requirements. There is no "information to follow" statements or similar.	☐
If a piece of evidence documentation is more than 2 pages long, either extract and include the relevant excerpts from the document only OR index and highlight the relevant part of the document and reference the page number(s) either at the front of the document or on a separate file.	☐
High quality colour scanning has been used for relevant evidence to maintain coloured highlighting and legibility of small text/details on plans.	☐
There are no files included larger than 10Mb.	☐
All files are orientated correctly for viewing i.e. landscape or portrait as appropriate.	☐
Files are clearly named with their contents and files names are 20 characters or less.	☐
All relevant Technical Question responses or Innovation responses from the NZGBC have been filed in the appropriate credit folder.	☐
Specifications	
The relevant section of the specification has been extracted and filed in the credit folder for each relevant credit.	☐
All specification extracts are easily identifiable as project related. Headers and footers are retained when extracting sections of specifications. If the header or footer does not reference the dwelling, the cover sheet and contents page of the specification has been submitted with each Credit.	☐
Specifications are not in draft format or labelled as "Homestar Issue" or similar. Only the final contractually binding specifications are used.	☐
Specifications have been marked-up/highlighted to direct Auditor to key information.	☐
Reports, Letters, Contracts, and Schedules	

Only relevant sections of reports are submitted, and all relevant wording is highlighted.	☐
All reports, letters and contracts explicitly refer to the project. These should be on letterhead and/or signed where appropriate, in particular when they confirm a commitment.	☐
A complete schedule of products (including the percentages where applicable) is provided where required.	☐
If the documented solution is complex or uncommon, diagrams and an explanation are provided to assist the audit.	☐
All drawings and schematics have a title bar, date, revision date, and are signed (if relevant).	☐
For a design rating, drawings are not in draft form (e.g. preliminary, Homestar submission issue, for information only). Only construction issue and tender drawings are acceptable.	☐
For a built rating, drawings are as-built (preferred) or for construction (accepted).	☐
Products and Materials	
For products and materials that are demonstrating compliance through an eco-label, the eco-label must be included in the accepted labels table on the Assessor Resources page of the NZGBC website, and the certificate provided must be current.	☐
The relevant product is highlighted on the certificate where the certificate rates more than one product. Product names certified should match the product names specified or an explanation should be provided.	☐
Submission	
All inputs are consistent throughout the submission. Cross-check related credits are using the same values (e.g. area figures).	☐
Template submission folder has been re-named with Homestar code (e.g. AKD345), assessment type (Design or Built), and audit round (R1 or R2) e.g. AKD345BR1	☐
Homestar assessment has been uploaded to DropBox or similar file transfer site. Email link to project to homestar@nzgbc.org.nz. Note in the email if there are considerations the NZGBC should be aware of.	☐
If submitting for a built rating, the official address of each dwelling has been obtained and included in the Dwellings Registry aligned with the appropriate typology and sub-type.	☐

General Submission Guidance

- Please provide all the audit documents requested in the Homestar Technical Manual e.g. if the Homestar Technical Manual requests three documents be submitted, then all three documents must be submitted for the points to be verified.

- Any variance from the credit and/or assessment criteria requires the submission of a Technical Question. The Technical Question form can be downloaded from the NZGBC website. Technical Questions must be submitted, and a response received from the NZGBC, before the assessment is submitted for audit.
- Only submit documentation that is requested in the audit documentation i.e. submit only extracts from specifications but ensure that they are easily identifiable as related to the specific project and are contractually binding.
- Please submit a complete set of information for each Credit i.e. documentation required by more than one Credit should be submitted for each within each credit folder.

Beware of Common Mistakes

- Submission of the correct document type, that do not contain explicit demonstration of what Is required for audit.
    - Please read the wording of the Homestar Technical Manual carefully and ensure that all requirements are met.
- Submission of documents that fail to explicitly reference the subject dwelling
- Submission of documents that do not clearly demonstrate that they are contractually binding.
- Submission of lengthy documents that do not direct the auditor to wherein the relevant Information Is contained.

Please note that multiple failures to provide accurate and complete documentation will result in a direction to submit a further round.