

SB

Scheme By-laws – New Scheme

Strata Titles Act 1985

Part 4 Division 4

Scheme Number: **85750**

☐ I / ☒ **We**¹ the owner(s)² **Perron Developments Pty Ltd (ACN 000 230 446) and Sustainable Settlements Pty Ltd (ACN 169 286 337)** of land the subject of the plan described as³ **Lot 22 on Deposited Plan 424111** apply to the Registrar of Titles to have the scheme by-laws as set out below registered with ☐ **my** / ☒ **our**¹ Application to Register Strata Titles Scheme in respect of the above land.

Part 1 – Consolidated by-laws

In this part provide the full text of the scheme by-laws classified as governance or conduct and with the relevant by-law number.

Governance By-Laws

1. DUTIES OF OWNER

(1) The owner of a lot must:

- (a) immediately carry out all work that may be ordered under a written law in respect of the lot and pay all rates, taxes, charges, outgoings and assessments that may be payable in respect of the lot; and
- (b) maintain and repair the lot, and keep it in a state of good condition, reasonable wear and tear, and damage by fire, storm, tempest or act of God excepted.

(2) The owner of a lot must:

- (a) notify the strata company in writing immediately on becoming the owner of the lot, including in the notice the owner's address for service for the purposes of this Act; and
- (b) if required in writing by the strata company, notify the strata company of any mortgage or other dealing in connection with the lot, including in the case of a lease of a lot, the name of the lessee and the term of the lease.

2. POWER OF STRATA COMPANY REGARDING SUBMETERS

- (1) If the supply of electricity or any other utility to a lot is regulated by means of a submeter, the strata company may require the owner or occupier of the lot to pay the strata company by way of security for the payment of charges arising through the submeter an amount not exceeding \$200 and, if any amount so paid is applied by the strata company under sub-bylaw (2), to pay such further amount or amounts by way of such security as may be necessary to maintain the amount of the security as, subject to this sub-bylaw, the strata company may require.

¹ Select one.

² Insert the name(s) of the owners of land the subject of the plan.

³ Insert the description of parcel, e.g. Lot 1 on Deposited Plan 12345.

- (2) The strata company must lodge every sum received under this by-law to the credit of an interest-bearing ADI account and all interest accruing in respect of amounts so received must, subject to this by-law, be held on trust for the owner or occupier who made the payment.
- (3) If the owner or occupier of a lot in respect of which a submeter is used for the supply of electricity or any other utility refuses or fails to pay any charges due for the supply of that utility to that lot, the strata company may apply in payment of those charges all, or such part as is necessary, of any amount paid to the strata company by that owner or occupier under this by-law, including any interest that may have accrued in respect of that amount.
- (4) If a person who has paid an amount under this by-law to a strata company satisfies the strata company that the person is no longer the owner or occupier of a lot and that the strata company no longer has any liability or contingent liability for the electricity or other utility to that lot during the period when that person was an owner or occupier of the lot, the strata company must refund to that person the amount then held on the person's behalf under this by-law.

3. CONSTITUTION OF COUNCIL

- (1) The powers and duties of the strata company must, subject to any restriction imposed or direction given at a general meeting, be exercised and performed by the council of the strata company and a meeting of the council at which a quorum is present is competent to exercise all or any of the authorities, functions or powers of the council.
- (2) Until the first annual general meeting of the strata company, the owners of all the lots constitute the council.
- (3) The council consists of not less than 3 nor more than 7 of the owners of the lots, as is determined by the strata company.
- (4) If there are more than 3 lots in the scheme, subject to by-law 5, the members of the council must be elected at each annual general meeting of the strata company or, if the number of lots in the scheme increases to more than 3, at an extraordinary general meeting convened for the purpose.
- (5) If there are co-owners of a lot, 1 only of the co-owners is eligible to be, or to be elected to be, a member of the council and the co-owner who is so eligible must be nominated by the co-owners, but, if the co-owners fail to agree on a nominee, the co-owner who owns the largest share of the lot is the nominee or, if there is no co-owner who owns the largest share of the lot, the co-owner whose name appears first in the certificate of title for the lot is the nominee.
- (6) Except if the council consists of all the owners of lots in the scheme, excluding any member of the council appointed under by-law 5, the strata company may by special resolution remove any member of the council before the expiration of the member's term of office.
- (7) A member of the council vacates office as a member of the council:
 - (a) if the member dies or ceases to be an owner or co-owner of a lot;
 - (b) on receipt by the strata company of a written notice of the member's resignation from the office of member;
 - (c) at the conclusion of an annual general meeting of the strata company at which an election of members of the council takes place and at which the member is not elected or re-elected;
 - (d) in a case where the member is a member of the council by reason of there being not more than 3 owners of lots in the scheme, on an election of members of the council (as a result of there being an increase in the number of owners to more than 3) at which the member is not elected;
 - (e) if the member is removed from office under sub-by-law (6); or
 - (f) if the Tribunal orders that the member's appointment is revoked, and the member is removed from office.

- (g) The remaining members of the council may appoint a person eligible for election to the council to fill a vacancy in the office of a member of the council, other than a vacancy arising under sub-by-law (7)(c) or (d), and any person so appointed holds office, subject to this by-law, for the balance of the predecessor's term of office.
- (8) Except if 1 person is the owner of all of the lots in the scheme, a quorum of the council is 2 if the council consists of 3 or 4 members; 3, if it consists of 5 or 6 members; and 4, if it consists of 7 members.
- (9) The continuing members of the council may act even if there is a vacancy in the council, but so long as the number of members is reduced below the number fixed by these by-laws as the quorum of the council, the continuing members or member of the council may act for the purpose of increasing the number of members of the council or convening a general meeting of the strata company, but for no other purpose.
- (10) All acts done in good faith by the council, even if it is afterwards discovered that there was some defect in the appointment or continuance in office of any member of the council, are as valid as if that member had been duly appointed or had duly continued in office.

4. ELECTION OF COUNCIL AT GENERAL MEETING

The procedure for nomination and election of members of a council must be in accordance with the following rules:

- (1) The meeting must determine, in accordance with the requirements of by-law 3(3) the number of persons of whom the council is to consist.
- (2) The chairperson must call on those persons who are present at the meeting in person or by proxy and entitled to nominate candidates to nominate candidates for election to the council.
- (3) A nomination is ineffective unless supported by the consent of the nominee to the nomination, given:
 - (a) in writing, and furnished to the chairperson at the meeting; or
 - (b) orally by a nominee who is present at the meeting in person or by proxy.
- (4) When no further nominations are forthcoming, the chairperson:
 - (a) if the number of candidates equals the number of members of the council determined in accordance with the requirements of by-law 3(3), must declare those candidates to be elected as members of the council; and
 - (b) if the number of candidates exceeds the number of members of the council as so determined, must direct that a ballot be held.
- (5) If a ballot is to be held, the chairperson must:
 - (a) announce the names of the candidates; and
 - (b) cause to be furnished to each person entitled to vote and present in person or by proxy, a blank form in respect of each lot in respect of which the person is entitled to vote for use as a ballot form.
- (6) A person who is entitled to vote must complete a valid ballot form by:
 - (a) writing on the form the names of candidates, equal in number to the number of members of the council so that no name is repeated;
 - (b) indicating on the form the number of each lot in respect of which the person's vote is cast and whether the person so votes as owner or first mortgagee of each such lot or as proxy of the owner or first mortgagee;
 - (c) signing the ballot form; and
 - (d) returning it to the chairperson.
- (7) The chairperson, or a person appointed by the chairperson, must count the votes recorded on valid ballot forms in favour of each candidate.

- (8) Subject to sub-by-law (9) and by-law 5, candidates, being equal in number to the number of members of the council determined in accordance with by-law 3(3), who receive the highest numbers (in terms of lots or unit entitlements as required under the Strata Titles Act 1985 section 122) of votes are to be declared elected to the council.
- (9) If the number (in terms of lots or unit entitlements as required under the Strata Titles Act 1985 section 122) of votes recorded in favour of any candidate is the lowest of the numbers of votes referred to in sub-by-law (8) and:
- (a) that number equals the number of votes recorded in favour of any other candidate; and
 - (b) if each of those candidates were to be declared elected the number of persons elected would exceed the number of persons required to be elected, as between those candidates, the election must be decided by a show of hands of those entitled to vote and present in person or by proxy.

5. ORIGINAL PROPRIETOR ENTITLED TO BE MEMBER OF COUNCIL

Notwithstanding the provisions of any other by-law (including by-law 4) and the requirements for a ballot for the election of the members of council, where the original proprietor or any related person or company (within the meaning of the Corporations Act 2001) remains the owner of any lot, that person or company or its nominee shall be entitled to be a member of the council without the requirement to participate in any election of the council provided that that person or company properly nominates for such election of the council as prescribed in the by-law 4(3).

6. CHAIRPERSON, SECRETARY AND TREASURER OF COUNCIL

- (1) The members of a council must, at the first meeting of the council after they assume office as such members, appoint a chairperson, a secretary and a treasurer of the council.
- (2) A person:
- (a) must not be appointed to an office referred to in sub-by-law (1) unless the person is a member of the council; and
 - (b) may be appointed to 1 or more of those offices.
- (3) A person appointed to an office referred to in sub-by-law (1) holds office until the first of the following events happens:
- (a) the person ceases to be a member of the council under by-law 3(7);
 - (b) receipt by the strata company of a written notice of the person's resignation from that office; and
 - (c) another person is appointed by the council to hold that office.
- (4) The remaining members of the council must appoint a member of the council to fill a vacancy in an office referred to in sub-by-law (1), other than a vacancy arising under by-law 3(7)(c) or 3(7)(d), and any person so appointed holds office, subject to this by-law, for the balance of the predecessor's term of office.
- (5) The chairperson is to preside at all meetings of the council but, if the chairperson is absent from, or is unwilling or unable to preside at, a meeting, the members of the council present at that meeting can appoint 1 of their number to preside at that meeting during the absence of the chairperson.

7. CHAIRPERSON, SECRETARY AND TREASURER OF STRATA COMPANY

- (1) Subject to sub-by-law (2), the chairperson, secretary and treasurer of the council are also respectively the chairperson, secretary and treasurer of the strata company.
- (2) A strata company may at a general meeting authorise a person who is not an owner of a lot to act as the chairperson of the strata company for the purposes of that meeting.
- (3) A person appointed under sub-by-law (2) may act until the end of the meeting for which the person was appointed to act.

8. MEETINGS OF COUNCIL

- (1) At meetings of the council, all matters must be determined by a simple majority vote.
- (2) The council may:
 - (a) meet together for the conduct of business and adjourn and otherwise regulate its meetings as it thinks fit, but the council must meet when any member of the council gives to the other members not less than 7 days' notice of a meeting proposed by the member specifying in the notice the reason for calling the meeting;
 - (b) employ or engage, on behalf of the strata company, any person as it thinks is necessary to provide any goods, amenity or service to the strata company; or
 - (c) subject to any restriction imposed or direction given at a general meeting of the strata company, delegate to 1 or more of its members such of its powers and duties as it thinks fit, and at any time revoke the delegation.
- (3) A member of a council may appoint an owner of a lot, or an individual authorised under the Strata Titles Act 1985 section 136 by a corporation which is an owner of a lot, to act in the member's place as a member of the council at any meeting of the council.
- (4) An owner of a lot or individual may be appointed under sub-bylaw (3) whether or not that person is a member of the council.
- (5) If a person appointed under sub-bylaw (3) is a member of the council the person may, at any meeting of the council, separately vote in the person's capacity as a member and on behalf of the member in whose place the person has been appointed to act.

9. POWERS AND DUTIES OF SECRETARY OF STRATA COMPANY

The powers and duties of the secretary of a strata company include:

- (a) the preparation and distribution of minutes of meetings of the strata company and the submission of a motion for confirmation of the minutes of any meeting of the strata company at the next such meeting;
- (b) the giving on behalf of the strata company and of the council of the notices required to be given under the Act;
- (c) the supply of information on behalf of the strata company in accordance with the Strata Titles Act 1985 sections 108 and 109;
- (d) the answering of communications addressed to the strata company;
- (e) the calling of nominations of candidates for election as members of the council; and
- (f) subject to the Strata Titles Act 1985 sections 127, 128, 129, 200(2)(f) and (g) the convening of meetings of the strata company and of the council.

10. POWERS AND DUTIES OF TREASURER OF STRATA COMPANY

The powers and duties of the treasurer of a strata company include:

- (a) the notifying of owners of lots of any contributions levied under the Strata Titles Act 1985;
- (b) the receipt, acknowledgment and banking of and the accounting for any money paid to the strata company;
- (c) the preparation of any certificate applied for under the Strata Titles Act 1985 section 110; and
- (d) the keeping of the records of account referred to in the Strata Titles Act 1985 section 101 and the preparation of the statement of accounts referred to in the Strata Titles Act 1985 section 101.

11. COUNCIL CODE OF CONDUCT

- (1) A code of conduct for the council (**Council Code of Conduct**) shall be adopted for the scheme, with the initial Council Code of Conduct forming Annexure A.
- (2) The Council Code of Conduct may only be amended by special resolution of the strata company.
- (3) The strata company must, within 4 weeks of a person being elected to the council, provide that person with an induction concerning their role as a member of the council and provide them with an induction package which shall include (but is not limited to):
 - (a) a copy of the by-laws of the scheme;
 - (b) a copy of the Council Code of Conduct;
 - (c) a document providing a clear description of the council's preferred models of positive communication and collaborative decision-making processes and conflict resolution procedures; and
 - (d) a description of the council's roles and responsibilities.
- (4) All council members must undertake the induction and sign and abide by the Council Code of Conduct at all times.

12. THEME OF DEVELOPMENT

- (1) The scheme is intended to be a sustainable residential development forming one of a number of schemes (**Clusters**) in what is commonly referred to as Witchcliffe Ecovillage (**Ecovillage**). The Ecovillage is a master plan development of what was Lot 1500 on Deposited Plan 416913 (**Original Land**) in accordance with the structure plan approved by the Planning Commission for this land.
- (2) It is intended that the Ecovillage operate as a highly sustainable, self-reliant community in a regional village setting, incorporating modern technology and human settlement design to enable its community to:
 - (a) produce as much energy as it consumes;
 - (b) be self-sufficient in water;
 - (c) produce organic fresh food produce;
 - (d) create less waste;
 - (e) care for and regenerate the local environment;
 - (f) provide a high level of pedestrian, wheelchair and bicycle access throughout the Ecovillage;
 - (g) be socially diverse, inclusive, cooperative and resilient; and
 - (h) respect the culture and traditions of the Wardandi people, the traditional owners of the land.
- (3) The scheme must operate in a manner consistent with, and must promote, the objectives of the Ecovillage referred to in sub-by-law (2) of this by-law.
- (4) As part of the theme of the Development the lots comprising the scheme are permitted to be used for short stay accommodation provided that any use as short stay accommodation must be undertaken in compliance with Conduct 2 By-law 21.
- (5) The Ecovillage includes common land (**Ecovillage Commons**) intended to:
 - (a) provide infrastructure, facilities and services to the Ecovillage at large; and
 - (b) include conservation areas, recreational areas, water storage (dams) and wastewater treatment facilities and infrastructure for the Ecovillage.
- (6) The Ecovillage Commons is to be owned and administered by Ecovillage Commons Ltd ACN 646 707 486 (**ECL**) a not for profit company limited by guarantee whose ordinary members will be the strata companies for the Clusters in accordance with the planning approval for the Ecovillage.

- (7) The Ecovillage:
- (a) is intended to be constructed in a number of Clusters over a period of time (**Development Period**);
 - (b) will involve construction works during the Development Period that may generate noise, vibration, dust and other disturbance;
 - (c) is intended to involve a number of land uses and these land uses may involve noise and other disturbance (such as those common with commercial, tourism, agricultural and viticultural business); and
 - (d) will involve the granting of various rights and the creation of various obligations between the Clusters (including the scheme) and their members. Such rights and obligations may include but are not limited to:
 - (i) access to and use of pathways; and
 - (ii) access to and use of stormwater drainage and dam storage.
- (8) Each owner and occupier consents to, and must not make any objection or claim concerning the matters referred to in sub-bylaw (7) provided they are undertaken in accordance with the requirements of any applicable government authority.

13. ECOVILLAGE COMMONS LTD (ECL)

- (1) ECL is a company limited by guarantee:
- (a) whose Ordinary Members are to be the strata companies of each Cluster, who are to:
 - (i) each have a number of votes corresponding with the number of lots in that Cluster (excluding common property lots); and
 - (ii) provide representation at General Meetings of ECL as specified in the ECL constitution;
 - (b) who the original proprietors are the Founding Members (a different form of membership that will apply during the Development Period);
 - (c) who may have other classes of members as established pursuant to the constitution of ECL;
 - (d) whose Directors are to be appointed by the original proprietors during the Development Period (pursuant to the rights as Founding Members) and will thereafter be appointed by the Ordinary Members (and possibly any other class of membership should any be established) as specified in the constitution of ECL; and
 - (e) which is intended to be a not for profit organisation for the purposes of the *Australian Charities and Not-for-profits Commission Act 2012* (Cth) with the objective of facilitating sustainable environment, social and amenity outcomes in the Ecovillage.
- (2) ECL will:
- (a) own the Ecovillage Commons and be responsible for its maintenance, upkeep and operation;
 - (b) provide a representative forum for each Cluster (and their owners); and
 - (c) provide a non-potable water supply to each Cluster using the Stormwater Infrastructure.
- (3) ECL will charge its members, being the strata companies of the Clusters (subject to any other persons that may be admitted as members pursuant to the constitution of ECL), for any utilities, such as non-potable water, and goods and services it provides. Such charges are to be reasonable commercial charges based on:
- (a) the current and anticipated future costs and expenses of ECL; and
 - (b) the consumption of those utilities or goods and services by each respective Cluster.
- (4) Following expiry of the Development Period, ECL will charge its members, being the strata companies of the Clusters (subject to any other persons that may be admitted as members pursuant to the constitution

of ECL), proportionately for its costs and expenses (including those for maintenance and repair of the Ecovillage Commons) to the extent that the income received by ECL from its activities (such as non-potable water supply charges) are insufficient to do so. During the Development Period the original proprietor shall pay any such shortfall.

14. ELECTRICITY MICROGRID

- (1) In accordance with the sustainability theme of the scheme, the scheme is serviced by an electricity microgrid and every lot will be provided with a Tesla PowerWall battery or equivalent at the completion of the construction of the primary dwelling for that lot.
- (2) The strata company must:
 - (a) provide access to the microgrid to all lots;
 - (b) manage and administer the microgrid, including regular and accurate reading of meters; and
 - (c) maintain the microgrid including the Western Power single point connection and infrastructure to allow the trading of electricity between owners and the Western Power grid.
- (3) The strata company may appoint a third party to manage and administer the microgrid and its operation and maintenance including reading of meters.
- (4) The owner must adhere to all energy requirements of the Building Design Guidelines, including installing and maintaining compliant solar panels, inverter/s and a National Metering Identifier (**NMI**) certified meter (as advised by the Scheme Developer) at the time of construction to enable energy trading and billing to occur.
- (5) An owner or occupier must not disconnect any dwelling on their lot from the microgrid or their lot's household battery, unless for the purposes of servicing or replacement.
- (6) An owner or occupier may not replace the household battery on their lot other than with a battery system of no less capacity than the Tesla PowerWall or equivalent approved by strata council acting reasonably.
- (7) To the extent that there is any inconsistency with this by-law and by-law 2, this by-law shall prevail.

15. WATER MANAGEMENT

- (1) The common property, verges and Ecovillage Commons include stormwater collection, treatment and management infrastructure and facilities (**Stormwater Infrastructure**). The lots are to be provided with a deep sewerage service by a wastewater provider licensed by the Economic Regulation Authority of Western Australia.
- (2) In accordance with the sustainability theme of the scheme and planning approvals of the Ecovillage:
 - (a) the Stormwater Infrastructure is intended to provide a non-potable water source for irrigation for agricultural and landscaping purposes within the Ecovillage (although not the lots within this scheme) including those associated with the productive use of the garden and common property for each Cluster including verge areas.
- (3) An owner or occupier must not:
 - (a) obstruct or interfere with any Stormwater Infrastructure;
 - (b) discharge stormwater from their lot into common property in a manner so as to cause erosion or damage;
 - (c) disconnect any dwelling on their lot from the Ecovillage wastewater connection; or
 - (d) provide a greywater system which is not compliant with the standards of the Health Department of Western Australia.
- (4) It is not intended that the Stormwater Infrastructure will supply non-potable water to lots within the Scheme, but rather supply non-potable water to other Clusters in the Ecovillage, the Ecovillage Commons land, public open space and landscaped street verges.

- (5) This by-law may not be added to amended or repealed without the consent of the Shire of Augusta Margaret River.

16. DEVELOPMENT OF LOT

- (1) The scheme is subject to:
- (a) a local development plan approved by the local government (**Local Development Plan**); and
 - (b) building design guidelines a copy of which, at the date of registration of these by-laws, forms Annexure B (**Building Design Guidelines**).
- (2) The Local Development Plan may be amended with the consent of the local government.
- (3) The Building Design Guidelines may be amended from time to time by the council to adapt to changes to government policies, building code requirements, availability of materials, sustainable technology innovations and the like.
- (4) An owner must not construct, erect or install, or permit to be constructed or erected or installed on their lot any building or building addition unless:
- (a) it is compliant with the Local Development Plan and Building Design Guidelines;
 - (b) they have first:
 - (i) submitted the building plans (including elevations and external colours and materials) to the council;
 - (ii) the council has approved such plans; and
 - (iii) the building is constructed strictly in accordance with those approved plans. For the avoidance of doubt an owner must not vary any building or building addition from its approved plans without the variations themselves being approved under this by-law);
 - (c) they have first provided a Maintenance Bond in accordance with by-law 19;
 - (d) those works are approved by the strata company pursuant to sections 88 and 89 of the Act (if applicable); and
 - (e) those works are undertaken in accordance with a valid building licence issued by the local government.
- (5) The council may not unreasonably withhold, delay or condition its approval pursuant to by-law 16(4)(b) where the building plans comply with the Local Development Plan and Building Design Guidelines.
- (6) The council may employ an appropriately qualified consultant to assist in the assessment of any building plans pursuant to this by-law and may levy the reasonable costs of such consultant to the owner of that lot (which shall be treated as a levy raised in accordance with the Act against that owner and be payable within 14 days of demand).
- (7) All requests to the council for assessment and approval of building plans must be processed by the council within 45 days of receipt in writing.
- (8) An owner must do all things reasonably required to obtain all necessary approvals (including pursuant to this by-law) and undertake all necessary actions to:
- (a) commence construction of a dwelling on their lot within 36 months of the date they, or their successor in title, settled on the purchase of the lot from the original proprietor; and
 - (b) complete construction of such dwelling within 48 months of the date they, or their successor in title, settled on the purchase of the lot from the original proprietor.
- (9) An owner may apply to the council for an extension to the construction start and completion timeframes referred to in sub-by-law (8) if extenuating financial or personal circumstances apply.
- (10) An owner must and must ensure that their selected builder and subcontractors do:

- (a) manage construction waste so as to minimise such waste and undertake to re-use and recycle construction waste wherever possible;
 - (b) provide a waste management plan to the strata company in accordance with the WA Master Builders' Smart Waste Guide; and
 - (c) minimise (in accordance with normal building practice and the requirements of the local government) any nuisance that construction of that dwelling may cause to neighbouring land owners, including but not limited to nuisance by reason of noise and dust.
- (11) An owner must do all things reasonably necessary to ensure minimal damage to roads, paths and landscaping of verges occurs as a result of the development of their lot and must on demand reimburse the strata company for any associated repair or replacement costs in this regard.
- (12) An owner or occupier must not remove, disable or allow to become dysfunctional any sustainability infrastructure required by the Building Design Guidelines unless the council provides prior written approval to replace such infrastructure with equivalent infrastructure without compromise of the original sustainability objective.
- (13) For a period of 36 months following registration of the scheme, the strata company and council irrevocably appoint the original proprietor as their agent for the purpose of this by-law, including approving building plans and any request for an extension to construction start or completion timeframes.

17. ANCILLARY DWELLINGS

An owner may construct an ancillary dwelling on a lot provided that:

- (a) the ancillary dwelling does not have a floorplan area exceeding 70m² and provides sufficient additional water storage in accordance with the Residential Water Supply Handbook, a copy of which forms **Annexure C**;
- (b) the ancillary dwelling is compliant with:
 - (i) the R-Codes;
 - (ii) the Local Planning Scheme of the local government; and
 - (iii) the Local Development Plan and Building Design Guidelines; and
- (c) the owner complies with by-law 16.

18. FENCING

- (1) The fencing for a lot must comply with the relevant requirements of the Local Development Plan and Building Design Guidelines.
- (2) An owner must maintain any boundary fencing in an attractive and functional state.
- (3) An owner must clearly define the boundary of their lot with a fence or landscaping.
- (4) An owner may provide a gate to the north boundary of their lot to access the adjacent Public Open Space.

19. MAINTENANCE BOND

- (1) An owner must lodge a bond of \$2,000.00 with the strata company before commencing construction of any building on their lot (**Maintenance Bond**).
- (2) The onus is on the owner to identify any defects to the common property before payment of the Maintenance Bond.
- (3) On completion of the building, an inspection of the common property, verge or public open space area will be carried out by the owner and a member of the council or the council's representative to identify any damage to the common property verge or public open space area caused by construction of the building.

- (4) If the inspection is satisfactory and there is no damage to the common property, verge or public open space area requiring repair, the Maintenance Bond must be returned to the owner within 14 days of this inspection.
- (5) If the inspection identifies damage to the common property, verge or public open space area the strata company shall retain the Maintenance Bond and use the funds to repair the damage. The strata company shall if necessary also levy the owner the cost of repairing any damage should these exceed the amount of the Maintenance Bond (which shall be treated as a levy raised in accordance with the Act against that owner and be payable within 14 days of demand). Should the amount of the Maintenance Bond exceed the cost of repairs the balance of the Maintenance Bond must be returned to the owner within 14 days or completion of the repairs.
- (6) For a period of 48 months following registration of the scheme, the strata company and council irrevocably appoint the original proprietor as their agent and representative to undertake the inspection and organize any required repairs pursuant to this by-law.

20. BUSHFIRE MANAGEMENT PLAN

- (1) The Original Land is subject to:
 - (a) the bushfire management plan submitted to the Local Authority and Department of Fire and Emergency Services and applicable for the Ecovillage, which at the date of preparation of this Contract is the Bushfire Management Plan for Lots 2807 and 2812 Bussell Highway Witchcliffe prepared by RUIC Fire (Rural Fire Risk Consultancy Pty Ltd) and dated January 2016 and as amended by Ecosystems Solutions in 2019. (**Bushfire Management Plan**); and
 - (b) a Bushfire Landscape Management Plan which has been developed by the original proprietors and is reflective of the requirements of the local authority setting out the management responsibilities of ECL, the strata companies for each of the Clusters (including this scheme) and the lot owners for each of the Clusters (including this scheme).
- (2) The Bushfire Landscape Management Plan may only be amended by resolution of the Directors of ECL and where the amendment is consistent with the relevant requirements of the local authority.
- (3) The strata company must retain a copy of the Bushfire Management Plan and Bushfire Landscape Management Plan.
- (4) The strata company and all owners and occupiers must comply with the requirements of the Bushfire Management Plan and Bushfire Landscape Management Plan to the extent that they are applicable to the scheme and their lot, the terms of which the strata company may enforce against an owner or occupier as if they are a by-law and set out in this by-law itself.

21. MANAGEMENT OF VERGES

- (1) The strata company will enter into and periodically update, if required, a verge management agreement with the local government, as per local planning policies.
- (2) In accordance with the sustainability essence and theme of the scheme, an owner must maintain all landscaping provided on the verge of their lot (where the local government approves such landscaping) including fruit trees, shrubs, and drainage swales:
 - (a) in accordance with organic principles;
 - (b) in a manner that will ensure public safety and amenity; and
 - (c) to the satisfaction of the local government (including in compliance with the requirements of any required verge management agreement).
- (3) If an owner does not maintain their verge in accordance with the requirements of by-law (2), the strata company may carry out any maintenance work reasonably necessary to meet those requirements and levy the owner for all cost and expense of doing so (which shall be treated as a levy raised in accordance with the Act against that owner and be payable within 14 days of demand).

22. MANAGEMENT OF COMMON PROPERTY

- (1) The Common Property of this Cluster consists of:
 - (a) common property lot "CP 10", a 306 m2 area including walkway located between lots 4 and 5 and native garden landscaping. It is a public access pathway and public access may not be impeded.; and
 - (b) common property lot "CP 1a", a 7m2 area which houses the strata microgrid switchboard.
- (2) In accordance with the sustainability essence and theme of the scheme, the strata company will maintain all garden areas located on common property as native vegetation landscaping.
- (3) The strata company will be responsible for:
 - (a) the financial management of the Common Property area;
 - (b) the implementation of organic gardening principles and practices; and
 - (c) ensuring that the common property walkway is maintained free of problematic weeds and/or pests.
- (4) In accordance with the sustainability essence and theme of the scheme, the strata company will maintain all garden areas located on common property as attractive native gardens.
- (5) The strata company will be responsible for:
 - (a) the financial management of the community garden area;
 - (b) the implementation of organic gardening principles and practices; and
 - (c) the organisation of busy bees or community participation activities if required.

23. LEVYING OF COSTS AND EXPENSES OTHER THAN ON A PROPORTIONATE UNIT ENTITLEMENT BASIS

- (1) Where the amount of any cost or expense incurred by the strata company is calculated by reference to the number of lots comprising the scheme (such as connection or service fees charged for utilities such as non-potable water), such cost or expense shall be levied to the owner of each lot equally and not in proportion to the unit entitlements of the respective lots.
- (2) Where any cost or expense charged to or incurred by the strata company relates solely to one or more lots (**Specified Lots**), but does not relate to all lots in the scheme, the strata company may levy such cost or expense solely on those Specified Lots and may do so in proportion to the amount that the strata company, acting reasonably, determines each Specified Lot has contributed to that cost or expense and not in proportion to the unit entitlements of those Specified Lots.

24. DISTRIBUTION OF COMMUNALLY GENERATED PROFITS

The strata company will make decisions concerning the distribution of any profits resulting from communal activities, including the sale of excess energy, and for the purpose of making such decisions may take into account the participation of each owner or occupier in the specific communal activity and result in a distribution on a basis other than the proportionate unit entitlement between owners.

25. OCCUPIERS TO BE BOUND BY THESE BY-LAWS

- (1) An occupier, including without limiting the generality of the term, any lessee or licensee of the owner or occupier shall be bound by these by-laws.
- (2) An owner or occupier must ensure that their invitees comply with these by-laws whilst upon the scheme.

26. STRATA COMPANY APPROVAL

When in these by-laws the consent of the strata company or the council is required, such consent:

- (a) may be withheld;
- (b) may be given on conditions including payment of a fee or insurance premium; and
- (c) may be withdrawn,

as the strata company or council, as the case may be, shall reasonably determine.

27. RECOVERY OF MONEY BY THE STRATA COMPANY

- (1) An owner must pay on demand to the strata company on a full indemnity basis all costs and expenses which the strata company pays, incurs or expends in consequence of:
- (a) any breach of the Act;
 - (b) any default in the performance or observance of any by-laws; and/or by the owner or occupier of that lot (including the making good of any damage caused by any such default or breach) including, but not limited to, recovery of strata company levies or contributions; and/or
 - (c) the pursuit and recovery of monies owing by an owner, including interest chargeable in accordance with the Act and the Regulations.

Such costs shall include the cost of engaging any strata manager (including any justifiable expenses of the strata manager outside of their normal duties as detailed in its agreement with the strata company), any solicitor and/or any debt collector.

- (2) If the strata company expends money to make good damage caused by a breach of the Act or the by-laws by any owner or occupier or their servants, agents, contractors, invitees or licensees, or incurs any other costs, expense or claim, the strata company shall, where permitted by law:
- (a) be entitled to recover that amount (and the costs of recovery) from the person who was the owner at the time when the breach occurred, whether or not they were the person who caused such expense; and
 - (b) if necessary, be recoverable as a debt in a Court of competent jurisdiction.
- (3) Any cost and expense payable by an owner pursuant to this by-law shall be levied on the owner as if levied in accordance with the Act and be payable within 14 days of demand.

Conduct By-Laws

1. VEHICLE OBLIGATIONS

- (1) An owner or occupier must:
- (a) not at any time, park or stand a motor vehicle or other vehicle on:
 - (i) the verge that forms part of the road reserve;
 - (ii) any other vacant strata lot; or
 - (iii) any part of the common property; and
 - (b) take all reasonable steps to ensure that the owner's or occupier's visitors comply with the scheme by-laws relating to the parking of motor vehicles.
- (2) To ensure reasonable peace and enjoyment of the scheme an owner or occupier shall not be permitted to park a motor vehicle or other vehicle within the parcel boundaries whose exhaust noise emissions do not comply with noise decibel limits imposed by the Road Traffic (Vehicle Standards) Rules 2002 – Reg 144 or any replacement of those rules.
- (3) For the purposes of this by-law “other vehicle” means, trailers, caravans, camper vans, boats on trailers, motor vehicles used for commercial purposes, motorcycles and any other related type of vehicle.

2. STRATA COMPANY RESPONSIBILITY

- (1) The strata company will maintain:
- (a) the gardens not forming part of any lot;
 - (b) pathways;
 - (c) the microgrid;
 - (d) any security lighting within the common property; and
 - (e) any other common property within the scheme.
- (2) Notwithstanding the above, to the extent that fittings, fixtures and systems are connected to the common property for the use of all, the strata company will be responsible for maintenance of the fittings, fixtures and systems and the running costs thereof proportionate to the extent of their use for such purposes.

3. USE OF LOT AND COMMON PROPERTY

An owner or occupier of a lot must:

- (a) use and enjoy the common property in such a manner as not unreasonably to interfere with the use and enjoyment of the common property by other owners or occupiers of lots or of their visitors;
- (b) not obstruct lawful use of common property by any person;
- (c) not store any items in or upon the common property (without the consent of the strata company);
- (d) not use the lot or permit it to be used in such manner or for such purpose as causes a nuisance to an occupier of another lot (whether an owner or not) or the family of such an occupier;
- (e) not make undue noise in or about any lot or common property;
- (f) take all reasonable steps to ensure that the owner's or occupier's visitors do not behave in a manner likely to interfere with the peaceful enjoyment of an owner or occupier of another lot or of a person lawfully using common property;
- (g) not carry out any activities (including using common property) that:
 - (i) is illegal, injurious to the reputation of the strata company or contravenes any regulation, by-law, or statute of the local government or any other government or regulating authority;
 - (ii) causes noise or inconvenience to the occupiers of any neighbouring properties; and

- (iii) allows any undue noise, odours or other matters which would unreasonably cause damage, nuisance or disturbance to other owners or occupants;
- (h) not allow a child to play upon any area of the common property that is a danger to children;
- (i) not use any part of the common property for their own purposes to the exclusion of others, save as otherwise permitted by these by-laws and
- (j) notwithstanding any other provision of this by-law, give at least 7 days' notice to the council and neighbours if planning to hold an event (such as a party) which might create additional noise or disturbance.

4. INTERFERENCE WITH COMMON PROPERTY

- (1) An owner or occupier must not:
- (a) damage common property, except for reasonable wear and tear during its use for the purposes for which it is intended for use; or
 - (b) without the written authority of the strata company:
 - (i) interfere with the operation of any plant and equipment comprising common property; or
 - (ii) remove any article from the common property placed there by direction or authority of the strata company and must use all reasonable endeavours to ensure that those articles are used only for their intended use and not damaged.
- (2) An owner or occupier must not:
- (a) allow to be held any public auction on the common property; or
 - (b) do anything which may prejudice the security or safety of the common property.

5. DAMAGE TO COMMON PROPERTY

- (1) An owner or occupier will be responsible for any damage to any part of the common property through misuse by the owner or occupier or their employees, agents and other invitees and shall be levied for the cost and expense of any repairs to make good the damage (which shall be treated as a levy raised in accordance with the Act and be payable within 14 days of demand).
- (2) An owner or occupier must immediately notify the strata company on becoming aware of any damage to or defect in the common property (which includes all services and equipment).

6. DAMAGE TO GARDENS ON COMMON PROPERTY

Except with the prior written approval of the strata company, an owner or occupier must not and must not permit any other person to:

- (a) damage or move any plant, tree, garden bed, lawn or infrastructure located on common property;
- (b) plant any tree, shrub or plant on common property without council permission;
- (c) construct or erect any building, shed, greenhouse, treehouse or other structure on common property; or
- (d) use non-organic fertilisers, herbicides or pesticides on common property.

7. BEHAVIOUR OF OWNERS AND OCCUPIERS

An owner or occupier of a lot or their guests must be adequately clothed when on common property and must not use language or behave in a manner likely to cause offence or embarrassment to an owner or occupier of another lot or to any person lawfully using common property.

8. DEPOSITING OF RUBBISH ON COMMON PROPERTY

An owner or occupier must not (and must ensure that their servants, agents, contractors, invitees or licensees do not) deposit or throw upon that lot or any other lot or the common property any rubbish or

other material likely to interfere with the peaceful enjoyment of another owner or occupier or guest or any other person lawfully using the common property.

9. ADDITIONAL DUTIES OF OWNERS/OCCUPIERS

An owner or occupier must:

- (a) ensure that their servants, agents, contractors, invitees or licensees comply with the provisions of the by-laws and shall do all such things as a reasonably necessary to ensure that any servant, agent, invitee or licensee who fails to comply with any by-law vacates the parcel as soon as possible;
- (b) not use chemical pesticides, herbicides, and/or fertilisers within a lot or community garden areas, unless the products are allowed by the Witchcliffe Ecovillage Residents Handbook, a copy of which will be retained by the strata company and may be amended from time to time by the council in order to accommodate future changes to organic practices and product availability;
- (c) not allow any vegetation on their lot to obstruct the winter solar access of approved buildings or the photovoltaic (PV) panels of any other lot; and
- (d) not excavate a hole deeper than 500mm on common property, easement areas or verges without first consulting the council to ensure that the safety and integrity of the wastewater or microgrid infrastructure is preserved.

10. NOTICE OF ALTERATION TO LOT

An owner of a lot must not alter or permit the alteration of the structure of the lot except as may be permitted and provided for under the Act and the by-laws and in any event must not alter the structure of the lot without giving to the strata company, not later than 14 days before commencement of the alteration, a written notice describing the proposed alteration.

11. GARDENS AND LANDSCAPING WITHIN A LOT

An owner or occupier must maintain the gardens and landscaping of that lot to a reasonable standard in keeping with the appearance of the scheme and the Ecovillage Sustainability Objectives including, without limitation, ensuring that:

- (a) all plants are cared for in accordance with organic principles; and
- (b) vegetation does not obstruct the winter solar access of approved buildings and solar panels on any other lot.

12. VERMIN, PESTS AND INSECT INFESTATION

- (1) An owner or occupier must keep their lot clean and reasonably free from infestation from vermin, pests and insects.
- (2) An owner or occupier must not use poison baits or non-organic chemicals / sprays for the management of pests, vermin and insects:
 - (a) on common property without the prior written approval of the council;
 - (b) on their lot unless the poison is formulated to have a reduced risk to non-target species, and is contained within a bait station; or
 - (c) on their lot unless the poison or non-organic chemical is an allowable input as scheduled in the Witchcliffe Ecovillage Residents Handbook.

13. SAFETY AND SECURITY

An owner or occupier must:

- (a) take all reasonable steps to maintain the safety and security of the parcel;
- (b) notify the council immediately if they become aware of any threat to the scheme;

- (c) comply with all directions of the council concerning the safety and security of the scheme;
- (d) not interfere with any security or safety equipment and use such equipment only in the manner it is intended when appropriate to do so; and
- (e) ensure compliance with all statutory and other requirements relating to fire safety in respect of the lot, including maintenance of smoke detectors in any building.

14. LIMITING ACCESS TO PARTS OF COMMON PROPERTY

The strata company may take measures to ensure the security and to preserve the safety of the common property and the lots from damage, fire or other hazards and, without limitation, may in respect of any part of the common property not required for access to a lot, close off on either a temporary or permanent basis, or otherwise restrict the access to, or use by, the owners or occupiers.

15. STORAGE AND USE OF DANGEROUS GOODS

- (1) An owner or occupier shall not be permitted to use or store upon any part of a lot or common property any Dangerous Good (as defined under the Dangerous Goods Safety Act 2004 in the Dangerous Goods Regulations 2007) including flammable gases, liquids, chemicals.
- (2) This by-law does not apply to:
 - (a) chemicals, liquids, gases or other material used or intended to be used for domestic purposes; or
 - (b) any chemical, liquid, gas or other material in a fuel tank of a motor vehicle or internal combustion engine.

16. WASTE MANAGEMENT

An owner or occupier must:

- (a) maintain within their lot in clean and dry condition and adequately covered, receptacles for the responsible management of household waste including recyclables, reusables and organic waste;
- (b) comply with all local laws relating to the disposal of waste; and
- (c) ensure that the health, hygiene and comfort of the owner or occupier or guest of any other lot is not adversely affected by their waste management.

17. SUSTAINABILITY COMMITMENT AND CODE OF CONDUCT

- (1) The scheme must adopt and implement a commitment and code of conduct concerning sustainable living (**Sustainability Commitment and Code of Conduct**).
- (2) The initial Sustainability Commitment and Code of Conduct forms Annexure D and may only be amended by special resolution of the strata company.
- (3) All owners and occupiers must comply with the Sustainability Commitment and Code of Conduct, the terms of which the strata company may enforce as if they are a by-law and set out in this by-law itself.

18. INSTRUCTING OF CONTRACTORS BY OWNERS

- (1) An owner or occupier shall not directly instruct any contractors or workmen employed by the strata company unless authorised by the strata company.
- (2) Any owner or occupier instructing any contractor or workmen without authorisation from the strata company shall:
 - (a) be responsible personally for the payment of such contractor or workmen and for the cost of removing or altering any such work which the strata company deems unsatisfactory; and
 - (b) indemnify the strata company against any costs, claims or liabilities arising from the improper instructions given to contractors or workmen,

and the strata company may levy the owner for all such amounts (which shall be treated as a levy raised in accordance with the Act and be payable within 14 days of demand).

19. NO SMOKING

No owner or occupier or invitee may smoke any tobacco or other substance in or on any part of the common property.

20. HOUSE RULES

- (1) The council may make rules from time to time in respect of the management, order, standards and operation of the common property including communal facilities of the scheme (**House Rules**).
- (2) The strata company shall ensure that any House Rules are displayed in a prominent position on areas to which they apply and that a copy is given to all owners.

21. SHORT STAY USE

- (1) An owner must not lease or licence a dwelling located on their lot as short stay accommodation unless the owner or other manager of that accommodation:
 - (a) is a permanent resident of another lot in the Ecovillage, or the manager of a tourism accommodation management company lawfully operating from a premises in the Ecovillage, or, if a manager located within the Ecovillage is not available or suitable, a manager of a tourism accommodation management company lawfully operating from premises within the Augusta Margaret River Shire;
 - (b) provides at all times to the council the current 24-hour accessible contact details of the owner and any other manager of that accommodation;
 - (c) maintains approval for short stay accommodation from the local government in accordance with all applicable policies and regulations;
 - (d) maintains an appropriate level of insurance required for short stay accommodation;
 - (e) ensures all health and safety requirements pertaining to short stay accommodation are complied with;
 - (f) takes all reasonable steps to ensure that all tenants are informed of and observe the strata company by-laws;
 - (g) takes all reasonable steps to ensure that all tenants or visitors comply with any restrictions to Ecovillage Commons land access imposed upon visitors or tenants as communicated by Ecovillage Commons Limited from time to time;
 - (h) takes all reasonable steps to ensure that all tenants do not behave in a manner likely to interfere with the peaceful enjoyment of any owner or occupier of any other lot or any person lawfully using the common property; and
 - (i) manages and advertises the short-stay accommodation as environmentally friendly sustainable accommodation in line with the overarching theme and vision of the Ecovillage, including providing guests with Ecovillage specific educational material, prominently displaying a summary of relevant conduct bylaws and a summary of Ecovillage Visitor rules as provided by the Original Proprietor and updated by Ecovillage Commons Limited from time to time, and implementing sustainable waste management practices.
- (2) For the purposes of this by-law short stay occupation means a period of occupation of less than 90 days or as otherwise defined by planning policies of the local government.

22. LEASING OF LOTS

Prior to the leasing of a lot, the owner shall before the commencement date of such lease:

- (a) inform the strata company of the name of the owner's managing agent for the lot (if any) and, excluding a lease for a period of less than 30 days, the name of the lessee. This information shall be recorded on the strata company roll;

- (b) provide the lessee with a copy of the by-laws, Sustainability Commitment and Code of Conduct, Witchcliffe Ecovillage Sustainability Infrastructure Disclosure Form and any House Rules; and
- (c) provide to the strata company a copy of an executed lease (unless the lease is for a period of less than 30 days) and ensure that such lease states that any non-compliance with the by-laws of the strata company shall be a default under the terms of such lease.

23. RESALE OF LOTS

- (1) The council must maintain a disclosure form concerning the sustainability infrastructure of the scheme and Ecovillage (**Witchcliffe Ecovillage Sustainability Infrastructure Disclosure Form**).
- (2) The initial Witchcliffe Ecovillage Sustainability Infrastructure Disclosure Form comprises Annexure E.
- (3) Any owner who intends to sell or otherwise dispose of their lot must prior to entering into any contract of sale or other agreement concerning the same provide to any prospective buyer/transferee:
 - (a) a completed Witchcliffe Ecovillage Sustainability Infrastructure Disclosure Form;
 - (b) a copy of the Sustainability Commitment and Code of Conduct; and
 - (c) a copy of the Local Development Plan and Building Design Guidelines.

24. KEEPING OF PETS

- (1) In this by-law Excluded Dog means:
 - (a) a pit bull terrier;
 - (b) an American pit bull terrier;
 - (c) any other outcross;
 - (d) any dog prohibited from importation into Australia by the Commonwealth government; and
 - (e) an unregistered or dangerous dog under the Dog Act 1976.
- (2) An owner or occupier may keep within their lot without the consent of the strata company any breed of dog which:
 - (a) is not an Excluded Dog; and
 - (b) is licensed and microchipped;
- (3) An owner or occupier must not keep any cat on or within their lot.
- (4) If an owner or occupier keeps in their lot an animal permitted under these by-laws, then they must ensure that:
 - (a) the animal is at all times kept under control and within the confines of their lot;
 - (b) dogs must be housed inside a building on the lot between the hours of 7:00pm and 6:00am to protect nocturnal wildlife and reduce risk of nuisance barking;
 - (c) when in or on any other part of the common property, the animal is at all times restrained on a leash or in a suitable temporary cage (e.g., chicken tractor); and
 - (d) the animal is effectively managed to ensure no nuisance (including by reason of barking).
- (5) This by-law:
 - (a) applies to any person in a lot or on common property with the express or implied consent of that owner or occupier; and
 - (b) does not prevent the keeping of an assistance animal by a person with a disability.
- (6) Where an owner or occupier is in breach of this by-law, including where an owner or occupier keeps a cat on their lot, the strata company will be entitled to require the immediate removal of the animal from

the scheme, provided that the strata company may not require the removal of any permitted animal by reason of a breach of sub-bylaw (4) unless:

- (a) the strata company has provided a written notice of the breach to the owner or occupier warning of the removal should the breach not be remedied within not less than 7 days and that breach is not remedied within that period; or
- (b) there are more than 5 breaches for which notice is provided to the owner or occupier concerning that dog in any 12 month period.

25. DISPUTE RESOLUTION PROCEDURE

- (1) The council must determine, maintain and amend from time to time a grievance procedure and decision making or communication model that is acceptable to a majority of the council.
- (2) In the event that an owner bound by the terms of these by-laws is in dispute with another owner or the strata company and such parties cannot resolve such a dispute through the council's agreed upon decision making procedures and communication models then it shall be determined by an independent expert as follows:
 - (a) if the dispute relates to legal issues, the dispute will be referred to a suitably qualified legal practitioner or mediator;
 - (b) if the dispute relates to monetary or financial issues, the dispute will be referred to a suitably qualified accountant; and
 - (c) if the dispute relates to the design of improvements or structural matters, the dispute will be referred to a suitably qualified architect or engineer.
- (3) If the parties cannot agree on the appropriate expert to whom the dispute is to be referred within 14 days of the dispute arising, the expert will be appointed by the President of the Law Society of Western Australia.
- (4) The parties and strata company may each submit to the expert written submissions within twenty one (21) days of the expert's appointment but may not make oral submissions or adduce any evidence. A copy of all submissions to the expert shall be provided contemporaneously to the other party and strata company. Within twenty eight (28) days of the expert's appointment the parties and strata company may each forward to the expert written comments on the other party's written submissions. For the purposes of this by-law time shall be of the essence.
- (5) The expert shall take into consideration any written submissions received within those periods but is not fettered by them and shall determine the dispute in accordance with their own judgment.
- (6) The decision of the expert will be final and binding on the parties to the dispute and the parties to the dispute will pay the costs of the expert equally.

ANNEXURE A - COUNCIL CODE OF CONDUCT

As an elected member of the Witchcliffe Ecovillage Cluster 4D Council, I agree that at all times I will:

1. Be committed to acquiring an understanding of the *Strata Title Act WA 1985* (or other relevant legislation as amended or superseded), this strata scheme, and all by-laws concerning this strata scheme.
2. Act honestly and fairly and not unreasonably disclose information held by the Strata Council, including information about a proprietor or occupier.
3. Act in the best interests of the Strata Council unless it is unlawful to do so.
4. Not cause a nuisance or otherwise behave in a way to bring disrepute or diminish the good reputation of this Strata Council.
5. Respect fellow members' opinions and differences and foster a spirit of teamwork and co-operation.
6. Be committed to attending all meetings of the Strata Council other than in exceptional circumstances.
7. Comply with Strata Council processes and procedure as determined by the Strata Council from time to time, including using agreed upon decision making and communication models.
8. Disclose to the Strata Council any conflict of interest I may have in a matter before the Strata Council and not vote on such matters.
9. Resolve conflicts or disagreements in a timely and respectful manner, with recourse to Strata Council endorsed methods/models of decision making / positive communication where necessary.

Signed:

Date:

ANNEXURE B - BUILDING DESIGN GUIDELINES



BUILDING DESIGN GUIDELINES

Updated September 2021

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BDG October 2020_Rev A © Sustainable Settlements Pty Ltd

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Document	Revision	Date Issued
WEV Building Design Guidelines	- A	October 2020 September 2021

Acknowledgement of Country

The Witchcliffe Ecovillage is located within the traditional lands of the Wardandi and Bibulmen/Pibelman peoples.

We acknowledge the Wardandi and Bibulmen/Pibelman peoples as the Traditional Custodians of the land, we respect their continuing connection to land, water, spirit and community, and we honour their unique cultural and spiritual relationships to the land.

We pay our respects to their ancestors and Elders past, present and emerging.

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A. SETTING THE SCENE

"It's a revolution. But it's the sort of revolution that no one will notice. It might get a little shadier. Buildings might function better. You might [need] less money [...] because your food is all around you and you don't have any energy costs. Giant amounts of money might be freed up in society so that we can provide for ourselves better. So it's a revolution."

~ Bill Mollison, co-founder of the Permaculture movement



1. Introduction

The Witchcliffe Ecovillage is a joint venture project between Sustainable Settlements Pty and Perron Developments Pty Ltd, and the culmination of a 20-year partnership focused on the design and development of small-scale, environmentally sensitive land developments. The Ecovillage is a unique development of multiple clustered survey strata schemes surrounding community gardens, united by joint custodianship of Ecovillage Common land, and bound by Ecovillage management statements and bylaws.

The Ecovillage has been master-planned to create a highly sustainable village that provides for as much of the community's day-to-day needs as possible. It responds to the site's location, topography and environmental features, and retains and conserves the land's remnant bush and creek lines. Working within local and State planning requirements and best practice sustainability outcomes, it provides for:

- Approx. 320 residential lots, ranging in size from 360m² to 2000m²
- Optimum solar orientation to all residential lots, with guaranteed solar access to the living rooms of all homes
- A Village Square with café, tavern, nature playground and outdoor meeting places
- 11 community gardens with productive landscaping and shared amenities
- Organic market garden lots
- Aged Care and affordable housing
- Commercial lots for retail, hospitality, food processing and value adding
- Innovation hub (business incubator), childcare centre
- Tourism lots, holiday homes and backpackers' accommodation
- A playing field and community hall
- 27.9 ha of Ecovillage community owned land, including 3 dams for storage of stormwater for irrigation as well as 3 dedicated conservation areas
- Pathways connecting all community gardens and open spaces to promote an active healthy community.





1.1 The Witchcliffe Ecovillage Vision

Our vision is to create a highly sustainable, self-reliant community in a regional village setting, incorporating the best of 21st century technology and human settlement design to enable Ecovillage residents to:

- be 100% self-sufficient in renewable energy;
- be 100% self-sufficient in water;
- grow their own organic fresh food;
- create less waste and reduce carbon emissions;
- care for the local environment;
- generate ongoing economic and social opportunities;
- foster creativity and innovation; and
- create an inclusive, active, cooperative, and resilient community.

The Witchcliffe Ecovillage is a place where people can live, work, socialise, and provide for their material needs sustainably; where most of what they consume on a daily basis can be produced within the Ecovillage; where built form, productive landscapes, natural environments, native flora and fauna, sustainable technology, and community exist in harmony and complement the existing rural character of Witchcliffe.

In time, the Witchcliffe Ecovillage will grow to be a model demonstration village where people can come to learn how to live more sustainably, with ample opportunities throughout for ecotourism, research and education.



1.2 The Cluster Garden Layout

"We're only truly secure when we can look out our kitchen window and see our food growing and our friends working nearby."

~ Bill Mollison

The Ecovillage residential cluster layouts have been carefully designed to optimise solar access to all lots, manage the flow of stormwater via overland living streams to the community dams, and provide generous private and shared garden spaces. Each cluster surrounds a community garden that includes exclusive use areas adjacent to each home for productive allotment style veggie gardens, shared netted fruit orchards and chicken run, a community building/shed, nature play area, an electric vehicle charger, and a visitor parking area. A network of garden paths connects the clusters and provides safe pedestrian and bike trails throughout the Ecovillage. Each cluster has a range of lot sizes which fall into 3 types:

Groupies

Designed to provide an affordable option within the village, these 360m² lots are oriented on the north / south axis, with living to the north. They are perfect to accommodate a small solar passive house (<100m²), similar to the weatherboard Group Settlement houses (affectionately known as "groupies" by locals) that were built throughout the South West in the 1930's.

Cottage

With garage and utilities to the south and living to the north, these 450 - 675m² Cottage lots are designed to capture and maximise solar gain. There's room for easy care courtyard gardens and play spaces, with direct access into the community gardens and shared path networks.

Family

Opening directly into the landscaped community gardens and path networks, the 750-1200m2 Family lots are oriented east / west with building setbacks to the north to ensure each home has optimum solar access and plenty of room for gardens, play areas, chook pen and a garden shed.

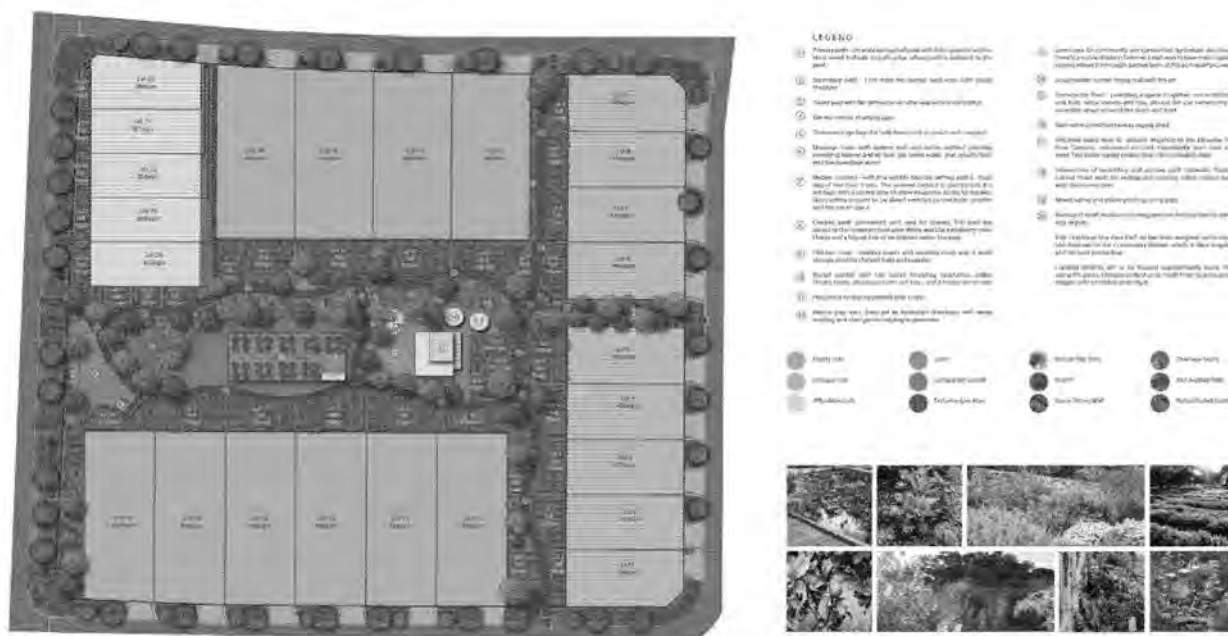


Figure 1. Witchcliffe Ecovillage Cluster Plan

1.3 Living in Witchcliffe

The rural village of Witchcliffe is located just 8km south of Margaret River. It sits within the South West Boojarah, which are the traditional lands of the Wardandi and Bibulmun/Pibelmen peoples. The South West Boojarah encompasses the towns of Capel, Margaret River, Witchcliffe, Augusta, Windy Harbour, Northcliffe, Pemberton, Manjimup, Bridgetown and Nannup, and covers about 10,085 km². For more information, visit <https://www.noongarculture.org.au/south-west-boojarah/>.

The Ecovillage is nestled in a rural and natural hinterland, immediately adjacent to the Witchcliffe village centre, with significant remnant bushland to the east, west and south. Witchcliffe is a sleepy village, with businesses on the main street offering an eclectic mix of farm services, bespoke and artisanal services and products, casual eateries, an electric bike shop, and up-cycling boutiques. It is 9 km east of Redgate Beach, a popular surfing, swimming and fishing spot, and the location of the famous 1876 wreck and rescue of the SS Georgette. The Ecovillage's winter creeks form the headwaters of 3 small tributaries which flow to the Chapman Brook, which then flows south east to join the Lower Blackwood River. Witchcliffe is also home to some of WA's most endangered species: Baudin's White-tailed Black Cockatoos; Western Ringtail Possums; and a tiny little froglet called *Geocrinia alba*, the White-bellied Frog, which is only found in the Witchcliffe area.

CLIMATE:

Witchcliffe has a mild temperate/Mediterranean climate with cold, wet winters and warm, dry summers. The Wadandi people recognise that there are six distinct seasons in the south west, and you can find information on the Noongar seasons here: <http://www.bom.gov.au/iwvk/calendars/nyoongar.shtml>. Witchcliffe is rated as sub zone 54 (Mandurah) on the NatHERS climate zone map and is most closely represented by Zone 6 in the *YourHome* factsheet, "Passive Design: Design for Climate" (p.99-100).

Summer temperatures average 27° Celsius by day and 14° at night, with infrequent maximum temperatures of 38-40° degrees occurring between December and February. Hot days are generally cooled off with an afternoon sea breeze, and summer evenings are mild. The winter months average 16° by day and 8° at night, with frosty mornings reaching an occasional minimum of 0° between May and July. The maximum sun angle is 80° on December 22nd (summer solstice) and 32° on June 21st (winter solstice).

The average yearly rainfall is around 1000mm, with most rain falling in the winter months and the shoulders of autumn and spring, with isolated but not uncommon heavy rainfall events (max. recorded rainfall in 24 hours, 99.4mm). In summer, the wind is generally south to south-easterly in the morning, with cooling south westerly sea breezes in the afternoon. In winter, the prevailing winds are less predictable, with intermittent cold fronts and storms.

GROWING CONDITIONS:

Soils at the Ecovillage typically have a shallow sandy-loam topsoil layer with loam, sand and gravel composites in the upper soil profile to a typical depth of 0.5-1m. Lower soil profiles are typically white to orange/brown clays and gravels. The well-drained upper soils are excellent for productive gardening and the less permeable lower layer helps to retain water in the soil. The Witchcliffe Ecovillage farm and vineyard are currently certified organic by NASAA.



1.4 Witchcliffe Ecovillage Design Guidelines

The purpose of the Witchcliffe Ecovillage Building Design Guidelines ("Design Guidelines") is to ensure that the built form and landscaping of the Ecovillage reflects the **strong vision of sustainability** and the **rural village character** set for the development. They provide straightforward guidelines that apply to all residential buildings in the Ecovillage. They will help owners, designers and builders create aesthetically harmonious buildings that are solar passive, efficient, affordable, and comfortable to live and work in.

PART A, SETTING THE SCENE, gives an overview of the Ecovillage project, sustainable house design principles, carbon negative material choices and architectural character.

PART B, DESIGNING YOUR HOME, deals with specific design requirements and is structured into three elements:

- **Objective** — states the outcome that we are seeking.
- **Guidance** — provides non-mandatory suggestions to help residents achieve the highest possible sustainability outcomes in their building proposals.
- **Required** — designates the mandatory or minimum building standards required for building plans to achieve endorsement from the Witchcliffe Ecovillage Design Team (the "Design Team") prior to submission to the local government for building permit.

PART C, APPROVALS AND CONSTRUCTION, explains the design approval process and how the Design Team will ensure that all homes meet the Ecovillage's required sustainability, architectural and construction standards. This section includes the Ecovillage requirements for thermal performance assessment and negative carbon certification through life cycle analysis.

The Design Guidelines must be read in conjunction with the Augusta-Margaret River (AMR) Shire's *Local Planning Scheme 1*, State Planning Policy *Z.3 Residential Design Codes*, and the *National Construction Code Volume 2*. The AMR Shire has adopted Local Development Plans (LDPs) for all lots in the Witchcliffe Ecovillage, to allow variations to R-codes as required to achieve sustainability and local character objectives (see section 9.1, Local Development Plans). Refer also to Local Planning Policy 22-Witchcliffe Ecovillage (AMRS).

While the Design Guidelines set out the requirements for building in the Ecovillage, any aspect of these guidelines can be varied on a merit basis at the discretion of the Design Team, **provided the outcome meets the objectives of the guidelines**.

All future renovations, additions or rebuilds will need to adhere to the Design Guidelines, and follow the same application process, with the respective strata body corporates replacing the Design Team as the approval body.

For more information on the design approval process and documentation requirements, see Section 9, Approvals.

1.5 Useful Resources

We strongly recommend *YourHome*, the Federal Government's excellent guide to sustainable building in Australia. It is available as a hardcopy from the *YourHome* website; however, the whole book is also accessible as factsheets on the website as well. "Passive Design: Design for Climate," (p 87-103) is an excellent starting place to familiarise you with designing a thermally efficient home (refer to the "mild temperate climate" information). The Low Carbon Cooperative Resource Centre's *Guide to Low Carbon Residential Buildings – New Build* is another useful free resource, with a focus on "reducing the carbon footprint (of new homes) in all phases of planning, design, construction and system (fixed appliance) selection."

We also recommend *The Smart Living Handbook*, by Melissa Wittig and Danielle King, which has a particular focus on creating healthy buildings, and provides detailed information on safe and efficient materials, finishes, appliances and products currently available in Australia. *Josh's House* is another excellent online resource which documents the build and occupation of a sustainable house project in Hilton, Perth, with informative factsheets and resources, videos and real time performance data.

When deciding on the built form outcomes for the Ecovillage, we referred to the Augusta Margaret River Shire's *Rural Hamlet Design Handbook* (2009) and *Patterns of Home: The Ten Essentials of Enduring Design* (2002). We have provided an excerpt from the *Rural Hamlet Design Handbook* at Appendix 2, and we thoroughly recommend you read *Patterns of Home*—it is a very accessible condensation of some of the important architectural principles in Christopher Alexander's brilliant but daunting *Pattern Language* (1977).

Sustainable Settlements is a member of ReNew (formerly the Alternative Technology Association) which produces two excellent magazines, *Sanctuary* and *ReNew*, and facilitates the Sustainable House day events around Australia each September. ReNew is great sources of inspiration and information for anyone planning or designing a sustainable home. We recommend you explore their website at <https://renew.org.au/> to access articles and factsheets and subscribe to the magazines.

2. Sustainable Housing

"... up to 80% of a building's efficiency can be traced back to the design. If you get the design right, you're well on your way to an efficient, sustainable home."

~ Melissa Wittig and Danielle King, The Smart Living Handbook.

The Witchcliffe Ecovillage has been masterplanned from the outset to allow households to be 100% self-sufficient in renewable energy and rainwater for household use. In addition, we expect all houses in the Ecovillage to:

- **Operate as carbon negative homes on an annual basis**—i.e., they will produce substantially more renewable energy onsite each year than the energy required to operate them; and
- **Be carbon negative over the lifetime of the building**—i.e., the house will produce more renewable energy over the 80-year life span of the building than its total embodied and operational energy consumption.

These objectives will be achieved through:

- the active generation of renewable power by the PV array on your roof;
- the passive energy efficiency achieved through designing a thermally efficient home with full solar access; and
- the embodied energy saved by choosing sustainable construction materials.



2.1 Sustainable Design Principles

Follow these 8 simple principles to design a comfortable sustainable home to provide you and your family with a low carbon, healthy lifestyle in the Witchcliffe Ecovillage.

1. REDUCE YOUR DWELLING'S CARBON FOOTPRINT

Australia has the largest average new house size in the world, and the largest residential floor space per capita. The **embodied** energy of the average Australian house is equivalent to approximately 15 years of its normal operational energy use (YourHome). Reducing overall house size and keeping your house shape and roof line simple also reduces the **operational** carbon footprint of your home, decreases construction costs and minimises the on-going running costs of heating and cooling your home every year. Reducing house size and choosing lower embodied energy construction materials wherever possible are the most cost-effective ways to reduce the embodied carbon footprint of your home (see Section 2.2, Choosing Sustainable Construction Materials and Products).

2. DESIGN A THERMALLY EFFICIENT HOME

There are four basic solar passive house design principles to follow in a temperate climate:

1. Allow winter sunshine to enter the house through appropriately sized and rated glazing to warm up thermal mass surfaces in living areas, and shade the house externally (glazing and walls) from the heat of summer sun (see Section 4.1, Thermal Performance, Section 6.8, Glazing, and Section 5.4, Shade Elements).
2. Provide sufficient correctly installed insulation to the outer shell of the house, including the roof cavity, to limit heat loss in winter and heat gain in summer. See Section 6.7, Insulation.
3. Place thermal mass or "phase change materials" strategically inside your home (e.g., concrete slab, internal brick or stone walls) to buffer your home from changes in external temperatures, (see Section 4.1, Thermal Performance).
4. Choose lightly coloured and reflective roofing materials and avoid thermal mass roofing materials (concrete, slate, or clay tiles) to reduce solar heat gain to your home in summer (see section 6.6, Roofing Materials).

3. SEAL YOUR HOUSE WELL

Ensure that your house is well sealed to exclude cold air in cold weather and prevent loss of warmth. Sealing your home is a very cost-effective way to prevent a significant 15-20% of heat loss in winter, and there are several common "leakage" points to pay attention to, such as doors, windows and exhaust fans. See Section 6.9, Vents and Sealing.

4. PROVIDE CROSS FLOW VENTILATION.

Provide effective ventilation and air flows via appropriately placed and specified windows, doors, vents, and ceiling fans to cool the house in hot weather and circulate warm air in winter. See Section 4.3, Passive Cooling.

5. PROVIDE NATURAL DAYLIGHT TO LIVING AREAS

Artificial internal lighting accounts for about 6% of average household energy consumption, so it is important to locate and design glazing to direct daylight into daytime living areas to provide a comfortable, inviting environment, and minimise energy use. You should aim to not require artificial lighting during daylight hours on a sunny day. See section 4.4, Natural Lighting.

6. PRODUCE YOUR OWN ENERGY, WATER AND FRESH FOOD

Energy:

The most efficient and environmentally responsible way to power your Ecovillage home (and offset the embodied energy used to construct it) is with renewable energy generated on site by rooftop solar panels, with shared battery storage and an independent microgrid in each strata cluster to provide renewable power at night. Households will have the potential to create significant excess energy to sell back to the Western Power grid or power an electric vehicle. For more information, see Section 8.1, Energy.

Water:

The supply of water to homes via a centralised provider like Water Corp creates significant carbon emissions and can place pressure on precious water resources, like the Yarragadee aquifer, one of the sources of Margaret River's mains water supply. By capturing and storing 100% of your water requirements onsite, reducing household water consumption through efficient appliances and fixtures, powering your rainwater pump with renewable energy from rooftop PVs, and connecting to the solar powered Ecovillage wastewater treatment service, you will reduce your water related carbon emissions, and enjoy sparkling clean un-chlorinated rainwater all year round. For more information, see Section 8.2, Water.

Food:

You can greatly reduce your food miles, carbon emissions, food waste and unnecessary packaging by growing the bulk of your fresh food requirements organically at home. Each Ecovillage household will have a generous exclusive use garden allotment in their strata's community garden, with irrigation water provided from the Ecovillage dams. The added bonus is that you will be socialising, exercising, improving your diet and enjoying fresh affordable organic produce at the same time.

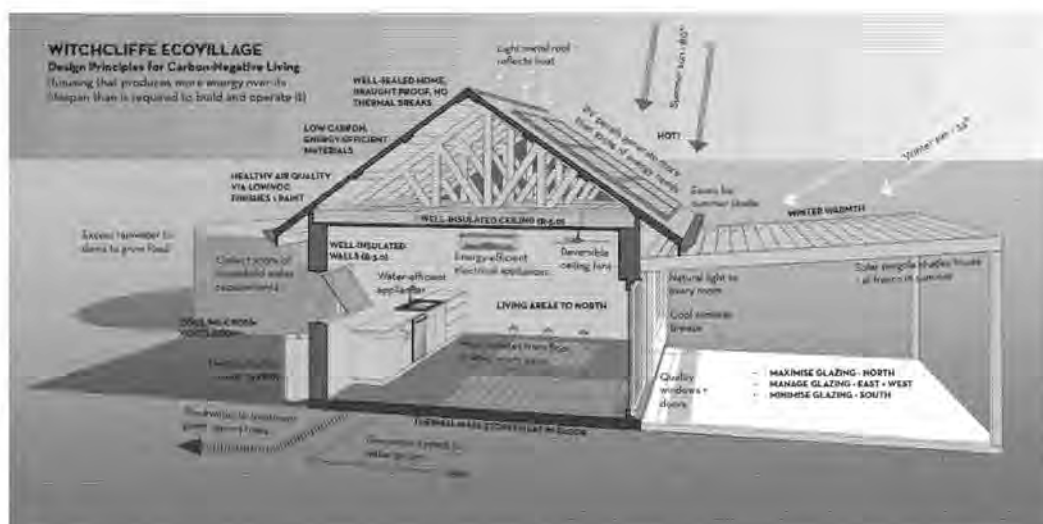
7. CHOOSE ENERGY AND WATER EFFICIENT FIXTURES AND APPLIANCES

To maximise carbon emission reduction and minimize rainwater tank storage requirements, homes are advised to install energy and water efficient fixtures (hot water systems, stoves and ovens, taps, etc.) throughout the home (see Section 8, Services and Appliances). To deliver even more carbon savings, households should choose the most energy and water efficient free-standing appliances (fridges, washers, televisions, etc.) wherever possible, and upgrade to the most efficient available whenever an appliance needs replacing (see Section 8.8, Free Standing Appliances). The more renewable energy that your house can send to the Western Power grid, the lower your home's operational carbon footprint.

8. CHOOSE POLLUTION FREE MATERIALS AND FINISHES

All houses in the Ecovillage should be constructed and finished with products that have low to zero volatile organic compounds. This not only provides pollution free air quality for residents and visitors, but also protects the health of on-site builders and off-site manufacturers, prevents off-site pollution, and promotes the wider availability and acceptance of VOC free products (see Section 7.5. Internal Air Quality).

Figure 2. WEV Negative carbon house design principles



2.2 Choosing Sustainable Construction Materials and Products

Choosing construction materials and products for your Ecovillage home is more involved than just deciding how you'd like the house to look. It is a process of weighing up all of the potential environmental impacts of various materials against the benefits of their thermal performance and their ability to reduce the on-going operational energy of your home, as well as achieving a great aesthetic outcome. Factor in the requirement to fit your choices within your budget, and it becomes a real balancing act!

To make this task easier for you, and to ensure your decisions will be based on the best available information, the Design Team commissioned Life Cycle Logic to create a detailed Life Cycle Analysis (LCA) report to assess the greenhouse warming potential and environmental impacts of a range of construction materials.

To accurately measure the carbon impact of homes, LCA can provide a global warming potential (GWP) metric measured in “kg CO₂ e” (kg of carbon dioxide equivalent emissions). The GWP combines all of the carbon emission impacts of every material used in the construction of a building, including all manufacturing inputs, the transportation required to get materials to the house site, as well as the inputs needed to operate and maintain the house over the (80 year) life span of the building, and the energy required to demolish and either recycle materials or send them to landfill at the end of its life cycle.

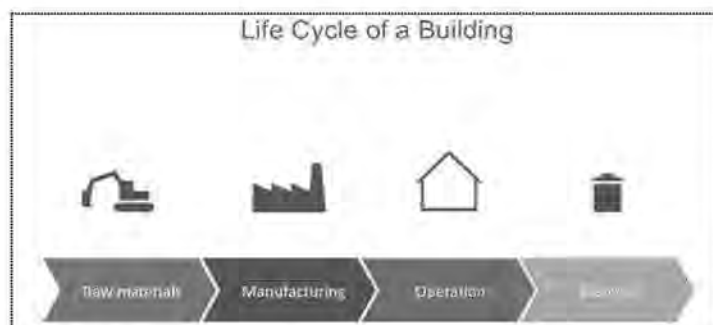


Figure 3. Life Cycle of a Building (image courtesy of Life Cycle Logic)

To enable accurate comparison of individual building elements, we had to assume a 'base-case' scenario that represented conventional construction materials and methods so we could understand the impacts of swapping out various materials. The 'base-case' house was modelled as having double-brick walls with air cavity, timber trusses, concrete slab foundation, single glazed aluminium windows, sand render exterior finish, zincalume corrugated roofing, synthetic carpets in bedrooms, tile in living spaces and wet areas, R6 ceiling insulation, cornices and skirting boards, standard wet plaster and paint on interiors. As all houses in the Ecovillage will be required to be solar passive and fitted with 6 kW of PV panels and rainwater tanks, the base case was also assumed to have these features in order to highlight just the impact of material and product choices. A separate LCA study investigated water heating options and assessed that certain heat pumps were the most efficient choice, so the base case also assumed a heat pump for hot water provision. These assumptions meant that the base case house design was already better than "business as usual."

The LCA assessed the incremental changes to GWP when swapping out particular elements with all other elements staying the same as the base-model. The elements investigated were:

- Wall types
- External cladding
- Window frames and glazing
- Ceiling insulation batts
- Flooring
- Foundations

The LCA also provided preliminary thermal performance assessments of the different materials, and investigated hot spots in the embodied and operational energy of the base case design that were not controlled by building material choices, e.g., water consumption and household appliance use. Table 1 shows the proportionate distribution of global warming potential across the major elements of the base model building's footprint. Heating and cooling, refrigeration, household appliances and water heating together account for over 60% of the building's embodied and operational carbon footprint.

Table 1. Proportionate distribution of GWP across the base model building

Building Elements	Share of Global Warming Potential (Embodied and Operational)
Heating and cooling (HVAC)	25%
Refrigeration	14%
Appliances (high efficiency)	13%
Hot water system (heat pump)	10%
Rainwater tanks and pumps	6%
UV Water treatment system	5%
Masonry wall external	5%
Masonry wall internal	4%
LED Lighting	4%
Wastewater treatment (1kL/ year WEV)	3%

Based on these outcomes, the LCA Report made the following 9 recommendations to reduce the carbon footprint of Ecovillage dwellings and achieve negative carbon outcomes:

1. Maximise the electricity production of household solar PV—this is the single most effective way to reduce the carbon footprint of Ecovillage buildings.
2. Use high energy-efficiency appliances and equipment, both fixed and freestanding.
3. Use external wall types with high insulation values (timber with insulation, straw bale with earth render, etc.) and internal walls with high thermal mass (mud brick, fast brick, rammed earth, stone). All Ecovillage proposed wall materials significantly reduced global warming potential over the base case double brick wall.
4. If using external cladding, use timber over fibre cement.
5. Use double glazed timber and uPVC windows where suitable (thermal modelling on individual houses will optimise thermal performance of glazing combinations).
6. Provide well insulated ceilings (but avoid the use of wool insulation).
7. Use polished concrete, timber, marmoleum or earth flooring, avoid wool carpets.
8. Include local supplementary cementitious materials in slab foundations (e.g., 30% Boral fly ash) as this lowers the GWP, and avoid slab edge insulation as this led to an overall increase in GWP.
9. Reduce household water consumption to 100 L p/person, p/day to reduce the carbon footprint of buildings (through reducing the electricity required for pumping and UV treatment, reducing the size of rainwater tanks, and reducing the global warming potential of wastewater treatment).

Tables summarising the LCA findings in relation to specific design and material/appliance/fixture choices are included where relevant throughout Section 6, Construction and Detailed Design.



Figure 5. Witchcliffe hemp house, Hemp Homes Australia



Figure 6. Straw bale home, Margaret River

2.3 Ecovillage Architectural Character

"Quite often when we are attracted to an area, we forget the very reason why we made that commitment. Clean air, beaches, bush, small town feel, food, wine – the sweet life. Yet so often we then impose change. Create a sameness. Very soon it looks like the last place we lived..."

Rural Hamlet Design Handbook, 2009.

While the Witchcliffe Ecovillage's building design principles are strongly focused on sustainability, we also aim to create a village that is welcoming and beautiful, sits lightly and respectfully in the local environment, and reflects the history and rural character of the Witchcliffe townscape. Historic timber buildings contribute a strong presence in the Witchcliffe village centre: Druids Hall, the CWA building, the former Sundance Health Food Shop, and Darnell's General Store all contribute to its cherished "sense of place." Rammed earth, mud brick, reclaimed timber, weatherboards and other recycled elements are featured in homes along Shervington Avenue and Mammoth Road; and steeply pitched or skillion roof lines in corrugated iron add rustic character. Witchcliffe was part of the historic WA Group Settlement programme of the 1930's, and "groupie" houses still stand in the area today—simple jarrah weatherboard and iron houses, which, despite their tiny size, often housed large families.

Witchcliffe Ecovillage buildings should generally reflect the rustic aesthetic of a small South West village, without needing to replicate or mimic existing building forms. Attention should be given to simplicity of form, expression of natural materials, harmonious proportions, and careful rendering of details and finishes on building facades.

The Augusta Margaret River Shire's *Rural Hamlet Design Handbook* (RHDH) provides architectural direction for developing a "sense of place" in new developments that reflects and enhances the values and aesthetics of this unique and beautiful region. (See extract, Appendix B.) This approach accords with our vision for the Witchcliffe Ecovillage, where the architectural place making should complement and consolidate the character and natural beauty of the existing village and natural environment, instead of imposing an "out of place" sprawl of suburban project homes.

Figure 4. Example North facing streetscape, *Rural Hamlet Design Handbook*



We have taken the *Rural Hamlet Design Handbook's* list of "key architectural elements" (Appendix B, p.186), and adapted them for contemporary application in the Ecovillage, making changes to prioritise sustainability features and materials. The following list should provide a starting place for your building's external expression and design:

- Simple geometric volumes and vertical elements
- A mixture of natural earth rendered and timber wall external elements
- Use of local, natural and sustainable materials wherever possible in construction and landscaping, such as plantation and recycled timber, straw bale and render, rammed earth, hempcrete, clay, recycled bricks, limestone and granite
- Zincalume metal sheeting for roofs and rainwater tanks
- Creative and artistic use of recycled and sustainable materials
- Predominantly steep (30°-45°) double pitch roofs with overhanging eaves at gable ends
- Skillion roofs with lower pitches, lean to elements and clerestory windows
- Loft spaces and dormer windows

- Deep overhangs of roof structures
- Larger building volumes broken up into parts using design elements
- Small punctured openings and double volume openings
- Recessed window and doors with proportionate frames
- Windows typically vertical or square rather than horizontal
- Balconies and verandahs to provide shade, shelter and legible entry statements
- Shutters, awnings, solar pergolas, and other seasonally adaptable shade elements
- Creative use of garden fencing, stone / rammed earth walls, and landscape features to complement buildings, gardens and streetscapes
- Attention to detail in materials, finishes and transitions
- Integration of sustainability features into building design, e.g., solar panels
- Consideration given to the presentation of all elevations of the home, not just the street façade
- Avoid overtly expressed period or regional styles (e.g., Federation, Balinese)

For more information, see Section 5, Building Form, and Section 6, Construction and Detailed Design.

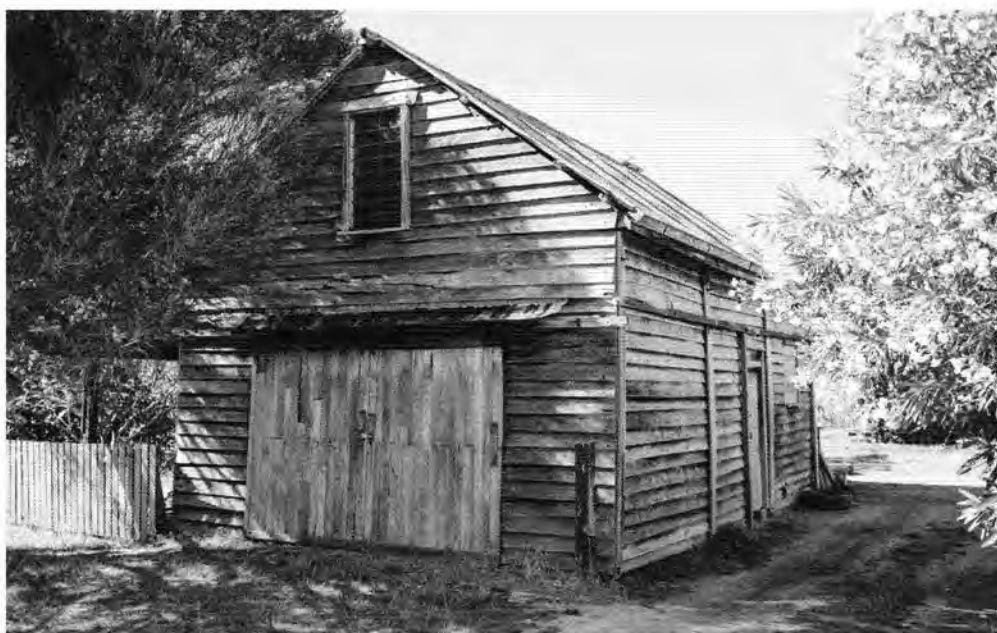


Figure 5. Witchcliffe timber outbuilding



B. DESIGNING YOUR HOME

A new house is an opportunity; not only to ensure affordability and the best possible liveability for future occupants, but to create high-performance dwellings that actively 'give back' by generating more power than they use, collecting and recycling water, and reducing the built environment's carbon footprint.

Guide to Low Carbon Residential Buildings – New Build, 2019.



Figure 6. Melbourne hempcrete house, image courtesy of OZHemp (<https://www.ozhemp.com.au/>)

3. Site planning

3.1 Site Analysis

Objective

Undertake a detailed analysis of the site prior to beginning the design process to provide a solid basis for design.

Guidance

- Key background information would include review of climate data such as prevailing winds, sun angles, rainfall amounts, and soil quality (see Section 1.3, Living in Witchcliffe).
- Important drawings would include a site feature survey of your block showing:
 - the extent and location of slope;
 - cadastral boundaries;
 - relevant Local Development Plan requirements, (e.g., nominated crossover location and building setbacks);
 - access to services (NBN, electricity microgrid, stormwater drainage) and
 - interface with the concept designs for the adjacent communal space or neighbouring lots (if available).

Required

- Compile and review relevant background information and drawings (see example Site Analysis, Fig. 7) prior to attending your Concept Review meeting with the Design Team (see Section 9.3, WEV Design Review Process).

3.2 Setbacks

Objective

Setbacks ensure that buildings are appropriately spaced apart to guarantee access to sunlight, ventilation, privacy and to create landscaped streets.

Guidance

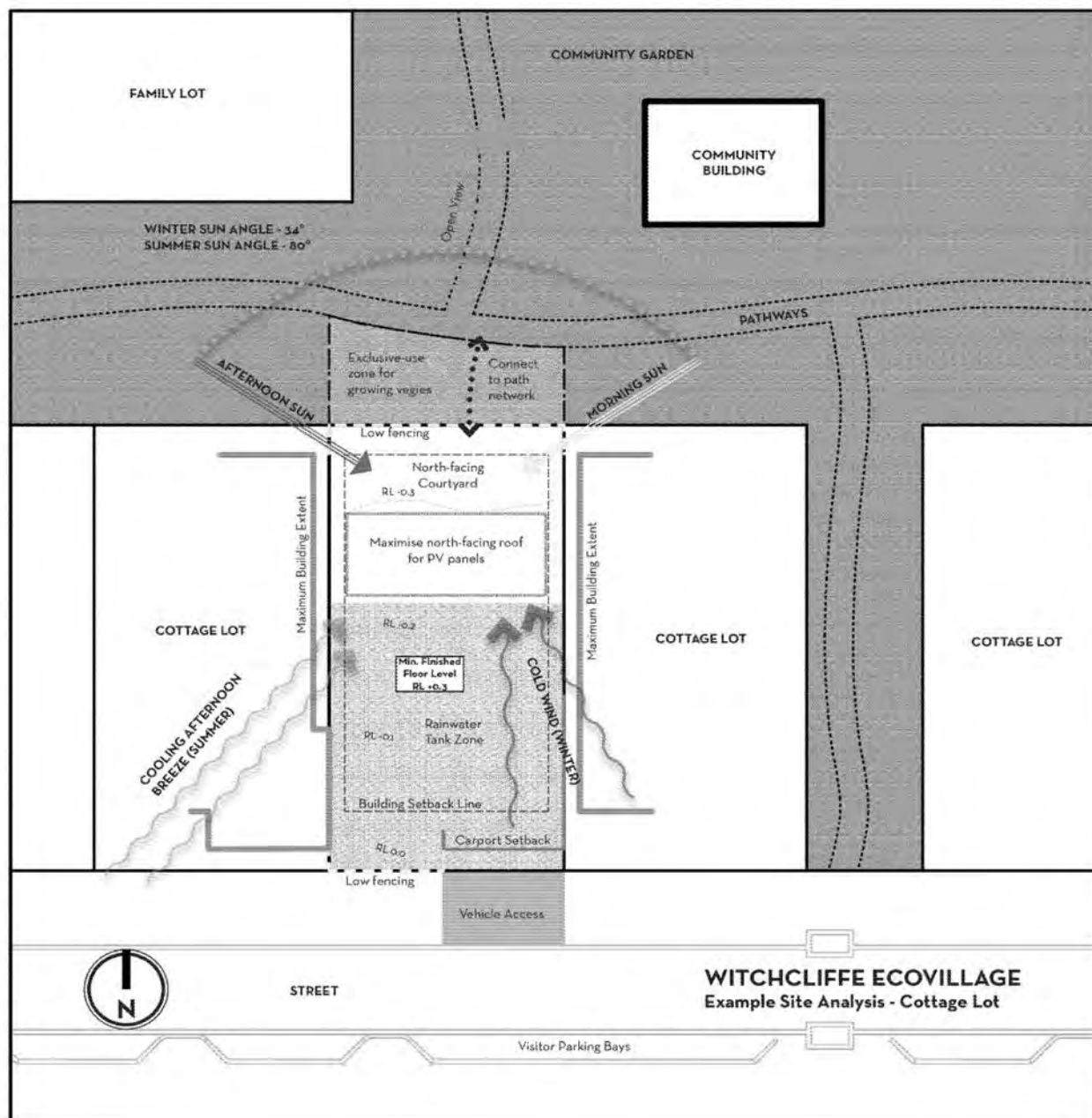
- Carefully review the applicable Local Development Plan based on your lot type to understand the specific setbacks for your block.
- Additional setback requirements apply to carports and rainwater tanks (see Section 5.5, Garages and Carports, and Section 3.7, Service Infrastructure).

Required

- Adhere to all setbacks specified by the Local Development Plan for your lot.



Figure 7. Example Cottage lot site analysis plan



3.3 Site Works

As the development footprint of the Ecovillage is largely located on flat land with natural undulations to the east and south of the residential area, roads, lots and stormwater drainage have been constructed to follow the natural lay of the land. Most lots in the Ecovillage will require minimal site works to provide a level building pad, while some more sloping lots will provide opportunities for split level building forms.

Objective

To minimise the extent of earthworks and retaining to reduce the impact on neighbouring properties and the streetscape.

Guidance

- In general, buildings and garden spaces should be designed to work with the prevailing slope of the block. This suggests the potential of stepping the ground plane of the building, with different rooms on different levels (split level).
- Homes built on elevated footings (stumps) to avoid retaining on sloping lots will need to provide sufficient thermal mass and under floor insulation to achieve efficient thermal performance (see Sections 4.1, Thermal Performance, and 6.7, Insulation).
- Where there is significant level change on the block down to the street, consider incorporating 'tuck-under' parking at ground level with the house above. This may facilitate a more direct interface with the communal space and offer better views on the street side.
- Integrate benched areas with natural landform by using landscaped batters in preference to retaining walls (see also Section 5.7, Fences and Retaining Walls).
- To reduce impact of a large flood event, it is recommended that building pad levels are set such that the finished floor level is a minimum of 300mm above low edge of the adjacent road pavement. Specific minimum Relative Levels (RLs) for pads is noted for some lots on the relevant Local Development Plan.

Required

- Cut and fill max. 0.5 m.
- No cut and fill within 1.5m of any internal lot boundary, excepting planter beds not exceeding 0.5m height.
- To reduce impact of a large flood event, building pad levels are required to be set such that the finished floor level is a minimum of 300mm above the projected 1:100 year flood levels.
- Minimum Finished Floor Levels are to be as nominated for each lot in the relevant LDP's or Finished Floor Level Plans available in the Ecovillage Document Library (<https://www.ecovillage.net.au/library/document-library/>).

3.4 Orientation

Every lot in the Ecovillage has been designed to guarantee maximum solar exposure and ensure that all houses can be designed to take advantage of passive solar design opportunities (see Section 2.1, Sustainable House Design Principles, Section 4.1, Passive Solar Heating) and north facing outdoor living spaces (see Section 3.8, Outdoor Spaces).

Objective

To achieve effective solar orientation of the house on site, with internal and external living spaces generally located to face north, and service areas to the south (see Figure 7, Temperate Climate Orientation).

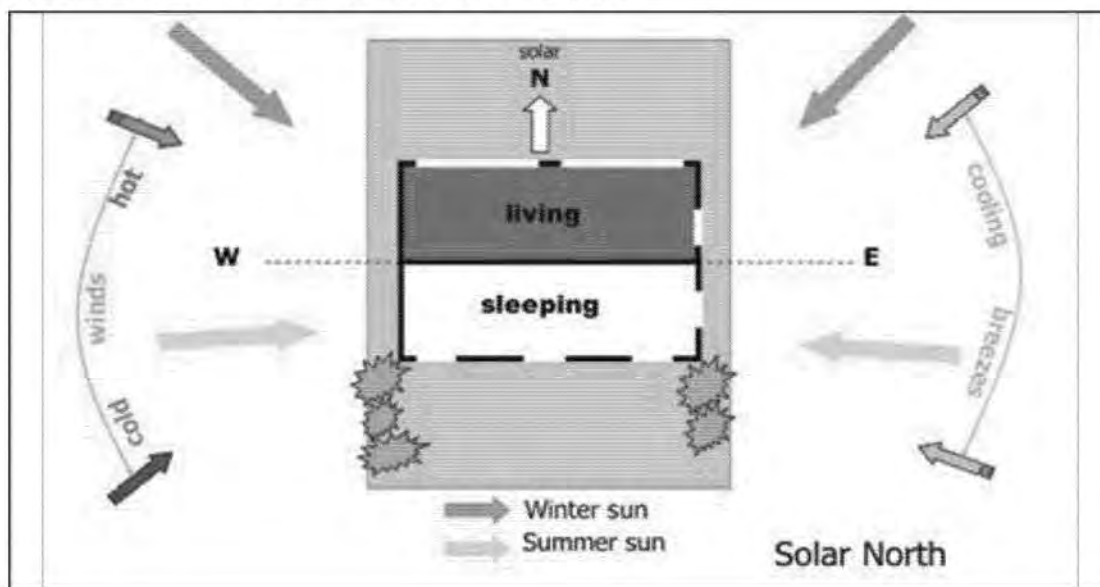
Guidance

- Smaller lots are positioned on a north/south axis with vehicle loading and services to the south and living to the north. Optimal building footprint on north-south oriented lots will maximise the northern built edge, with tall windows or raked ceilings with glazing to maximise solar penetration into living areas located to the north.
- Larger blocks are positioned on an east/west axis, with setbacks provided on each lot to ensure winter solar access is guaranteed to the living rooms of all homes. The most effective building footprint on east/west lots maximises the northern facade, with the north and south-facing facades 1.5 to 2.0 times the length of the east and west facades.

Required

- Building floorplans must demonstrate effective solar passive building orientation for your lot.

Figure 8. Temperate climate orientation. (*YourHome*, Suntech Design).



3.5 Outdoor Spaces

...a house by its very presence on a site, creates outdoor rooms as well as indoor rooms. And the outdoor rooms should be as well-considered and well-proportioned as the indoor rooms. In a well-designed house, there is a lively balance of indoor and outdoor rooms, and the two types of spaces form a kind of interlocking checkerboard on the site.

Patterns of Homes: The Ten Essentials of Enduring Design, 2002.

Objective

Encourage indoor-outdoor living that takes advantage of solar orientation, promotes social interaction, and integrates exterior spaces into the overall design concept of the dwelling.

Guidance

- Maximise northern exposure into principal outdoor spaces.
- Consider function and best time of day/season, e.g., east facing breakfast courtyard, south facing verandah to provide a cool summer space, deck to north with clear sheeting for winter protection and solar pergola for summer shade, etc.).
- Plant deciduous trees north of the principle courtyard to provide summer shade.
- Ensure landscaping doesn't impact on your or your neighbour's solar access.
- Design outdoor areas adjacent to the community garden to facilitate easy access and neighbourly interaction.
- Design landscaping to provide wind protection.
- Where space permits, locate a habitable outdoor space at street frontage, e.g., porch or verandah, to assist with passive surveillance, and provide a cool outdoor space to sit on a hot summer day.
- Consider providing an undercover-clothes drying area for all year use.
- AMR Shire provides households with three wheelie bins for general, compostable and recyclable waste streams. Provide a convenient and discreet area to enable efficient waste management.

Required

- At least one usable open space (minimum dimension 4m) must have direct northern exposure and be located adjacent to an indoor living area.
- Shade structures over outdoor spaces to be designed and located to maximise winter sun access to the dwelling (see section 5.4, Shade Elements).
- Locate clothes drying in an area that is screened from street and community garden view.



Figure 9. Margaret River straw bale home

3.6 Views

All Ecovillage homes will have the ability to make the most of pleasing nature-based outlooks. Some blocks will have views of dams, conservation bush, or agricultural plots. Others will have more immediate views looking out to landscaped streets, public open space, community gardens or their own private gardens and courtyards.

Objective

Maximise the impact of attractive views from your block without diminishing the thermal efficiency of your building.

Guidance

- Design your house to emphasise and take advantage of views.
- Windows facing east will also let in morning sunlight. Consider placing the kitchen or breakfast nook in this location.
- Windows facing west will receive late afternoon sun and will require a design intervention to prevent overheating in summer (see Section 5.4, Shade Elements).
- Buildings with views looking north are optimally placed to benefit from large amounts of glazing which captures the view and lets in winter sunlight. Size your eaves and shade structures carefully (see Section 5.4, Shade Elements).
- Buildings with views to the south must strike a careful balance between capturing the view and not making windows too large (as this could lead to a poor thermal outcome). One solution to this predicament is specifying high performance windows in this location (see Section 6.8, Window Frames and Glazing).



Figure 10. Views over the Witchcliffe Ecovillage dams and vineyard

3.7 Service Infrastructure

Conventional land subdivisions rely on external provision of services like power, water and wastewater; at the Ecovillage, providing all of those services on site is key to meeting our sustainability objectives. Some of the sustainability features required in the Ecovillage will also set it apart visually—notably the infrastructure supplying every household with water and power. We envisage that the shining rainwater tanks and grids of rooftop PVs will distinguish the Ecovillage as a model for the future. Considering all of your required sustainability features from the beginning of your design process will ensure optimal efficiency and functionality, as well as achieving integrated design outcomes.

Objective

To ensure an efficient layout of service infrastructure that will minimise visual impact on the streetscape.

Guidance

- Configure optimal locations for essential service infrastructure including solar panels, inverter, rainwater tanks, monitoring interfaces, reticulation controller, bin storage, etc. Consider access, setbacks, visual amenity and functionality.
- Locate solar panels to optimise solar collection (see section 8.1, Energy, and section 5.3, Roof Forms).
- Calculate the water demand of your household and size your rainwater tanks accordingly (see section 8.2, Water).
- If you plan to provide household batteries to supplement your lot's shared strata battery allocation, batteries must be located to comply with safety regulations and provide practical access (see Section 8.1, Energy).
- Make provision for stormwater flows and rainwater tank overflows.

Required

- Provide location and specifications for all service infrastructure on detailed Infrastructure Plan.
- Aside from solar panels, solar hot water systems and unpainted metal rainwater tanks, all external fixtures must be screened from the street and pedestrian walkways.
- Locate your rainwater tanks in a suitable location that addresses LDP setback requirements and doesn't interfere with solar gain to indoor and outdoor living spaces.
- Situate rainwater tank to facilitate overflow to stormwater drainage.



Figure 11. Rainwater tanks, Margaret River Econcepts house.

3.8 Bushfire Protection

Living and building anywhere in rural Western Australia requires attention to bushfire management and planning, and all development in the State is assessed against State government bushfire regulations.

Objective

To ensure all homes within the Ecovillage meet State Planning Policy requirements for bushfire protection.

Guidance

A detailed Bushfire Management Plan (BMP) was developed during the structure planning of the Ecovillage, and it specified a range of bush protection measures to provide a safe environment for Ecovillage residents, including:

- 3 x 328,000L rainwater tanks for firefighting purposes (in addition to the 3 Ecovillage dams on site);
- 3m perimeter firebreak around the whole Ecovillage;
- 2 access roads for emergency egress;
- 6m wide roadways to allow emergency vehicle access to all lots; and
- fire sensitive landscaping.

The BMP identified that most lots in the Ecovillage are located in areas with low bushfire risk and will therefore not require additional bushfire management strategies. However, as the region has some risk of future bushfire, it is recommended to design all homes to BAL 12.5 standards. Some lots on the eastern and western edges of the village are located in areas of moderate bushfire risk (BAL 12.5 - 19). Development on these lots may require additional construction requirements and limitations and fire-sensitive landscaping planning and management.

For more information, please refer to your applicable LDP, the BMP map (Appendix C) and State Planning Policy (SPP) 3.7, Planning in Bushfire Prone Areas (<https://www.dplh.wa.gov.au/information-and-services/state-planning/bushfire-planning-reform/state-planning-policy-3-7-and-guidelines>)

Required

- Plans must specify the BAL rating of lot and address all requirements of State Planning Policy 3.7 if applicable, or any other subsequent State fire regulations.

3.9 Driveways and Crossovers

Objective

Minimise the impact of crossovers and driveways on the streetscape, and provide low maintenance, functional design.

Guidance

- Design the driveway and crossover width based on your on-site parking configuration.
- Consider single or tandem parking on smaller lots, as it allows more space for landscape and a stronger building presentation to the street.
- Consider creative integration of turf or ground cover into driveway design using dispersed pavers or paved strips.
- Crossovers constructed of *in situ* concrete and comply with the Shire of Augusta-Margaret River's 'Standard Crossing' specifications and are eligible for a Shire subsidy.

Required

- Design vehicle access and parking based on the nominated crossover location on the applicable Local Development Plan.
- Single vehicle crossovers min. 2.8m, max. 3.5m in width.
- Double vehicle crossovers maximum 6m in width.

- Driveway material must be paved, bitumen, concrete or compacted gravel.
- Crossovers constructed of *in situ* concrete must include 30% min. supplementary cementitious materials (e.g., Boral fly ash).
- Bitumen paving is to be red-brown in colour, with red oxide added, rather than black.

3.10 Fencing and Retaining walls

Lot boundary fencing is the interface between private lots and the Ecovillage landscape. How you fence your boundary will impact on the streetscape, the adjacent community garden, and your neighbours' gardens. The Building Design Guidelines provides guidance to help households achieve aesthetic outcomes that promote community activation, while also providing privacy and security.

Please note that side and rear boundary fencing is also regulated by the *Dividing Fences Act 1961*, which defines your rights and responsibilities when it comes to replacing, maintaining and repairing shared fences.

Objective

To ensure appropriate heights and materials of fencing to balance privacy requirements and community interaction and create aesthetically pleasing streetscapes and community garden outlooks.

Guidance

- Post and wire rural style fencing at 1.8m will be provided on side boundaries between lots. Using these structures for growing plants and vines is recommended for privacy. Sections can be filled in or blocked to create more privacy in desired locations.
- Timber fencing may be stained, sealed or painted in line with Ecovillage aesthetic or left unsealed to weather naturally.
- Gates, archways, and thresholds are opportunities for creative expression.
- Creative configurations and clever uses of recycled materials are encouraged.
- Natural limestone (not reconstituted) and granite for walls can be sourced locally.



Figure 12. Recycled timber and iron fencing, Margaret River

Required

- Fencing height and design must comply with applicable LDPs and Table 2, Witchcliffe Ecovillage Fencing Requirements.
- Submit a fencing design concept for assessment during the formal design approval process. This is not required for side boundaries between lots.
- Fencing is to be made of natural materials that are compatible with the intended rustic aesthetic such as timber, wire, brush, stone, earth, recycled Zincolume panels, etc., NOT Colourbond steel sheeting or fibre cement boards.
- Retaining walls to be constructed of granite or natural limestone stonework, recycled masonry or rammed earth using local clay, NOT reconstituted limestone blocks, concrete, or post and panel configurations.
- A functional gate / accessway must be provided and maintained between the private lot and the Exclusive Use gardening area, and the boundary must be clearly defined with a fence or landscaping.

Table 2. Witchcliffe Ecovillage Fencing Requirements

Lot Types	Within primary street setback	Rear boundary	Side boundary
Groupies	1.5m	• 1.8m max. • 1.5m max. on portion of rear fence adjacent to community garden. • Any change in fence height is required to step immediately rather than gradually sloping to the new height.	• 1.8m max. • Side boundary fencing adjacent to the street verge or community garden must match the height of the adjacent primary street or rear fence. • Any change in fence height is required to step immediately rather than gradually sloping to the new height and must occur at or prior to front/rear setback lines.
Family and Cottage	1.2m max.	• 1.2m max.	• 1.8m • Side boundary fencing adjacent to the street verge or community garden must match the height of the adjacent primary street or rear fence. • Any change in fence height is required to step immediately rather than gradually sloping to the new height and must occur at or prior to front/rear setback lines.
Additional requirements			
Side fencing in "sensitive" locations (e.g., adjacent to street frontage, community garden or public accessway)	Side fencing in sensitive locations to be a maximum height of 1.8m, with either: • 50% visual permeability above 1.5m along its entire length; or • maximum of 1.5m along 50% of its length		
Dog fencing to front and rear (if required for larger dogs)	1.5m max., set back at least 6m from front or rear boundary. Ideally incorporated into the building edge.		



3.11 Additional Buildings

Objective

To ensure that buildings additional to the primary dwelling are complementary to the exterior presentation of the property and do not negatively impact neighbours, and that habitable additional buildings address sustainable building design principles.

Guidance

- Consult R-Codes and applicable LDPs for maximum shed size.
- Any outbuilding (non-habitable Class 10 A structure, e.g., shed) exceeding 10m² or 2.4m in height is required to have a Building Permit (see Section 9.5, Building Permit).

Required

- Additional buildings on site are to be visually compatible with the primary residence.
- Outbuildings may not be placed within the primary or secondary street setback.
- Outbuildings must maintain a 1m setback from all boundaries.
- Lots with Ancillary Dwellings must provide sufficient additional rainwater tank storage and PVs to meet the calculated demand of both homes.
- Ancillary Dwellings must be appropriately located and designed to meet passive solar and ventilation requirements, and not impact the solar access of the main dwelling.
- Ancillary buildings that are unable to orient living spaces to solar north must adhere to Passive House principles.
- Ancillary Dwellings facing the street or communal open space must provide at least one window at sight level to provide passive surveillance.



Figure 13. Modern rustic shed, Margaret River

3.12 Pools and Spas



Figure 14. Biological swimming pool, Margaret River

Objective

Minimise negative impacts on neighbours and the environment from residents' private pools or spas.

Guidance

- Conventional pools and spas (including “saltwater pools”) are not encouraged at the Ecovillage. The three large dams will provide excellent opportunities for swimming and water sports in a communal setting, and Redgate Beach is just a short 10 minute drive away, so individual pools may be redundant.
- Non-chlorinated and biological pools will be considered, provided there is surplus roof area / tank storage provided to fill and top up pool/spa with rainwater over summer.

Required

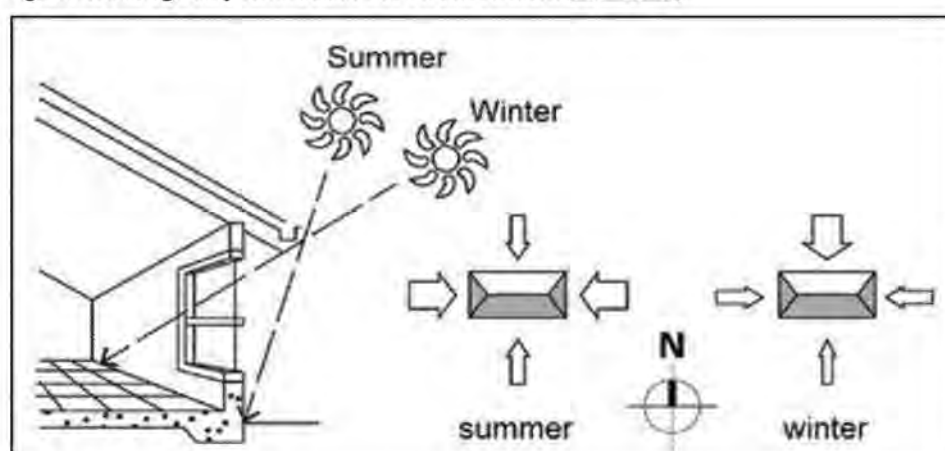
- Pools and spas must be non-chlorine or ‘natural pools’ only.
- Pools with filters and pumps must be run from 100% renewable energy.
- Pool must be located to minimise noise impacts on neighbours.
- Water budget must demonstrate provision of sufficient additional roof size / tank storage to provide for summer evaporation top up requirements.
- Ponds, pools and spas must be designed and managed biologically to control mosquito breeding.

4. Internal layout

4.1 Passive Solar Heating

Capturing and storing the heat of the sun is the cheapest, most environmentally sustainable way to heat your home. Passive heating requires careful placement of glazing, layout of rooms and incorporation of thermal mass, as well as a well-insulated and sealed building perimeter and roof, (see also Sections 6.7, Insulation; and 6.9, Sealing and Ventilation).

Figure 15. Average daily solar radiation on vertical surfaces. (YourHome.)



Objective

Design your house to take advantage of renewable solar energy from the sun to heat your house in winter without overheating in summer.

Guidance

SOLAR GAIN

- The maximum sun angle at Witchcliffe is 80° on December 22nd (summer solstice) and 32° on June 21st (winter solstice). Design windows to maximise sun exposure for one month on either side of the winter solstice, and to minimise direct sun exposure for one month on either side of the summer solstice.
- Solar gain during hot weather in the morning (east) and evening (west) must be carefully controlled because of the low angle of the sun. Consider vertical louvers, deciduous vines, adjustable external shades / shutters or deep verandahs.
- Efficient solar passive houses are generally no more than 2 rooms deep to allow warmth to penetrate to rooms on the south, and approximately 1.5 times longer on the east west axis.

THERMAL MASS

- The key characteristics of thermal mass materials are: high density, thermal conduction, appropriate thermal lag, low reflectivity, and high-volume heat capacity.
- Thermal mass materials have poor insulation (R) values, so are not recommended for external walls. Incorporate thermal mass materials in the interior of homes to provide temperature moderating benefits by absorbing heat from the sun (via solar access) during the day and then releasing it at night as temperatures cool.
- Materials that are considered good thermal mass include concrete, stone, rammed earth, brick, adobe, and water.

- Newer phase-change materials (PCMs) provide thermal mass that may be useful in light-weight construction. While currently more expensive, they take up less room and are lighter so less costly to support on an upper level. These materials include paraffin wax and a range of benign salts, with new products emerging every year.
- The WEV Life Cycle Assessment recommended the use of thermal mass wall elements for all internal walls (e.g., single brick, recycled brick, mud brick, stone, rammed earth, light earth construction, etc.) to maximise thermal performance.

Required

- Living spaces must generally be located on the northern side of buildings.
- Provide sufficient and appropriately located thermal mass to capture and store winter heat (e.g., thermal mass floor in northern living areas, internal rammed earth wall placed to absorb winter sunshine through glazing, single leaf internal brick walls).
- Thermal mass materials can only be used as part of an external wall (e.g., rammed earth) if insulated to Ecovillage R-value standards, see Section 6.7, Insulation.

4.2 Passive Cooling

Summers in Witchcliffe are generally milder than Perth, but still involve periods of hot weather, so houses must be designed to be cool and comfortable in the heat to avoid the need for energy intensive air conditioning.

Objective

To utilise the breeze and the dynamics of heat rising to naturally cool your house in summer and to provide fresh air to internal rooms.

Guidance

- See YourHome, "Passive Cooling" (p.135-48), for advice regarding air movement and cross ventilation, including best window and overhang designs for directing air flow.
- Provide appropriate shading to external walls and glazing, see Section 5.4, Eaves and Shade Elements.
- Provide reflective and bulk insulation in roof space as per Section 6.7, Insulation.

CROSS VENTILATION

- The prevailing summer winds at Witchcliffe are from the SE in the morning and SW in afternoon.
- To achieve effective cross-ventilation, houses should ideally be no more than two rooms deep, with an opening (window or door) allowing air into each room and another on an opposite wall to allow it to exit.
- To create higher velocity, the 'upwind' opening (south) should be smaller than the 'downwind' opening (north).
- Choose window types with large effective openings such as double-hung, sliding, casement or louvers (high-efficiency well-sealed louver units only).
- South facing windows should be thermally efficient and minimised in area to what is necessary to provide cross ventilation and satisfy National Construction Code requirements, in order to avoid heat loss in winter.
- Windows / doors located for cross ventilation should also provide insect screens.
- Consider installing an earth coupled heat exchanger system ("earth tube") in the slab to provide a low cost source of summer cooling (see https://en.wikipedia.org/wiki/Ground-coupled_heat_exchanger).
- We recommend that all living areas and bedrooms should be provided with ceiling fans to provide supplementary air flow when required, see Section 8.6, Heating and Cooling.

THERMAL MASS

- Provide thermal mass (e.g., concrete floor, single leaf brick walls, rammed earth feature wall) located internally to lose heat via breezes, ceiling fans or night venting in summer.
- Shade thermal mass from direct sun in summer (e.g., eaves, solar pergola, deciduous trees, etc.).

Required

- House designs must demonstrate adequate cross ventilation through primary living spaces and bedrooms with flow-path diagrams and appropriately located thermal mass.
- Two storey or homes with vaulted ceilings must provide a mechanism to vent heat in summer via 'stack ventilation' (e.g., clerestory windows, roof ventilators).

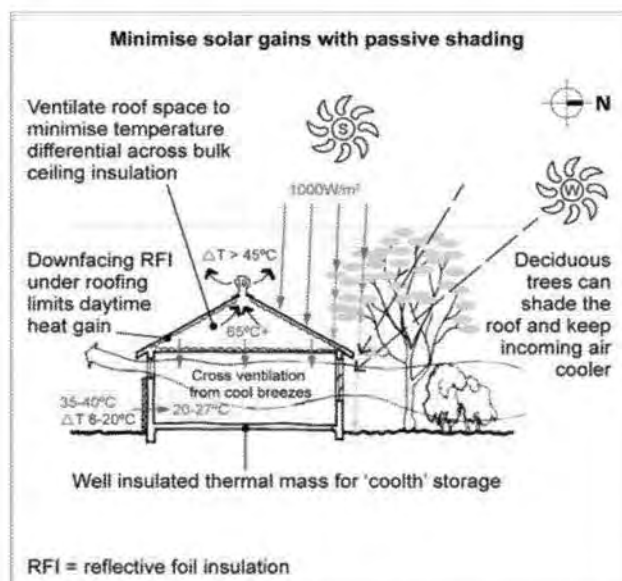


Figure 16, Cooling strategies, *YourHome*, (<http://www.yourhome.gov.au/passive-design/passive-cooling>)



4.3 Natural Lighting

When we build homes, it is important to locate and organise them in a way that allows all important spaces to receive abundant natural light. This single step probably has more effect on our perception of comfort than does any other aspect of home design.

Patterns of Home: The Ten Essentials of Enduring Design, 2002.

Objective

Design and locate glazing to direct natural sunlight to task areas where it is most useful to reduce the need for artificial lighting.

Guidance

- To enable sufficient natural lighting, the extent of glazing should be proportional to room size and volume. The general rule of thumb is that the glazing should be at least 10% of floor area of the room.
- Aim to provide light sources from at least two sides in all living spaces to create a balance of dispersed light in the space.
- Consider placing rooms on the east and west that would benefit from either morning or afternoon light.
- Windows placed higher on the wall allow for deeper light penetration into a room.
- For east-west oriented lots, keep building footprint 'skinny' to allow sufficient light to access centre of home from the north.
- Regular skylights should be used sparingly, as they cannot be easily shaded in summer, and allow heat loss in winter. Consider a dormer window or thermally efficient skylight instead.
- Lighter floor colours naturally bounce light around a room.

Required

- Appropriate glazing is provided so that tasks can be comfortably undertaken during the day without artificial lighting.



Figure 17. Margaret River timber house, image courtesy of Sorenson Architects (<http://sorensenarchitects.com.au/>)

4.4 Room Layout

Like ecological niches in a biocommunity, homes should provide a wide variety of settings for group and private life. And these settings should be interrelated, so that we are able to find a measure of privacy at the edges of a group space, yet still maintain connection to the common core when we're in the private places. The two needs are not exclusive; each arises within the frame of the other, and a good house helps us find comfortable places in this critical dimension, places that give a sense of balance to our lives.

Patterns of Home, The Ten Essentials of Enduring Design, 2002.

Taking the architectural patterns described in *Patterns of Home* (p179-205) into consideration when you design your internal layout can help you create a comfortable, welcoming home that "flows," encouraging social interaction at its heart, as well as providing for privacy and retreat. Simple, disciplined floor plans will help to keep building elevations balanced and roof lines uncomplicated, and have the added bonus of being more affordable to build.

Objective

To achieve internal room layouts that are thermally efficient, comfortable, and functional.

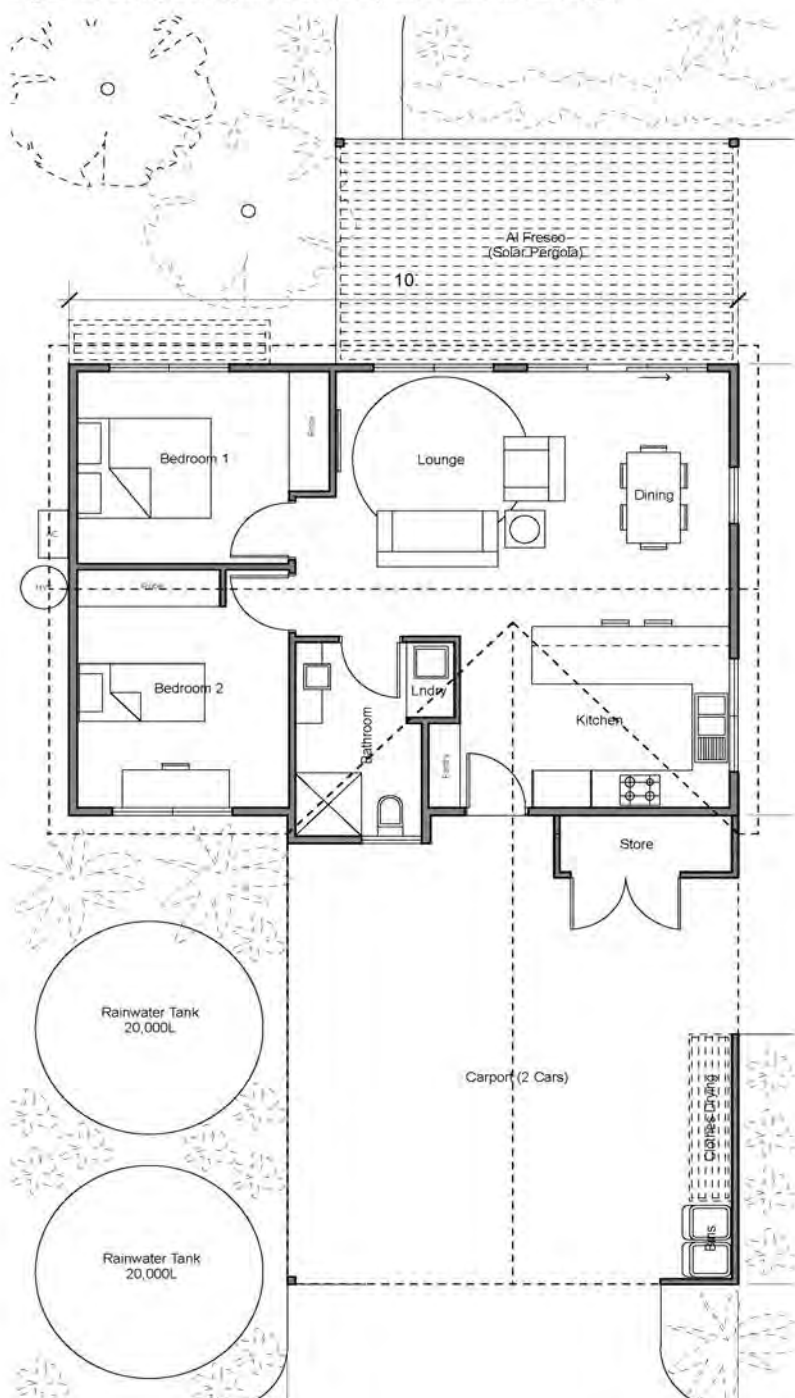
Guidance

- Design floor plan to maximise thermal efficiency (see Section 3.2, Orientation, 4.1 Solar Passive Heating and 4.2 Passive Cooling).
- Design floorplan with external expression in mind to create attractive and balanced elevations (see Section 5, Building Form).
- Begin with a simple rectangular shape and simple roof form, (see Section 5.3, Roof Forms) and be aware of the impact of any extruding rooms on roof form.
- In open plan and/or double storey houses, make provision for areas to be thermally isolated so that heating/cooling energy can be focused only on areas being used.
- Consider providing airlocks/mudrooms at commonly used entrances to help maintain a comfortable internal air temperature. These have the added benefit of helping to reduce clutter and keep the house clean.
- Consider layouts of existing or proposed furniture to provide functional flow.
- Design 'wet areas' (rooms with plumbing) so that they are clustered together and close to the location of the hot water system. Shared plumbing walls will help to minimise pipe runs, saving money and reducing heat loss for hot water.
- Consider reducing the number of bathrooms, and conveniently locate at least 1 bathroom with a separate toilet to avoid requiring an additional powder room.
- In small homes, consider combining a bathroom and concealed laundry to minimise wet areas.
- Locate kitchens and laundries close to each other and provide a convenient doorway to an outdoor service area to provide easy access to carport/garage/store, bin storage and washing line.
- Locate built in storage/book cases in hallways to make use of an otherwise redundant space.
- Bedrooms are generally the least actively used rooms in a house, used mainly for dressing and sleeping. Consider reducing their size, or incorporating other elements, such as storage, craft or study spaces.
- Design guest bedrooms as multi-purpose spaces—yoga room, craft room, study, etc.

Required

- Internal room layout allows for effective solar passive design outcomes.

Figure 18. Example floorplan, WEV Groupie lot (72m² house design)



4.5 Accessibility

All Australians benefit from homes designed with comfort, safety and ease of access as core design features. These features make the home easier for parents to manoeuvre prams, easier to carry the shopping into the house, easier for people with disability or temporary injury to get around and easier to move furniture. These same features enable key living spaces to be more easily and cost effectively adapted to meet the changing needs and abilities of home occupants such as ageing baby boomers and people who have or acquire disability.

Livable Housing Guide, 2017

Objective

To design your house to suit your current needs while also allowing the flexibility to provide accessibility to all visitors and accommodate future needs.

Guidance

- As part of the design process, consider accessibility and changing spatial needs, which may include children, grandchildren or elderly parents, or relate to the mobility requirements of yourself or visitors.
- The *Livable Housing Design Guidelines* (4th Ed.) provide dimensions and spatial requirements for three categories of accessibility (Silver, Gold and Platinum), which vary by the degree to which they accommodate those with mobility challenges. (For more dimensions and specifications, visit <http://www.livablehousingaustralia.org.au/>.)
- To achieve full Universal Access compliance inside and outside of the home, use the standards set out in AS1428.1.

Required

- At a minimum, adopt the requirements of *Livable Housing Design Guidelines* Silver Category to provide future flexibility and ensure the basic accessibility of your home to visitors with differing mobility needs:
 1. A safe and continuous and step free path of travel from the street entrance and/or parking area to a dwelling entrance that is level.
 2. At least one level step-free entrance into the dwelling.
 3. Internal doors and corridors that facilitate comfortable and unimpeded movement between spaces.
 4. A toilet on the ground or entry level that provides easy access.
 5. A bathroom on ground or entry level that contains a hobless shower recess.
 6. Reinforced walls around the toilet, shower and bath to support the safe installation of grabrails at a later date.
 7. Stairways designed to reduce the likelihood of injury and also enable future adaptation.



5. Building Form

Wonderful homes always instruct us anew on the power of natural light on a wall, the truth of materials, the pleasures of outdoor rooms, the proportions of height to width in rooms, the sense of arrival, the feeling of shelter and refuge.

Jacobsen, et al, Patterns of Home: The Ten Essentials of Enduring Design, (2002).

5.1 Building Facades

Objective

To ensure that building facades visible from the street, community garden or pathways are well-composed, expressive, and balanced, with appropriate scaling, legibility, and use of compatible materials.

Guidance

- See Section 2.3, Architectural Character.
- Design the internal layout of the building with the external expression in mind (see Section 4.5, Room Layout).
- Harmonious proportions and the use of natural external materials are key considerations.
- Keep the main building volume simple and attach external elements to break up long walls or add shadowlines, such as verandas, balconies, louvres, shade structures, awnings, and bay or dormer windows.
- Arrange windows and doors to achieve a visually balanced composition (symmetrical or asymmetrical.)
- Windows should generally be rectangular with a vertical proportion.
- A separate window surrounded by solid wall tends to be more attractive in a vertical proportion (window panes with a minimum 1:1 height to width ratio) as it relates to human scale and proportion.
- Windows ganged together allow for greater flexibility in terms of shape/proportion where a 'window wall' is intended. These are often combined with sliding glass or French doors.
- "Punched" or recessed openings (to create external overhangs and window sills) are preferred to flush openings and can create visually interesting facades without adding cost.
- Avoid long blank walls (>5m) without openings facing the street or community garden. If unavoidable (for example, a west facing wall) explore the use of texture and pattern expressed in natural materials or features such as fences / walls, landscaping, shade structures, etc., to provide visual interest.
- Use landscaping features (walls, fences, shrubs) where possible to soften the visual impact of rainwater tanks and carports / garages on the streetscape.
- Design simple, high quality and well executed external finishes and details, including gable ends, use of colour, material transitions, etc., (see Section 7, Finishes and Details).
- Avoid overtly expressed period or regional styles (e.g., Federation, Tuscan, etc.) as these are not considered consistent with the Ecovillage aesthetic or rural character of the region.
- Double storey porticos are not allowed.

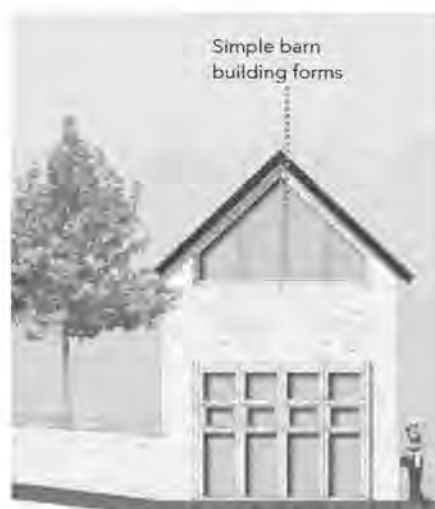


Figure 19. Example building form, *Rural Hamlet Design Handbook*

Required

- Building form and facades must generally accord with the Ecovillage's adapted Rural Hamlet design principles, see Section 2.3, Ecovillage Architectural Character.
- Create a comfortable entry experience from the public street, including a separate pedestrian pathway, adequate lighting, and a clearly visible entry door.
- Ensure that building facades address and appear attractive from the streetscape, the community garden and pedestrian walkways (where applicable).

5.2 Building Height and Bulk

Each lot owner must check the applicable Local Development Plan for additional restrictions on the location of the upper building level relative to property boundaries to ensure all lots have guaranteed solar access. Building height is measured from natural ground level adjacent to the elevation in question.

Objective

To ensure that the height and bulk of buildings is compatible with the intended village scale and does not negatively impact the solar access opportunities on neighbouring lots.

Guidance

- On larger lots, buildings can be designed as a collection of smaller segments rather than one large mass. These segments can be used to effectively shape exterior space and create micro-climates. Typical configurations include footprints shaped like a U, T, or L. Overly complex shapes and rooflines will add cost to the build, and potentially increase the operational cost of heating or cooling your home.
- Ridge height is limited on Groupie lots but is more generous on Cottage and Family lots (see applicable LDPs). This height is slightly higher than the AMR Shire standard but takes into account the Ecovillage requirement for steeper pitches on gabled roofs.

Required

- Building walls are limited in height to 2 storeys (maximum 6.5 m plate height) unless site falls more than 2m, in which case additional building height can be supported.
- Ridge height maximum:
 - Groupie lots: 8m
 - Cottage and Family lots: 9.5m



Figure 20. Margaret River pitched roof, Pamela Forward Design

5.3 Roof Forms

One of the defining comforts of home is the feeling of being enveloped by a simple sloping roof.... More than any other single element, the form of the roof—as experienced both outside and in—carries the look and meaning of shelter, of home.

Jacobsen, et al, Patterns of Home: The Ten Essentials of Enduring Design, (2002)

Arriving at standardised requirements for roof form in the Ecovillage was surprisingly difficult. These guidelines aim to define a set of recommended roof forms that invoke a simple authentic "down south" aesthetic and the Pattern Language notion of a "sheltering roof," but at the same time provide functionality in terms of solar PV placement and rainwater collection. The roofing requirements also had to accommodate affordability, and the differing constraints of the various lot orientations and dimensions. Three roof forms met these requirements: the steep pitched barn style roof recommended by the Rural Hamlet Design Guidelines, and "modern pavilion" or "mid-century" inspired skillion and skillion with lean to roofs. Each style has pros and cons, dependent on your lot size and orientation. If you are having any difficulty interpreting the roof form requirements, please seek guidance from the Design Team at your initial briefing (see Section 9.3, WEV Design Review Process).

Objective

To ensure that buildings have roof types and configurations that fit with the intended character of the Ecovillage and provide for efficient placement of solar panel arrays.

Guidance

ECOVILLAGE CHARACTER

- Keep roof forms clear and simple, with one roof type / form clearly dominant and all others minor.
- Ensure roof forms generally adhere to Figure 21, WEV Roof Types.
- Hip roofs are not consistent with Ecovillage architectural character.
- The preferred and recommended Ecovillage roof forms are:
 - Steep (30°- 45°) symmetrical, double pitch gable roofs with overhanging eaves at gable ends;
 - Skillion (10°-15°) with overhanging eaves; and
 - Skillion (20°-25°) with lean to or split gable with overhanging eaves.
- Gable roofs take their cue predominantly from steeper pitched roofs as found in barns, using their form to create opportunities for useable loft spaces.
- A steep gable can look disproportionate in > 8m width at the gable end. Consider reducing building width, increasing plate height, adding loft or bay windows, verandahs / pergolas, or providing feature material transitions to achieve balance. A split gable may also be a solution over a wider span.
- For skillion roofs, ensure roof pitch and sheeting span are sufficient to provide adequate rainwater run-off, as well as achieve aesthetic outcomes. Skillion roofs can look disproportionate if the span is too short and steep, or if the span is too long.
- Butterfly, saw tooth, flat roof forms and other configurations with box gutters over internal spaces are not recommended due to the risk of leakage during heavy rain events.
- See also Section 5.4, Shade Elements, regarding eave requirements.

SOLAR PANELS

- Design your roof to accommodate your required solar panel array. The minimum 6.0 kW array will occupy approximately 40m² roof area.
- Solar panels are most effective when positioned to face north at a 32° angle (Witchcliffe latitude) to maximise winter solar access, however, efficiency is adequate between approx. 15° and 45°. (See Table 3, Solar Panel Efficiency by Orientation and Plane Inclination.)
- North facing roof space for PV array can be located on carport if adequately sized and located if your home doesn't provide sufficient north facing roof surface (consider potential shading of carport PV panels by house roof on Cottage lots).

- East and west facing placement of PVs will lead to an approximate 15-20% reduction in PV performance (depending on roof angle) and is generally not recommended (see Table 3, Solar Panel Efficiency by Orientation and Plane Inclination). However, an exception may be considered on Cottage lots, where lot dimensions and house size/massing outcomes may necessitate a roof gable opening to the north. The reduction in PV efficiency would impact carbon footprint outcomes (see Section 9.2, Thermal Assessment and Life Cycle Analysis) and may necessitate the addition of extra PVs.

Table 3. Solar Panel Efficiency by Orientation and Plane Inclination

Direction (plane azimuth)	Solar Panel Efficiency (%)				
	Solar Panel Plane Inclination (degrees)				
	12°	22°	32°	42°	52°
North (0°)	94%	98%	100%	99%	95%
East (90°)	88%	87%	84%	81%	77%
South (180°)	82%	74%	65%	55%	46%
West (270°)	88%	87%	85%	81%	77%

NB: Table is based on *Clean Energy Council GC Design Guidelines* figures for Perth latitude, optimising winter sun generation. Figures have been adjusted to roughly reflect 100% efficiency at 32° for Witchcliffe location.
(<https://solarcalculator.com.au/wp-content/uploads/solar-power/CEC-guidelines-direction-panel-angle.pdf>)

Required

- No hip roofs.
- Gable roofs must be min. 30° pitch (recommend 30° – 45° for spans up to 8m wide, 30° for 9-12m wide) and generally symmetrical.
- Skillion roofs are to be no steeper than 25° with max. 10m spans.
- Flat roofs or sections of flat roof will be considered only if house design can demonstrate that:
 - the design principles of Section 2.3, Ecovillage Architectural Character, have been addressed through built form and material selection;
 - all windows are provided with appropriate external shade elements; and
 - roof has sufficient slope / waterproofing to facilitate rainwater run-off and avoid leakage
- Gable dormers to loft spaces must have eaves and same slope roof as primary roof.
- Flat and skillion roofs must demonstrate aesthetic and functional accommodation of PVs and gutters for rainwater collection.
- Any box gutter over internal rooms must be sized to accommodate one in 50-year rain events.



Figure 21. Witchcliffe Ecovillage Roof Guide

5.4 Eaves and Shade Elements

Unprotected glazing and walls are a significant source of radiant heat gain to a house in summer. Effective shading can eliminate up to 90% of this heat gain (YourHome). Shading elements such as deep eaves, verandahs, balconies, pergolas and porches can also be used architecturally to provide interest to blank walls and create legible entry statements and outdoor living spaces.

Objective

To design visually integrated shading that allows solar gain in winter but protects walls and glazing from summer heat transfer.

Guidance

EAVES

- North-facing gable eaves should be sized so they allow maximum solar penetration for one month on either side of the winter solstice, and are fully shaded for one month on either side of the summer solstice.
- All other gable eaves to be minimum of 300mm (see Section 7.4, Gable Ends and Eaves). Ideally eaves will be symmetrical and balanced across building elevations visible to the street or community garden, as well as sized to provide shading to walls and glazing as required.
- Skillion roofs facing north and clerestory windows to north will require case by case assessment of windows and eaves to achieve effective winter solar access and summer shade, and may require additional shade structures (e.g., solar pergola).

WINDOW SHADING

- North-facing windows should maximise winter solar access, using external shading (eaves, solar pergola, deciduous trees) to minimise heat gain in summer.
- West facing windows require deep eaves, verandahs or additional shade structures to diminish late afternoon sun in summer.
- East facing windows are a valued source of morning sunshine to living areas in winter, and are best protected with seasonally adaptable external shading (awnings, fins, deciduous plantings, etc.)
- Ensure that fixed shading structures over west and east facing windows still allow lower angled winter sun penetration to living rooms.

EXTERNAL SHADE STRUCTURES

- Individual external window shades can augment eaves in protecting key windows (gable end to west or flat roof).
- Balconies, porches and verandahs should be designed as integral parts of the façade, complement the style and construction materials of the building, and only provide beneficial shading impacts on rooms below.
- Balconies and verandahs may project into boundary setbacks areas as identified in the applicable LDP.

Required

- Adequate roof eaves/overhangs (responsive to orientation) must be provided over all external walls of the dwelling (unless a parapet wall and flat roof is specified, in which case all glazing must be separately and adequately shaded.)
- All other gable overhangs and eaves to be minimum of 300mm.
- Verandahs, pergolas, patios and other external shade structures over outdoor spaces on the north must not exclude winter solar access to northern glazing.
- Balconies and verandahs must be supported by posts or columns of at least 120mm x 120mm (or ground floor of house).
- Balconies may cantilever no more than 750mm without visible support structures such as brackets.
- Balconies and verandahs are to be no less than 1.8m deep to provide a functional sitting area.

5.5 Carports and Garages

The Ecovillage masterplan differs from conventional subdivision layouts by prioritizing pedestrians and sustainability outcomes over the automobile. Each house interfaces with both the street and strata cluster community garden. All footpaths run through the community gardens (rather than along the streets) to maximise community interaction and amenity. In order to minimize the visual impact of garages and carports on the streetscape, it is important that the placement of carports and garages is carefully regulated and that they complement main building in materials and form.

Objective

Minimise the impact of vehicle parking on the streetscape and encourage social interaction.

Guidance

- Consult the applicable LDP for your lot for crossover locations and garage and carport setbacks.
- Carports are not subject to side setback requirements and may be located on the side boundary of the lot (subject to *National Construction Code, Vol.2* fire separation standards).
- Free standing carports (steep gable or skillion roofed) are the preferred design outcome as they have less visual impact from the street than an attached garage with double doors, and the open design encourages neighbourly interaction as residents come and go.
- The design of the carport should complement the main structure either by mimicking the roof configuration (same roof slope and type) or by 'deferring' to the primary building by keeping the profile low to minimising visual impact. In both cases, streetscape impact is the primary consideration.
- Gabled carports can easily incorporate a loft storage space for surfboards, etc., and lockable storage at ground level.
- If carport gable is to be filled in, keep finish and detail simple.
- On Family Lots, double garages which adjoin the dwelling can be approved but must address LDP requirements to ensure that the garage does not dominate the house façade.
- Garages can incorporate an upper floor studio (with window to the street frontage) or covered outdoor living area to maximise space and (where applicable) take advantage of views.
- Roof decks (uncovered) over carports may be possible subject to visual privacy setbacks.
- Preferred garage doors are sectional or tilt doors in timber.

Required

- Carports and garages must meet all setback requirements of the applicable LDP.
- Garage and carport construction and roofing materials to reflect and / or complement main building.
- Gable roofs to carports must reflect the pitch of the main house (if main house has gable roof).
- Carports are required to have min. 300mm eaves for non-boundary wall.



Figure 22. Single gable carport

Figure 23. Single skillion carport



6. Construction and Detailed Design

The power to make buildings beautiful lies in each of us already.

Christopher Alexander, The Timeless Way of Building, (1979).



6.1 Sustainable Materials

Any fossil-fuel energy used in manufacturing and transporting construction materials leads to carbon emissions. This is known as “embodied energy.” 26% of the energy use of a typical house over its lifetime is contributed by the embodied energy of the materials used in its construction (*YourHome*). With the use of life cycle analysis tools, it is possible to significantly reduce the carbon emissions associated with building your home. In addition, life cycle analysis weighs up all other negative environmental impacts associated with the manufacture of construction materials, as well as the material’s thermal performance, allowing you to make evidence-based choices to achieve a carbon negative, sustainable house.

Objective

To minimise the carbon emissions and environmental impacts associated with the construction and life cycle of buildings in the Ecovillage.

Guidance

- Consult Table 4, WEV Life Cycle Analysis – Construction Materials, and choose materials that will assist you to achieve the thermal performance and carbon negative objectives required by Section 9.2, Thermal Assessment and Life Cycle Analysis.
- If material you want to use is not included in Table 3, please contact the manufacturer and request life cycle analysis data (if available) to assist with eTool Life Cycle Assessment of your building plans (see Section 9.2, Thermal Assessment and Life Cycle Analysis).

Required

- Provide a detailed schedule of all construction materials and finishes with building application.
- All timber must be Australian certified plantation, FSC certified, locally milled from fallen paddock or verge trees, or recycled timber.

6.2 Unconventional Construction Materials / Methods

Objective

To ensure non-standard construction methods comply with building standards and conform with Ecovillage sustainable design requirements.

Guidance

- Innovative sustainable construction methods will be considered by the Design Team; however, house plans will need to comply with National Construction Code (NCC) requirements in order to gain Augusta Margaret River Shire development approval. If you are considering using a non-conventional building method, it is recommended that you check with the AMR Shire Planning Department prior to beginning design work. Tiny houses on wheels, shipping container buildings, and earth ships, etc., would fall into this category.

Required

- All plans for unconventional building construction methods must demonstrate ability to comply with AMR Shire and NCC requirements, as well as Witchcliffe Ecovillage Building Design Guideline requirements, including meeting LCA minimum carbon emissions and thermal performance targets (as per Section 9.2, Thermal Assessment and Life Cycle Analysis) and adequate roof space for solar PV array and rainwater collection.

6.3 Walls

Objective

To use sustainable wall construction materials which provide excellent insulation values and provide internal thermal mass.

Guidance

- In order to achieve carbon negative outcomes, you should choose low carbon, thermally efficient wall construction materials wherever possible (see Table 4, WEV Life Cycle Analysis – Wall Sections). These figures relate specifically to the WEV LCA of the base case house model but give a reasonable indication of the relative thermal and GWP performance of the materials in a Witchcliffe context.
- Exterior wall assemblies must meet the insulation requirements of these design guidelines (see Section 6.7, Insulation). R-values of common wall types are included in Table 4, WEV Life Cycle Analysis – Wall Sections.
- Internal walls that add thermal mass (e.g., rammed earth, fast brick, mudbrick, stonework) can help moderate temperature swings if located correctly (see Section 4.1, Passive Solar Heating, and 4.2, Passive Cooling).
- Timber framing should comprise studs, appropriate moisture barrier, battens, and then external cladding to ensure that moisture can evaporate and not condense behind cladding
- SIPs that are sealed to Passive House standard will require a mechanical ventilation system, (see Section 6.9, Sealing and Ventilation) which will need to be factored into the building's life cycle assessment.

Required

- Wall framing to be constructed from timber not steel.
- Walls must be constructed of locally sourced, low carbon, and/or renewable materials wherever possible.

Table 4. WEV Life Cycle Analysis – Wall Sections

Wall Sections (NB: All NatHERS and GWP metrics are specific to the WEV LCA of the base case house design with 6 kW PV)	NatHERS Star Rating Impact (higher is better)		GWP (kg CO ₂ e) Compared to Base Case	Insulation R- value (higher is better)
	With internal timber/plaster- board walls	With internal brick walls		
Wall Structures			With internal timber/plaster- board walls	
Double brick, no insulation	-	(Base Case)	0%	0.46
300mm Hempcrete (imported) / Exterior Lime Plaster	+0.9 stars	+1.5 stars	-98%	4.10
300mm Hempcrete (local) / Exterior Lime Plaster	+0.9 stars	+1.5 stars	-120%	4.10
90mm Timber Frame / R3 Batts / 25mm Battens	+0.8 stars	+1.2stars	-132%	3.08
Steel Frame / R3 Batts	+0.8 stars	+1.2 stars	-128%	3.08
450mm Strawbale (Infill) / Clay Render	+1.0 stars	+1.7 stars	-159%	4.54
175mm SIPs Panels / 50mm Battens (+ERV)	+0.9 stars	+1.5 stars	-105%	4.49
Timber Frame + Reverse Veneer (Mud Brick)	+1.4 stars	+1.8 stars	-178%	3.17
Timber Frame + Reverse Veneer (brick)	+1.4 stars	+1.8 stars	-141%	Not assessed

6.4 Foundations

Objective

To provide building foundations that play a useful role in the heating and cooling strategy of the home.

Guidance

- "Slab on ground" is the most common approach to housing foundations in a cool climate. This is a cost-effective way to achieve thermal mass inside a building and can even serve as the internal floor surface (with appropriate treatment). Production of concrete is responsible for significant greenhouse gas emissions, so it is important to minimise your building footprint as much as you can by eliminating wasted spaces.
- The WEV LCA Report recommended the inclusion of local supplementary cementitious materials in the slab foundations (e.g., Boral fly ash) to reduce the GWP of the slab. This is available locally and is no more expensive than normal cement mixes. It has slightly different qualities to conventional cement (e.g., slower curing time) but has many overall benefits. Recommend incorporation of up to 30-40% fly ash into concrete mix if covering building slab with additional floor cover such as timber. Not recommended for concrete floor slabs that will be cut and polished.
- Other "green cement" products will be considered and approved as alternative materials become available in WA.
- Rammed earth flooring is also an option for home builders and provides a small saving in greenhouse warming potential (GWP) but does require additional concrete wall footings.
- Most Ecovillage lots will provide a level building site, however, on sloping sites, building 'on stilts' with columns and footings is an approach that allows the building to float above the ground. This is not recommended without the provision of either:
 - a suspended slab; or
 - timber floor with the addition of underfloor insulation (e.g., R-2.0 underfloor batts) to prevent heat loss; and
 - either appropriately located thermal mass internal walls, or new generation "phase change materials" to buffer temperature changes.
- For more information on phase change materials, see <https://renew.org.au/sanctuary-magazine/building-materials/changing-phase-are-pcms-living-up-to-their-promise/>.
- Insulation is required below a suspended slab with no habitable rooms below (e.g., above a garage), however, slab edges on ground do not require insulation. See Section 6.7, Insulation.

Required

- House designs without a concrete slab must demonstrate equivalent thermal performance outcomes through the incorporation of thermal mass materials.

Table 5. WEV Life Cycle Analysis - Foundations

Foundations (All assuming 6 kW PV panels and base case house design)	Heating / cooling load (MJ/m ² /y) (lower is better)	GWP % saving of CO ₂ e compared to standard concrete (lower is better)
Eco (extended) concrete	3.4 / 94.4 = Total 97.8	-3%
Standard concrete	3.4 / 94.4 = Total 97.8	0
Insulated slab edge	4.7 / 94.2 = Total 98.9	+3%
Rammed earth floor	not assessed	-5%

6.5 Spanning Elements

Objective

To select spanning elements which are structurally appropriate and environmentally responsible.

Guidance

- The two most common spanning materials in a house are steel and timber. Concrete is occasionally used (e.g., suspended slabs) but these are always reinforced with steel to handle the tension load.
- Structural steel beams allow for long single spans and portal frames. However, steel is a high embodied energy material and expensive. Cold formed steel is often used in construction for smaller structural members, but it is difficult to recycle. As such, timber should be substituted wherever possible (timber laminated beams or trusses should be able to achieve the required spans in most cases).
- To minimise structural costs, consider the maximum spans of standard timber beams and design accordingly.
- Suspended slab for second storey is permitted if thermal mass and noise attenuation qualities are required. Alternative load bearing cementitious flooring systems will also be considered.

Required

- Timber is to be used as the primary spanning material unless it cannot reasonably be used to meet the structural needs of the design.

6.6 Roofing Materials

Objective

To ensure that roofing within the Ecovillage reflects excess summer heat from the building and provides a consistent aesthetic.

Guidance

- Light coloured and reflective roofing materials such as zincalume or steel sheeting reduce heat gain in summer. Dark coloured steel sheeting or tiles (concrete, slate, or clay) absorb heat and increase heat gain in summer.
- Zincalume steel provides up to four times the serviceable lifespan of galvanised steel sheeting.
- Roofing materials that incorporate solar electricity generation can be approved as a variation if they provide an environmental advantage over standard roofing material and PVs see (Section 9.3, WEV Design Review Process).
- 'Green' roofs planted out with vegetation or grasses are allowed, provided there is still sufficient impermeable roof space for rainwater requirements (see Section 8.2, Water). Green roof proposals must include a management plan and safe access considerations and be *National Construction Code, Vol. 2* compliant.

Required

- Roofing material must be zincalume sheeting (not galvanised or Colorbond).
- Allowable metal profiles are corrugated or standing seam. Other profiles can be considered with approval from the WEV Design Team.

6.7 Insulation

All Australian homes need to be well insulated to ensure comfortable internal temperatures all year round. Materials that are poor conductors of heat and that trap air tend to have high insulation values (see section 6.3, Walls). Some wall construction materials will require no additional insulation (e.g., straw bale with render); others will require additional insulation (e.g., timber framed weatherboard with plasterboard). For more information, see *YourHome*, "Insulation," p. 160-177.

To calculate the overall R value of the wall / ceiling, combine the individual R values of all elements and cavity spaces. Use an online R-value calculator or consult your builder/designer.

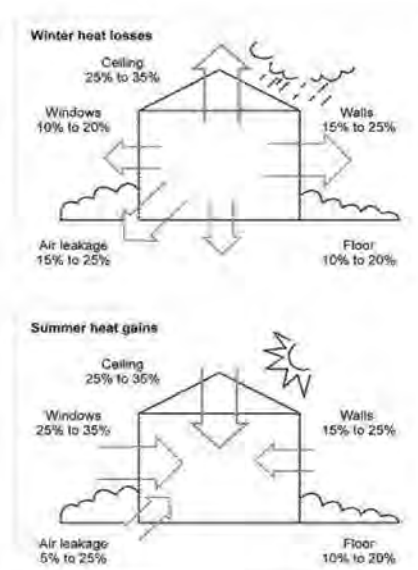


Figure 24. Typical heat losses and gains without insulation in a temperate climate (*YourHome*).

Objective

To optimise the amount of insulation within the building envelope in order to minimise the requirement for heating and cooling.

Guidance

- Choose add-on insulation products which are non-toxic, durable, and resistant to fire, water, and vermin. The Witchcliffe Ecovillage Life Cycle Assessment compared the carbon footprint of a variety of locally available add-on insulation materials, see Table 6, WEV Life Cycle Analysis - Insulation.
- Reflective foil barriers combined with a layer of air provide directional resistance to thermal flows in walls and ceilings, ensure it is installed correctly to achieve desired effect and avoid condensation issues.
- Ensure that wall wraps for timber framed weatherboard walls are vapour permeable to prevent condensation / air quality issues.
- Vapour permeable sarking (rather than reflective foil) is recommended for use in roofs with higher levels of ceiling insulation in our cold winter, warm summer climate zone.
- Avoid cellulose blow-in insulation (e.g., recycled newspaper) as this may be flammable and can promote pests and mould.
- Avoid wool insulation as it has a high carbon footprint and may be flammable.
- Ensure that corners of walls, ceilings and floors are properly insulated as this is where most thermal gaps occur.
- The WEV LCA indicated that slab edge insulation is not required in our climate (see Section 6.4). In addition, it does not facilitate visual inspection for termites.

Table 6. WEV Life Cycle Analysis – Insulation

Insulation type (assumed equivalent R-δ ceiling application in base case house design)	GWP % saving of CO ₂ e compared to rockwool (lower is better)
Hemp Batts (EU)	-4%
Recycled cotton (denim, US)	-4%
Rockwool	+0%
275mm Fibreglass batts	+0%
Polyester batts (virgin)	+1%
Rigid polystyrene	+8%
Wool	+97%

Required

- All house roofs, walls and non-slab floors (open to the exterior) must achieve minimum R-Values as specified in Table 7, Witchcliffe Ecovillage Minimum R-Values.
- Add-on insulation materials must be installed correctly and inspected during construction, with attention to detail to ensure even distribution and no gaps.
- Any thermal mass material forming part of the external walls must be paired with an additional component that provides a layer of insulation sufficient that entire wall assembly complies with minimum R value, see Table 7, Witchcliffe Ecovillage Minimum R-value Standards.

Table 7. Witchcliffe Ecovillage Minimum R-Value Standards

Construction elements plus insulation	Min. R Value	NCC min. R Value (for comparison)
Roof / ceiling	5.0	4.6
Walls	3.0	2.8
Non-slab floor / suspended floor with exterior exposure	2.7	1.0

6.8 Window Frames and Glazing

Inefficient glazing in your home can lead to a loss of up to 40% of a house's heating energy in winter, and a gain of up to 87% of summer heat (*YourHome*). Thermally efficient glazing can add additional cost to a building project, however, in our cool climate it can be an important investment to help you achieve a warm and comfortable home. It is also important to choose window framing materials which minimise the carbon footprint of your home and avoid toxic finishes.

The Witchcliffe Ecovillage Life Cycle Assessment compared the carbon emission potential and thermal performance of four standard window frames and three glazing options in the base case house design (see Table 8, WEV Life Cycle Analysis - Window Glazing and Frame Comparison). This table refers specifically to the WEV LCA of the base case house model, but give a reasonable indication of the relative thermal and GWP performance of the glazing and frame options in a Witchcliffe context. Note that this comparison assumed the use of the same type of window and frame combination throughout the assessed house design; in reality, the best thermal performance would be achieved with a mix of window frame and glazing types appropriately chosen for each part of the house.

For more information, see also the WERS rating scheme website <http://www.wers.net/werscontent/how-to-select-windows>, the Efficient Glazing Calculator on the Australian Window Association website <http://www.efficientglazing.net/>, and ReNew's "Window and Film Buyers Guide" http://www.renew.org.au/pdf/Windows_guide_table_2018.pdf.

Table 8. WEV Life Cycle Analysis - Window Glazing and Frame Comparison

Glazing and Frames (*relative to assessment in WEV base case house design with 6 kW PV)	NatHERS Star Rating Impact* (higher is better)	Global Warming Potential* (lower is better)
Aluminium frame / single glazed	(Base Case)	(Base Case)
Aluminium frame / 6mm single glazed / low-E	+0.2 stars	-8%
Aluminium frame / double glazed	+0.4 stars	-15%
Aluminium frame / double glazed / thermal break	+0.3 stars	-14%
Timber frame / single glazed	No difference	-6%
Timber frame / 6mm single glazed / low-E	No difference	No difference
Timber frame / double glazed	+0.5 stars	-33%
uPVC frame / single glazed	No difference	-6%
uPVC frame / 6mm single glazed / low-E	No difference	No difference
uPVC frame / double glazed	+0.5 stars	-33%

Objective

To design and locate efficient windows that maximise winter solar gain, natural light, and cross-ventilation, while minimising conductive heat transfer through the building envelope.

Guidance

- Invest in high quality window and glazed door units wherever possible, and be guided by any recommendations arising from life cycle and thermal assessments. The design, quality, and thermal efficiency of your glazing can have a significant impact on the thermal performance and visual presentation of your home.

GLAZING

- Given the cool climate in Witchcliffe (see Section 2.2 Climate), winter heating is the priority. As such, the design requirement for windows is low thermal transmittance (U-values) for all windows and high solar penetration (SHGC) for windows facing north (see Table 8, Indicative Window Thermal Performance).
- The SHGC difference between awning and fixed frame windows (see Table 9, Indicative Window Thermal Performance) is caused by the relatively larger frame to glass ratio in an awning window; therefore awning windows to north should be slightly larger than fixed/sliding windows to achieve an equivalent SHGC.

Table 9. Indicative Window Thermal Performance

Glazing (based on equivalent sized windows in WEV LCA base case house design)	Window type	U-Value (heat conductivity) (lower is better for insulation)	Solar Heat Gain Coefficient (SHGC) (higher is better for winter solar ingress on north facing elevation)
6mm Single glazing	Awning	5.4	0.56
	Fixed / sliding	5.4	0.63
6mm Single glazing Low-E	Awning	4.3	0.42
	Fixed / sliding	4.3	0.50
Double glazing	Awning	3.0	0.48
	Fixed / sliding	3.0	0.56

FRAMES

- Conventional steel and aluminium frames are generally considered to be thermally inefficient and require expensive “thermal breaks” to avoid compromising your home’s thermal performance. However, the WEV LCA Report found no benefit from thermally broken frames in our mild temperate climate (see Table 8. WEV Life Cycle Analysis - Window Glazing and Frame Comparison).
- Aluminium window frames were assessed by the WEV LCA to have a higher GWP than plantation timber or lead free UPVC frames, but they have been included as an option to provide a wider design choice.
- Choose operable window types (casement, sliding, etc.) that provide adequate cross flow ventilation while also sealing effectively to avoid heat loss in winter.
- Lead free uPVC frames provide a lower cost and maintenance free alternative to timber frames and are available as efficiently sealed double and triple glazed units, however uPVC frames may have a shorter life span than timber or aluminium.
- Louvre type windows are not recommended unless they are thermally efficient, tight sealing units.
- A high Solar Heat Gain Coefficient (above 0.45) is recommended on north-facing windows for passive heating

Required

- House design plans must specify window frames / glazing type and must meet the following requirements:
 - Overall Uw maximum 3.0 for all windows (frames plus glazing)
 - Window frames are made from sustainably sourced timber, lead-free uPVC or aluminium.



6.9 Sealing and Ventilation

Objective

To avoid creating air gaps in the building envelope that can transfer heat / coolness in or out of a building, and to avoid creating air quality issues through lack of ventilation.

Guidance

SEALING

- Minimise the number of penetrations in the insulation layer of the building (e.g., select light fixtures that do not project into the roof space). Where it cannot be avoided, ensure an air seal around the penetration, and where possible add insulation to compensate.
- Pay attention to common leakage points (see Figure 25 below). Consider draught proofing.
- Design airlocks at frequently used external door openings.
- Choose external doors and windows with airtight seals and ensure gaps between window frames, door frames, skirting boards and walls are effectively sealed.

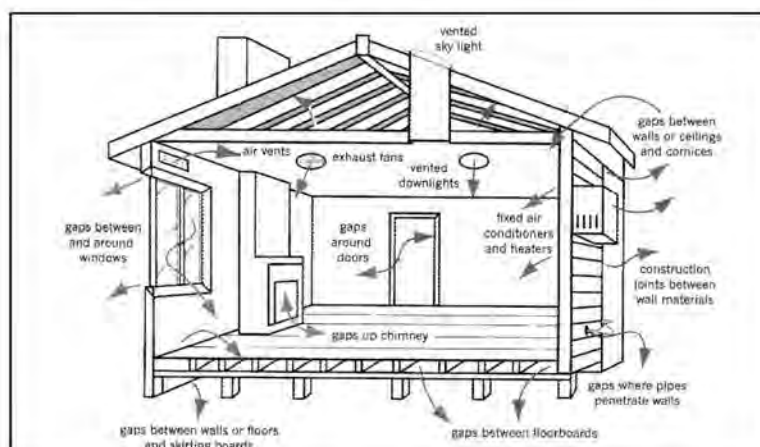


Figure 25. Common Leakage Points (*YourHome*).

VENTILATION:

- Blower-door testing measures the air tightness of a building in "air changes per hour at 50 pascals" or ACH@50Pa. The average Australian home gets an airtightness score of a breezy 15 ACH@50Pa and is generally draughty and expensive to heat and cool. Your house designer / builder can advise you of the expected airtightness score of your new home.
- A sustainable home built with attention to detail to sealing common gaps and penetrations should score between 3 and 7, and will maintain excellent air quality as long as there are operable windows, exhaust fans and no indoor pollutants in winter time when windows are closed for long periods (e.g., gas cookers, wood fires).
- A very airtight home, with a score of 1-3 may require a small mechanical ventilation with heat recovery (MVHR) unit to avoid condensation and air quality issues in winter.
- An extremely well-sealed house, e.g., to Passivhaus standards with a score less than 1, will require a centralised MVHR system.
- Choose external doors and windows with airtight seals and ensure gaps between window frames, door frames, skirting boards and walls are effectively sealed.
- Roof spaces should be provided with adjustable ventilation to vent summer heat and avoid winter heat loss.

Required

- Avoid unsealed recessed down lighting.
- If using ventilated skylights, refrigerator floor vents, wall vents etc., ensure that they can be made airtight in winter.
- Ensure exhaust fans are ducted and have non-return bales.
- Houses built to Passivhaus or similarly airtight standards (>1 ACH@50Pa) will require a MVHR system.

6.10 Termite, Vermin and Wildlife proofing

Feral rodents, as well as native possums, phascogales and lizards, like to live inside roof and wall cavity spaces, and can squeeze through any space which can accommodate their head. For mice and lizards, this can be gaps as small as 1-2cm in width. It is illegal to trap and relocate wildlife off your property and baiting for vermin can lead to secondary poisoning of owls and other native predators. It makes sense to ensure that your roof space and wall cavities are properly sealed to exclude all unwanted visitors and to build physical vermin and termite proofing into the design and construction of the house.

Objective

Design new buildings to exclude termites, wildlife and vermin.

Required

- All houses must be constructed with roof spaces and wall cavities sealed to exclude animals.
- Sub-soil chemical termite treatment is not permitted; provide physical termite barriers placed under slab in accordance with AS3660.1-2000.
- Houses using straw bale construction or panels must use wire or fibreglass exclusion mesh between straw and render, or other method of vermin proofing.



Figure 26, Endangered Western Ringtail possum, image courtesy of Nature Conservation Margaret River Region



7. Finishes and Details

7.1 Exterior Wall Finish

Objective

To ensure that the exterior wall finish is compatible with the intended architectural character and sustainability objectives.

Guidance

- The Witchcliffe Ecovillage will achieve a cohesive architectural sense of place through the use of an external palette of natural building materials and finishes, prioritising local, renewable, durable and low-embodied energy materials, (e.g., timber weatherboards, hemp render, lime and clay / earth renders, recycled or mud brick).
- Artificial and composite cladding products are not encouraged, unless they are products that can demonstrate a sustainability / embodied energy advantage and still adhere to the aesthetics of the materials palette.
- A homeowner wishing to use an alternative cladding or render finish must submit a detailed case to the WEV Design Team including the product source, specifications and life cycle assessment information.

Required

- All external building finishes to be in accordance with Ecovillage aesthetic principles and materials palette above.
- Stonework must be a minimum of 100mm thick (no stone veneers).
- Metal sheeting for cladding is only permitted on sheds / outbuildings (not Ancillary Dwelling) and if selected must be Zinclalume
- Any external brick walls must use recycled or mud brick
- The following cladding materials are permitted:

Timber Cladding

Any solid timber cladding is allowed that can be verified as one of the following:

- FSC Certified (Forest Stewardship Council)
- Plantation Timber (with a chain of custody document or Statutory Declaration)
- Recycled Timber
- Locally milled timber sourced from fallen paddock / verge trees (a Statutory Declaration required from miller)

Modified / Manufactured Wood Cladding

The following modified wood cladding is approved for use:

- Shadowclad external plywood panels by Carter Holt Harvey
- Vulcan thermally modified timber cladding by Austim
- Accoya chemically-modified (vinegar) timber cladding
- Vacoa thermally modified timber cladding by Mortlock Timbers
- NewTechWood composite timber cladding (recycled plastic / wood fibre)

Fibre Cement Cladding

The following fibre cement cladding options are approved:

- Linea Weatherboard Smooth 150 or 180 horizontal cladding and Axon 133 Smooth vertical cladding by James Hardie (product is supported by a detailed EPD that demonstrates the life-cycle / sustainability of the product and manufacturing process). Simulated or faux wood grain profiles are not permitted.

7.2 External Material Transition

Objective

To ensure that material transitions occur in locations that maintain the integrity of the design and the cladding material.

Guidance

- External elevations should generally be made up of no more than two primary cladding or visible materials (e.g. timber weatherboards and rendered straw bale / hemp.)
- Ensure that attention to material choice and details are applied to the whole house, not just the façade.
- Lighter-appearing materials should generally be located above heavier-appearing materials on the building façade.

Required

- Joints between cladding materials in the same plane must be formed using a transition element such as a 'negative detail' (notch) or overlapping trim.
- No exterior material changes on an outside corner (inside corner only).



Figure 27. Vertical colour / materials changes



Figure 28. Horizontal colour / materials changes

7.3 Application of Colour

The existing Witchcliffe village centre has a distinctive character largely based on simple historic buildings, natural finishes and utilitarian agricultural sheds. The main street's businesses tend towards an upcycled, quirky look, with light-hearted application of colour and recycled materials. The town's original group settlement houses expressed a simple aesthetic of dark Jarrah weatherboards with lighter trim on windows and doors.

Objective

To encourage an overall approach to colours within the Ecovillage that is consistent with the intended rural village aesthetic.

Guidance

- If painted, external walls should be predominately light or mid-tone with some allowance for feature elements of brighter colour or darker tone.
- Contrasting colours are allowed on trim and elements such as fascia boards, downpipes, window frames, architraves, balustrades, etc.
- Dark timber finishes are permitted, as are untreated hardwood weatherboards.

Required

- Avoid larger areas of bright, stark, or incongruous colours that do not suit the overall naturalistic palette of the Ecovillage.



Figure 22. Witchcliffe main street.

7.4 Gable Ends and Eaves

Objective

To ensure that gable ends and eaves are well-detailed, transitioning between materials at the appropriate locations.

Guidance

- Pay attention to the finish of all roof eaves as this seemingly minor detail will have a substantial impact on the visual presentation of your house.
- Raked eaves may be left open with rafters/trusses exposed as long as the attic space is sealed, as per Figure 9, Margaret Rive Strawbale Home.
- Raked eaves closed with an angled soffit are consistent with the Ecovillage architectural aesthetic, as per Figure 28, Indicative Gable Eave Detail, and Figure 5, Margaret River Hempcrete House.
- "Boxed" eaves should be avoided, or closed with a flat soffit with raised heel, as per Figure 28, Indicative Gable Eave Detail.

Figure 28. Indicative Gable Eave Detail (Fine Home Building, <https://www.finehomebuilding.com/2019/01/10/design-build-gable-end-eave-design>)

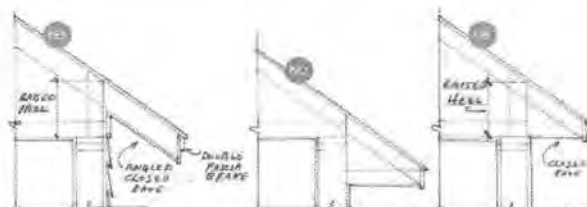
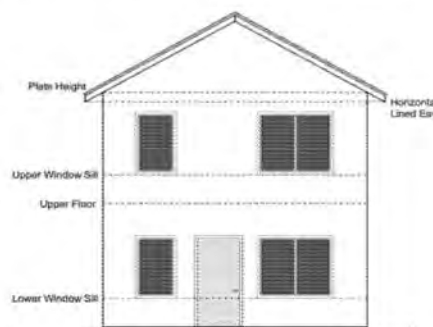


Figure 30. Gable End + Horizontal Eave Transition



Figure 31. Location for Materials Changes on Gable Ends



Required

- Gable ends should be of a consistent exterior material, or if a material change occurs horizontally it should be at plate height; in line with the horizontal eaves; at upper floor height; or at the bottom of primary windows (Figure 30).
- Transitions between gable ends and hip roofs need to be carefully detailed using one of two approaches:
- Line entire eave on the rake, and lining follows rafter angle around the corner on the hip roof.
- If horizontal eave lining is desired for hip roof, gable end must feature material change / moulding at the lower edge of the lined eave to create a regular triangle of one consistent material at the top of the gable end (Fig. 29)



Figure 32. Lino floor, Straw Bale home, Margaret River

7.5 Flooring

The type of flooring you use in your home makes very little difference to its thermal performance, as long as you have a concrete slab providing thermal mass. However, there is significant variation between the global warming potential (GWP) of some commonly used flooring materials. The WEV Life Cycle Analysis included a comparison of flooring materials in the base case design (Table 7, WEV Life Cycle Analysis - Flooring).

Wool carpet, in particular, was assessed as having a high carbon footprint, while sustainably harvested timber and linoleum were the materials with the lowest footprints. For people who are sensitive to dust mites and allergens, suggest avoiding carpet altogether, and if it is chosen, please choose carpet that is free from PFAS and PVC. Whatever flooring materials you choose, make sure that all glues, sealants, backings, underlays, etc., used to install them have little or no VOC (see Section 7.6, Internal Air Quality).

Table 8. WEV Life Cycle Analysis – Flooring

Floor Types	GWP % saving of CO ₂ e compared to base case (lower is better)
Living Room Area	
Tiles (base case)	+0
Linoleum	-7%
Polished concrete	-2%
Cork	+2%
Rammed earth	-5%
Timber	-7%
Bedroom Area	
Nylon carpet (base case)	+0
Wool carpet	+52%
Timber	-14%

7.6 Non-Toxic Materials and Finishes

Healthy homes enhance liveability, embrace good design and lifestyle principles, foster environmentally responsible choices and promote quality of life outcomes... [a] healthy home is the missing ingredient to improved family health and positive environmental outcomes.

The Smart Living Handbook, 2014.

Indoor air quality is critical for human health and comfort and is largely determined by the materials used in house construction and fit out. It can also be impacted by the everyday use of cleaning chemicals, gas cooktops and fireplaces, as well as the emissions given off by furniture. Construction materials and finishes can also create environmental impacts off site and impact negatively on workers' health (e.g., composite stone benchtops.) Indoor air quality is additionally important in a solar passive home, where design and construction of the building have paid greater attention to sealing and stopping draughts than a conventional building.

However, toxins within the home are not just inhaled, but can affect human health through ingestion and absorption as well, and this particularly can affect young children who tend to spend more time touching (and tasting!) the internal surfaces of a home. There are 38,000 chemicals approved for use in Australia, and it is beyond the scope of the Building Design Guidelines to regulate all internal finishes and materials, however, we have set some broad requirements. For more information, we strongly recommend *The Smart Living Handbook* as a very comprehensive guide to building and furnishing a healthy, low toxin home in Australia.

Objective

To ensure excellent indoor air quality in all new homes to promote a healthy environment for residents, and to prevent off site pollution and health impacts caused by the manufacturing of materials and finishes.

Guidance

- When purchasing new furniture, ensure materials and finishes have low toxicity and do not contain PFAS, a potentially toxic fire-retardant chemical.
- Many standard construction materials / finishes (e.g., chipboard / plywood, resin and laminate countertops, vinyl, paint) may contain high Volatile Organic Compounds (VOC) levels and are not permitted, see Table 10, Prohibited VOC Materials).
- Fibre cement board is allowed to be used internally in wet areas and as lining for eaves / outdoor ceilings.



Figure 31. Melbourne hempcrete home (image courtesy OzHemp, <https://www.ozhemp.com.au/>)

Required

- All materials chosen in the construction and finishing of your home must be below the CETEC VOC emission benchmark (0.5mg/m²/hour over 24 hours or 7 days, depending on the material).
- All internal glues must be low-VOC, and paints and stains must emit zero VOCs.
- Ensure installation of composite stone benchtops adhere to all safety standards for workers' lung health.

Table 9. Prohibited VOC Materials

Category	Prohibited Item	Reason	Suggested Alternative											
Treated timber	New CCA (Copper Chrome Arsenate) treated timber	Arsenic risk	Non-arsenic alternatives are commonly available, e.g., LSOP or 'blue' pyrethrin based treatment is acceptable. Note: aged CCA timber is acceptable for landscaping use.											
	Chipboards, MDF, plywood, composite wood products that contain large amounts of formaldehyde resin—used in cabinetry in kitchen, bathrooms, etc.	Inhalation risk	Low formaldehyde versions of composite wood products are commonly available. <table><tr><th>Emission Class</th><th>Formaldehyde Emission Limit (mg/l)</th></tr><tr><td>Super E0</td><td>Less than 0.3</td></tr><tr><td>E0</td><td>Less than 0.5</td></tr><tr><td>E1</td><td>Less than 1.0</td></tr><tr><td>E2</td><td>Less than 2.0</td></tr><tr><td>E3</td><td>Greater than 2.0</td></tr></table> We suggest E0 as a target, which can be met by all Austral plywood products, for example. Slightly above this target, Ikea cabinetry sits at about 0.6 mg/l.	Emission Class	Formaldehyde Emission Limit (mg/l)	Super E0	Less than 0.3	E0	Less than 0.5	E1	Less than 1.0	E2	Less than 2.0	E3
Emission Class	Formaldehyde Emission Limit (mg/l)													
Super E0	Less than 0.3													
E0	Less than 0.5													
E1	Less than 1.0													
E2	Less than 2.0													
E3	Greater than 2.0													
Paint	Paints containing VOCs	Inhalation risk	Nil VOC alternatives are readily available.											
Copper	Copper water pipes	Copper leaching and toxicity	HDPE and butelane piping.											
Carpets	Carpets containing PFAS or PVC	PFAS persists in the environment, linked to cancer and high cholesterol	Non-PFAS and non-PVC carpets, linoleum, cork, timber											
Vinyl	PVC water piping used inside residences for drinking water	Ingestion risk	HDPE and butelane piping.											
	Vinyl and vinyl-backed floor and wall coverings or other vinyl cladding	Inhalation risk	Natural fibre flooring, concrete slab, linoleum, cork, timber.											
Glues and coatings	Toxic adhesives used in quantity, e.g., timber flooring	Inhalation risk. Adhesives are responsible for much persistent indoor air pollution.	Water-based alternatives, or screw and joint rather than glue.											
	Polyurethane finishes for timber, polished concrete, etc.	Inhalation, absorption risk.	Water based polyurethane finishes are generally safer than solvent based but check labels for VOC levels. Oils and waxes are a natural alternative.											

8. Services and Appliances

The tragic reality is that very few sustainable systems are designed or applied by those who hold power, and the reason for this is obvious and simple: to let people arrange their own food, energy and shelter is to lose economic and political control over them. We should cease to look to power structures, hierarchical systems, or governments to help us, and devise ways to help ourselves.

Bill Mollison, co-founder Permaculture

8.1 Energy

Renewable energy generated by PVs is by far the most sustainable source of energy for all appliances within your Ecovillage home. The infrastructure required for a village scale wind power, geothermal, biogas or other energy plant is not a viable or practical option in a semi-rural residential area.

While many people will be accustomed to using gas for cooking and heating, it is a fossil fuel and its extraction and consumption contribute to carbon emissions. As the only household gas available in the Margaret River area is bottled LPG, it is also an expensive and inconvenient form of energy for everyday heating and cooking. Likewise, using a wood fuelled heater is a very inefficient way to heat your home or hot water and produces greenhouse gases and particulate pollution (see Section 8.6, Heating and Cooling).

The Ecovillage is therefore designed to be self-sufficient in renewable energy to all households through energy generated during the day by roof top solar PVs on every roof and stored for night-time use in centralised storage battery banks. A Western Power connection is provided to each cluster to enable export of excess renewable power back to the grid and provide continuity of supply. The total renewable energy produced within the Ecovillage over a whole year has been designed (using worst case cloud cover weather data) to be significantly greater than the total energy that residents consume.

Each strata cluster company will maintain a private microgrid and shared battery bank located in strata common property. The microgrid will connect all homes within the strata cluster to each other, to the central battery, and to Western Power, to enable each household to export their excess renewable energy for sale to other households or the Western Power grid. The microgrid network will also include two 3-phase (fast charging) electrical vehicle charging stations in each strata cluster on communal land.

All houses are required to install a minimum 6.0 kW solar photovoltaic panel (PV) array and a maximum 5kW inverter to provide greater than net neutral energy generation. PVs and inverters will be supplied by homeowners, who will be eligible for rebates under the Small-scale Renewable Energy Scheme for up to 6.6 kW of PVs (<http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/How-the-scheme-works/Small-scale-Renewable-Energy-Scheme>). High quality PVs will be made available for residents to purchase at bulk buy discounted prices through the Ecovillage Developer. Every lot will access the shared battery for night-time power, with kW hour allocations as per Appendix D, Witchcliffe Ecovillage Residential Energy Handbook.

Table 10. Example Witchcliffe Ecovillage Battery Allocation by Lot Type

Lot type	Cluster 1A	Cluster 1B	Cluster 1C
Groupie	5 kW hours	6 kW hours	6 kW hours
Cottage	9 kW hours	9.5 kW hours	10 kW hours
Family	12 kW hours	13.5 kW hours	15 kW hours

For further details, please see Appendix D, Witchcliffe Ecovillage Residential Energy Handbook.

Objective

To ensure a self-sufficient, resilient, renewable electricity power supply to meet the needs of all Ecovillage households.

Guidance

- Solar panels are to be considered as an integrated design element of the building. The permitted roof angles (see Section 5.3, Roof Forms) are designed to allow optimal solar energy production (between 90-100% if facing north) and present an aesthetically pleasing streetscape.

- The minimum PV requirements have been designed to cater for the average Ecovillage household's energy requirements and provide renewable energy self-sufficiency. If your household has higher energy needs (e.g., greater use of appliances, higher than average heating or cooling requirements) or would like to generate additional energy for sale back to the grid, there is no restriction on households installing additional PV's and batteries. However, the PV inverter sizes will be limited as per Appendix D, Witchcliffe Ecovillage Residential Energy Handbook.
- At the Initial Briefing (see Section 9.3, WEV Design Review Process) the Design Team will provide assistance with household energy budgeting and infrastructure requirements.
- As electric vehicles grow in popularity and accessibility and reduce in price, it will be important to ensure that all houses in the Ecovillage can provide a convenient outlet for slow charging of electric vehicles in their carports (10Amp is sufficient).
- As of 2019, all solar PV systems, inverters, and storage batteries installed in Australia must comply with the following Australian Standards:
 - AS - 477 Grid-connections of energy systems via inverters.
 - AS/NZS - 3000 Electrical wiring rules.
 - AS - 1768 Lightning protection.
 - AS/NZS - 1170.2 Wind loads.
 - AS/NZS - 5033 Installation of photovoltaic (PV) arrays.
 - AS IEC - 62619:2017 Secondary cells and batteries containing alkaline or other non-acid electrolytes / Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

Required

- Submitted plans must include an Energy Budget and Infrastructure Plan.
- Each lot must meet minimum 6.0 kW PV and comply with all relevant Australian Standards. Maximum inverter size varies by lot type and cluster as per Appendix D, Witchcliffe Ecovillage Residential Energy Handbook.
- All lots must supply and maintain a connection to the strata owned microgrid, as per the Witchcliffe Ecovillage Residential Energy Handbook (indicate microgrid connection location on site plan).
- All homes must be fitted SATEC NMI meter to enable integration with the strata microgrid.
- The use of bottled gas for heating, water heating and indoor cooking is not permitted.
- At least one parking space per lot must be located within 2m of a standard A/C wall outlet to facilitate slow charging of electric vehicles.



Figure 33. 6.4 kW PV array, Cottesloe

8.2 Water

The Ecovillage is completely self-sufficient in water supply, with all water for household use captured and stored in rainwater tanks on each lot, and all water required for community gardens, landscaping and agricultural food production supplied by stormwater captured in the Ecovillage's three sustainable dams.

Objective

To ensure sufficient potable water supply to meet your household's water needs.

Guidance

- To calculate roof area and water storage requirements, please see Table 14, Tank Sizing Guide, and read the Residential Water Supply Guide, attached as Appendix C.
- Recommended minimum sizes / person are 50m² of roof and 18,750L of tank storage.
- Seek expert advice from a licensed plumber to ensure an appropriately sized pump is fitted to the rainwater tank.
- It is recommended that houses are fitted with integrated "smart" water monitoring systems.
- Additional information is available regarding the management and use of rainwater tanks in the Australian Dept of Health's "Guidance on Use of Rainwater Tanks," ([https://www1.health.gov.au/internet/main/publishing.nsf/Content/0D71DB86E9DA7CF1CA2578F0001CBF2F/\\$File/enhealth-raitank.pdf](https://www1.health.gov.au/internet/main/publishing.nsf/Content/0D71DB86E9DA7CF1CA2578F0001CBF2F/$File/enhealth-raitank.pdf)).
- Ensure efficient use of water within the home by installing high efficiency WELS rated fixtures (see Table 15) and appliances (see Section 8.8, Freestanding Appliances.)
- Overland flow paths for stormwater runoff and rainwater tank overflow from private lots through community gardens to the stormwater system located within their community garden must be maintained.
- Pre-tank filtration can provide a very high standard of water quality, depending on filtration system.
- UV treatment systems may be installed post-tank but do add an energy consumption factor to household energy budget. UV treatment systems are covered by Australian standards, see https://www2.health.wa.gov.au/Articles/U_Z/UVtraviolet-disinfection-of-drinking-water.

Required

- Submitted plans must include a Water Budget (Appendix H) and Infrastructure Plan, demonstrating that 100% of water requirements can be met by onsite water collection and storage.
- Tanks to be fitted with an external tank level gauge and/or integrated flow monitoring device to assist in monitoring usage and detecting water leaks.
- Rainwater filtration systems (pre- and / or post- tank) must be installed to guarantee water quality and safety and reduce tank maintenance.
- Any roof discharge points not connected to rainwater tanks and rainwater tank overflows must be managed by connection to a rain barrel or rain garden and directed to vegetated areas that will spread and slow down water flows.
- Install fixtures (e.g., toilets, showers, taps) as per Table 12, Minimum WELS Fixture Ratings.

Table 11. Rainwater Tank / Roof Sizing Chart

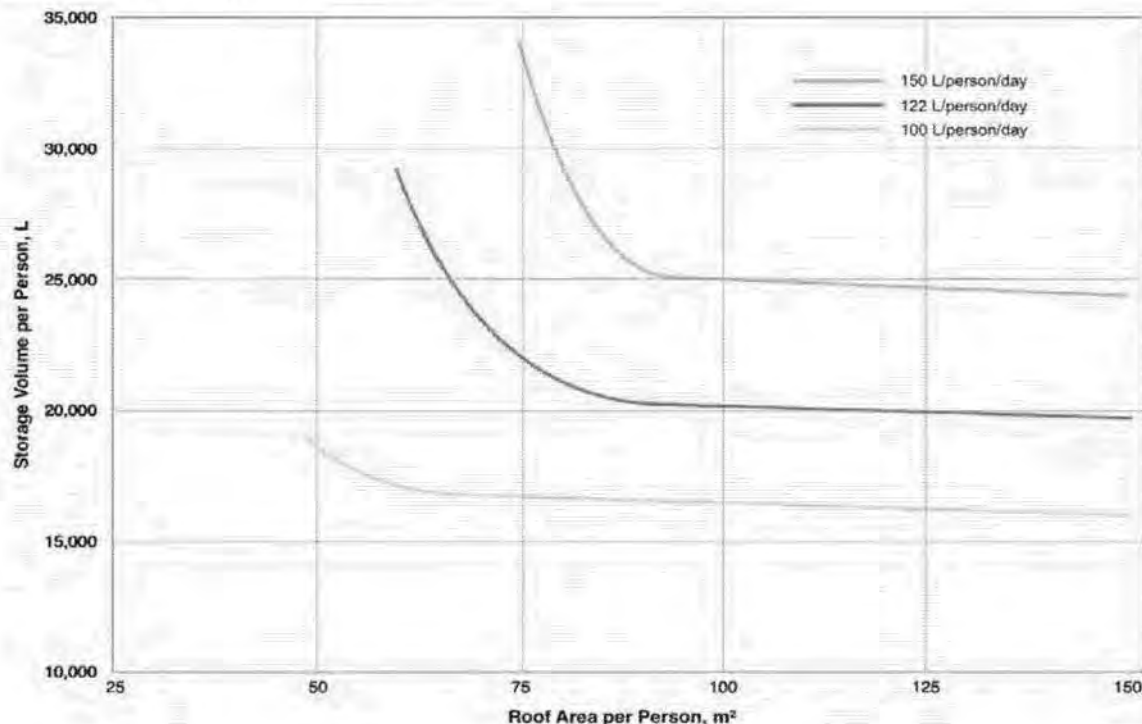


Table 12. Witchcliffe Ecovillage Minimum WELS Ratings

Fixture	National Construction Code minimum	Witchcliffe Ecovillage minimum / recommended	Comment
Taps	4 stars: 6-7.5L/minute	5 stars: 4.5-6L/minute	
Showerheads	3 stars: 7.5-9L/minute	4 stars: 6-7.5L/minute 5 stars: 4.9L/minute	Choice will depend on budget and level of water efficiency aimed for.
Toilets	4 stars: 4.5-3L/flush	4 stars: 4.5-3L/flush 5 stars: 4.5-3L/ flush with integrated hand basin 6 stars: 3-1.8L/flush (e.g., vacuum flush macerator technology that reuses water)	Choice will depend on budget and level of water efficiency aimed for.

8.3 Wastewater

The Witchcliffe Ecovillage Wastewater Treatment Plant is a private wastewater facility located on Davis Rd at the southern end of the development, powered by renewable energy. It is operated by TMC Witchcliffe, a wastewater service provider licenced by the WA Economic Regulatory Authority. Ecovillage residents will be charged an annual connection fee and rates for the treatment of their wastewater, similar to a conventional Water Corp sewerage service. Wastewater treated to A1 agricultural standard will be discharged onto Ecovillage Common Company agricultural land to grow tree crops.

For more information, see <https://www.ecovillage.net.au/sustainability/water/>.

Objective

To provide sustainable wastewater treatment that retains and reuses grey and black wastewater on site.

Guidance

- Installation of a household greywater system is recommended to supply additional water for gardens.
- Composting toilets are not allowed by WA Health Department regulations on any residential lot that has a sewer connection, therefore composting toilets are not permitted in the Ecovillage.

Required

- All houses must be connected to the Witchcliffe Ecovillage wastewater treatment system.
- All houses in Witchcliffe Ecovillage must install dual plumbing to allow for greywater separation for water recycling. Connections are required only from the bathroom(s). Connections to the laundry are optional and need to be carefully considered as water can become quite alkaline, which is inappropriate for some landscaping.
- A grey water 'Builder's Kit' is to be installed during construction to facilitate connection of the grey water system and to avoid costly retrofitting if the system is not commissioned at completion of construction.
- All greywater recycling must be via WA Health Dept. approved systems.



Figure 34. Avocado harvest, Witchcliffe.

8.4 Internet

Objective

To provide high-speed fibre internet connections to every dwelling and commercial building.

Guidance

- The Witchcliffe Ecovillage will provide National Broadband Network (NBN) fibre to the premises (FTTP) connections via the common service trench to all lots to facilitate telephone and high-speed data services for every building in the development.
- FTTP is the highest level of NBN service provision available and will ensure households and home businesses will enjoy a higher level of NBN service and capacity than is available with the fibre to the node connections or satellite services generally provided in rural areas.

Required

- NBN connection is required to every home to enable energy monitoring and metering networks.

8.5 Hot Water Systems

21% of energy used in the average Australian home heats water (*YourHome*), so it makes sense to ensure that you choose a hot water system that minimises your energy consumption. Unlike homes in a conventional subdivision, Witchcliffe Ecovillage homes are powered by renewable energy, so electric hot water systems are far more environmentally sustainable and affordable to run than gas systems.

Objective

To ensure that hot water systems are well-insulated and high-efficiency to minimise energy use.

Guidance

- Hot water systems should be chosen to fit within the overall electricity budget of the house and sized to suit the living requirements of the household.
- Heat pump hot water systems are highly efficient (up to 80% energy savings) and are more efficient in our colder climate than solar hot water systems, but can be variable in quality and carbon emission performance. Preferred heat pump hot water systems use low greenhouse warming potential (GWP) refrigerant gas (e.g., CO2 or R32) and must be higher quality, leak free units. We are able to offer excellent discounts on Reclaim, which are high quality units that meet these standards.
- Solar thermal panels for solar hot water systems only have one function - to produce hot water. Once the tank is hot, the panels are idle. In contrast, solar PV panels can produce hot water via a heat pump, as well as run other appliances inside the house, charge the batteries, or an electric car, etc., so it is more effective to use the space on your roof for PVs rather than a solar hot water system.
- For more information, see the extensive analysis of electric-based systems in this review: <https://renew.org.au/renew-magazine/buyers-guides/hot-water-buyers-guide/>.

Required

- All hot water systems must be electrically powered or boosted, no LPG gas.
- Heat pump systems must demonstrate that refrigerant used has low greenhouse warming potential.
- Include nominated system in Energy and Water Budget (Appendix H) and Infrastructure Plan.

8.6 Heating and Cooling

Space heating and cooling accounts for 40% of the average Australian house energy use (*YourHome*), and was responsible for 25% of the total carbon emissions (embodied and operational) of the base case house assessed in the WEV Life Cycle Assessment. A well designed solar passive home in the Ecovillage will remain thermally comfortable for most of the year, greatly reducing that energy requirement. However, during extended periods of overcast weather in winter and spikes in summer heat, some supplementary heating and cooling may be required. It is important to choose an energy efficient, easy to use, and environmentally friendly heating or cooling system.

Objective

To ensure energy efficient heating and cooling of homes and avoid local air pollution.

Guidance

- Ceiling fans provide a very efficient and low energy approach to summer cooling and are recommended in all living spaces. Locate fans above main occupation areas (dining tables, lounge suites, beds, etc.). While fans do not actually cool the air in rooms, the air movement they create cools people very effectively.
- Choose a fan which has reverse or "winter" mode, to assist circulation of warm air around living spaces in cold weather, particularly in living areas with raked ceilings.
- Reverse cycle air conditioning units powered by renewable energy are a relatively efficient, convenient and inexpensive way to provide occasional heating / cooling capacity. Make sure you choose a system which:
 - has the most energyrating stars for COLD climate zone you can afford (aim for ≥ 3.5 star cooling and ≥ 4 star heating);
 - is suitably sized for your living space's area/insulation/glazing/shading (use an online calculator);
 - has an "eco" mode and an automated timer; and
 - provides air filtration.
- The new Zoned Energy Rating Label for air conditioners is explained here:
http://energyrating.gov.au/sites/new.energyrating/files/documents/Factsheet_How_To_Read_The_ZERL_For_Air_Conditioners.pdf
http://energyrating.gov.au/sites/new.energyrating/files/documents/Factsheet_How_To_Read_The_ZERL_For_Air_Conditioners.pdf.
- The smaller the area you are heating or cooling, the more efficient the air-conditioning system, so try to design spaces which can be shut off with doors to create zones, so you are not heating or cooling unused space.
- Another heating system to consider is hydronic heating (radiator or in-slab) powered by heat pump hot water systems, but be aware of the variable quality and Greenhouse Warming Potential (GWP) of different heat pump models (see Section 8.5, Water Heating).
- Underfloor hydronic systems may also assist in cooling the house in summer.
- Gas space heating contributes to carbon emissions, gives off fumes inside your home, and is only available in expensive and inconvenient LPG bottles in the Margaret River area.
- Wood burning stoves and heaters are not recommended for everyday use in built up areas as they are inefficient converters of fuel to heat, contribute to carbon emissions, cause local air pollution to neighbours and residents with breathing difficulties, and are generally fuelled by unsustainably harvested forest hardwoods. They are not recommended in well-sealed houses, as they burn oxygen inside the home and require ventilation. In poorly sealed homes, they pull in cold air from outside. Outdoor fire pits are allowed.
- We recommend pellet heaters over solid fuel combustion heaters due to their efficiency and low particulate emissions (dependant on make and model), use of plantation softwoods, convenience, and ability to regulate temperature via thermostat control and timers.
- For more information see <https://www.energy.gov.au/households/heating-and-cooling>, and the *YourHome* and *Renew* websites.

Required

- Space heating and cooling provision and specifications (including Zoned Energy Rating Certificate) are to be included in Infrastructure Plan and Energy and Water Budget (Appendix H).
- Air conditioner energy rating certificate must demonstrate the appliance suitability for area to be heated/cooled, and demonstrate a minimum 3.5 star (cooling) and 4 star (heating) rating for COLD climate zone.
- Any selected pellet stove must not exceed 0.8g/kg particulate emissions (Australian Certified). See list of units on the Australian Home Heating Association website. <https://www.homeheat.com.au/wood-heaters/certified-wood-heaters/>
- Gas or wood fired space heating is not permitted.
- Underfloor hydronic system must specify low GWP heat pump system.

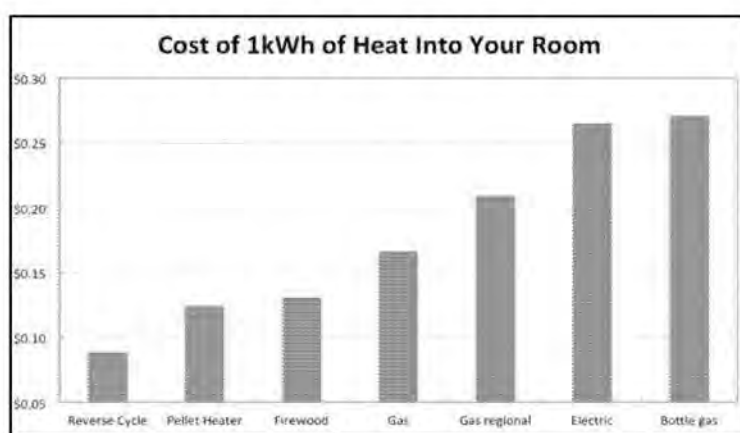


Figure 35. Comparison of Heating Costs (Enviroheat Australia, <http://enviroheat.net.au/home-heating-2/running-costs-of-pellet-heaters-versus-alternatives/>.)



Figure 36. Pellet Heater (Innovations Enviro Heating <http://www.enviroheating.com.au/heaters/nike-pellet-heater>)

8.7 Lighting

Lighting contributes about 6% of your home's energy consumption (*YourHome*), and the interior spaces of many houses are over lit. Thoughtful lighting design can reduce day to day energy use and provide appropriately lit living environments.

Objective

To ensure that lighting design is fit-for-purpose and energy efficient.

Guidance

- Avoid applying a generic "lights per m2" lighting approach, and instead design a specific lighting plan for each room. Focus direct lighting (downlights) over task areas such as benchtops and work areas and use indirect light (uplights, wall brackets) for general ambient lighting. Use lamps to provide additional locational lighting related to furniture configurations.
- Create lighting zones on separate switches, rather than one large bank of lights controlled by one switch.
- Consider the colour temperature that is appropriate for each room and use. Colour temperature in lighting ranges from warm white (2700-3500K) to natural white (3500-4500K) to daylight white (5000-6000K). Higher colour temperatures become more blue and less yellow, are less cosy and are better for detailed tasks. Choose warm spectrum lights for bedrooms and night-time living spaces, as blue spectrum light disrupts melatonin production and can impact on sleep cycles if used at night.
- We recommend LED lighting for efficiency and to avoid any lighting higher than 4500K.
- Keep external lighting to a minimum and face away from neighbours to avoid light pollution.
- Use low bollard-type or at-ground lighting outside rather than taller pole lights.

Require

- Submit a lighting plan with house plans.
- All lighting for dwellings (interior and external) must be high-efficiency.
- All external lighting must be directed away from neighbours and community garden areas.



Figure 37. Margaret River hempcrete house, built by Hemp Homes Australia (<https://hemphomesaustralia.net.au/>)

8.8 Free Standing Appliances

As your Ecovillage home is completely self-sufficient in renewable energy and water, it is important to include the expected energy and water consumption of freestanding appliances in your energy and water budget calculations. Household appliances account for approximately one third of household energy use, and laundry appliances account for over 20% of household water consumption. Choosing household appliances carefully can have a significant impact on reducing your energy and water consumption, directly reducing your operational carbon emissions, and freeing up more renewable energy that you can sell back to the Western Power grid.

The importance of household appliance choice was confirmed by the WEV Life Cycle Analysis Report, which found that if our base model house used **average** energy efficient (1-2 star) appliances instead of **high efficiency** appliances (4-7 stars), the global warming potential would increase by 154% and would create 26 t CO₂ e over the 80 year life of the building. The results of this scenario highlight the importance of the use of high-efficiency appliances in the dwelling to ensure a net carbon negative result.

The [Smart Living Handbook](#) and the [YourHome](#), [WELS](#) and [energyrating](#) websites all provide excellent advice on choosing energy and water efficient appliances. If your budget to upgrade appliances is limited, focus attention on appliances which are always on or used frequently (e.g., refrigerators) which can deliver the best investment to energy savings return, and aim to replace all appliances over time to 4-7 stars. **The higher the stars, the greater the efficiency.**

Objective

To assist households in choosing appliances that are energy and water efficient.

Guidance

- Use the highest rated water efficient appliances possible (4-6 WELS star rating).
- Use the highest rated energy efficient appliances possible (4-10 Energy Rating stars).
- Carefully select refrigerators and freezers that suit your family size and requirements, and ensure seals and motors are well maintained.
- To ensure efficient operation of appliances, provide ducting/minimum clearances as per appliance specifications.
- If using a tumble dryer, choose one with a heat pump to increase efficiency.
- Consider appliances that do not require standby power, or install smart management devices.

Required

- Include indicative freestanding appliance specifications, including star ratings, in Energy and Water budgets.



Figure 38. Water rating label

<https://www.waterrating.gov.au/choose/water-rating-label>



Figure 39. Energy rating labels

(<https://www.energy.gov.au/households/energy-rating>)



C. APPROVALS AND CONSTRUCTION



9.2 Thermal Assessment and Life Cycle Assessment

All Ecovillage buildings must meet minimum building permit standards as required in the National Construction Code (NCC) Vol. 2., which includes the requirement to meet the building thermal performance requirement for Class 1 buildings via one of three methods of thermal assessment:

1. Obtaining a Deemed to Satisfy energy rating of at least 6 stars using a software tool accredited under NatHERS;
2. Complying with the relevant Deemed to Satisfy elemental provisions detailed in the NCC (which prescribe specific levels of energy efficiency materials be included in the home, such as insulation and glazing); or
3. Providing a Performance Solution, where it can be demonstrated that the proposed solution meets the Performance Requirement through other means. For example, a Performance Solution could demonstrate that the heating and cooling loads of the proposed building are less than or equal to the heating and cooling loads of a reference building, as prescribed in the NCC (V2.6.2.2).

We anticipate that most Ecovillage houses will easily achieve 6 plus NatHERS stars. Therefore, the Design Guidelines specifies a minimum NatHERS star rating requirement of **8.0 stars** in order to achieve our sustainability outcomes. NatHERS only rates thermal performance and not the embodied energy or other environmental impacts of building materials and fixtures. It may be that the embodied energy or cost of the additional materials and products required to achieve a 10 star house (additional insulation, added phase change materials, triple glazing, etc.) outweigh the operational energy gains that would be achieved in our climate zone. To account for the operational energy use of the house, a NatHERS assessment of each house will be required (ie. a star rating out of 10).

Life cycle assessment provides a far more comprehensive tool for analysing the thermal performance and long-term global warming potential and environmental impacts of your building (see Figure 41, Star rating vs Life Cycle Design).

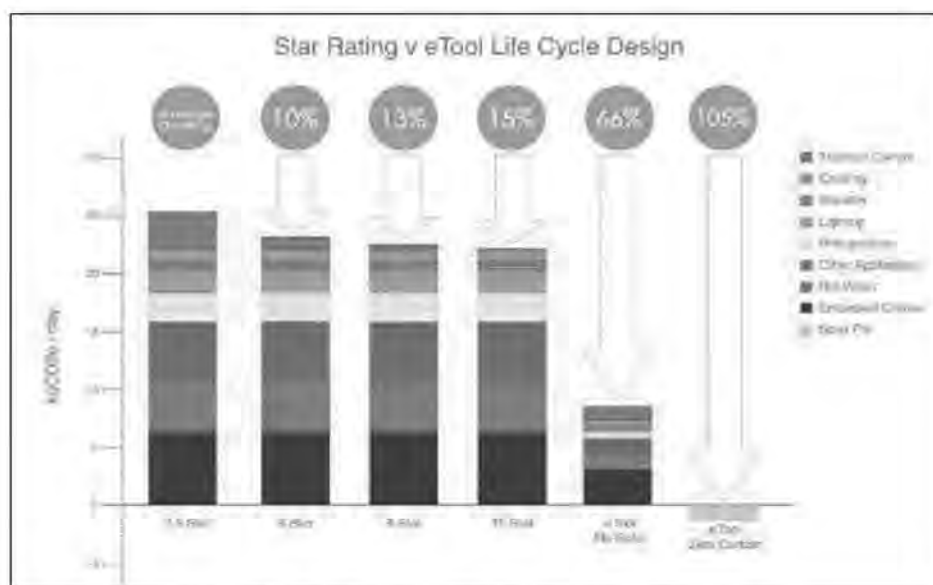


Figure 41. Star Rating vs Life Cycle Design (courtesy eTool <https://etoolglobal.com/>)

In order to ensure that all homes are meeting the high Ecovillage sustainability standards, every home will be required to undergo a standardised Life Cycle Assessment and achieve minimum carbon emission outcomes, as per Table 9, WEV LCA Minimum Carbon Emission Outcomes. The Design Team has negotiated a discounted LCA service for Ecovillage homeowners with eTool (www.etoologlobal.com), which will be included in the lot price. You should undertake the LCA following the submission of your initial concept plans and specifications and prior to submitting final documents for Formal Assessment (see 9.3 WEV Design Review Process).

The targets we are setting for each lot type will ensure that each house is carbon negative (incl. the solar panels and microgrid).

Table 13. WEV LCA Minimum Carbon Emission Outcomes

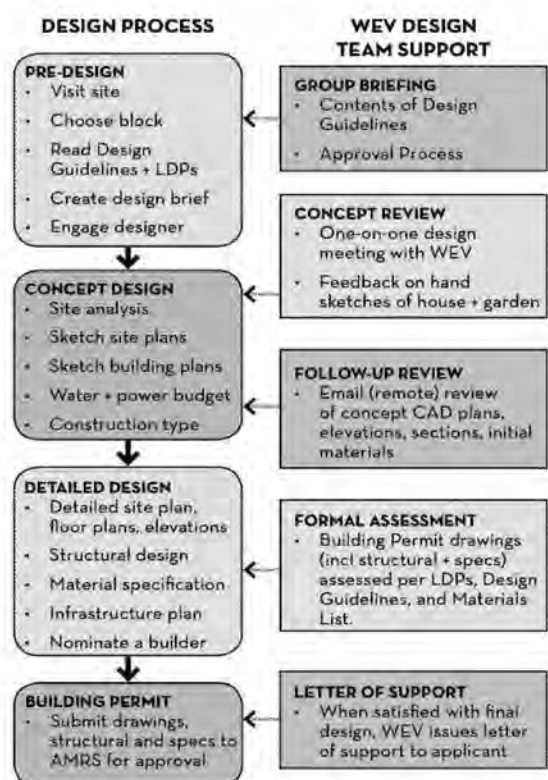
Lot type	Operational and Embodied Carbon kg CO ₂ e
Min. Requirement	-105% Carbon Emission compared to OECD Average

* Occupancy figure used is not actual household size; rather it is average occupancy (ABS Data) by house size based on number of bedrooms. Negative number means more carbon is taken out of the atmosphere than is emitted as a result of the project.

Access to the assessment software and instructions can be found by clicking on the following link:
<https://rapidlca.com>

9.3 WEV Design Review Process

In order to ensure that new homes in the Ecovillage are designed in accordance with our sustainability objectives, you (and/or your designer) must participate in a series of design reviews with the Design Team during the process. Please ensure that you have thoroughly read these Design Guidelines before attending the Initial Briefing and the Concept Review.



1. **Initial Briefing** – Witchcliffe Ecovillage (WEV) provides induction on design requirements, basic principles of passive solar design, service requirements, approval process, etc.

2. **Concept Review** – one on one review of initial butter paper concept (including site analysis plan, design brief and preliminary energy and water budget) for house and garden with each purchaser/builder.

3. **Follow-Up Review** – email (remote) review of concept level CAD plans, elevations, sections, initial specifications, etc.

4. **Formal Assessment** – applicant submits final Building Permit documentation (including structural), detailed specification (prior to Shire or private certification), LCA results, and all other WEV documentation (see Section 9.4) to confirm compliance. WEV reviews against LDPs and WEV Building Design Guidelines, and issues an approval letter or requirement for revisions.

5. **Revisions** – if revisions are required, an additional Formal Assessment is required once the areas of non-compliance are addressed.

6. **Augusta-Margaret River Shire (AMRS) Building Permit** – applicant submits final drawings and specifications along with WEV approval letter to Shire for assessment and approval (or approval if applicant opts for private certification).

This process assumes that you do not require Development Approval from AMRS, which will be the case for any residential development that is in accordance with the relevant Local Development Plan and the R-Codes.

9.4 WEV Formal Assessment Documentation

At Formal assessment stage, submitted documentation must include the following:

- Building permit documentation (including structural).
- Finished Floor Level nominated on Building Permit documentation
- Detailed specification (prior to Shire or private certification).
- eTool LCA report., including GWP Summary indicating percentage of GWP savings achieved.
- WEV Building Design Guidelines Checklist, Appendix G, which demonstrates your home's compliance with all Building Design Guideline requirements and/or provides rationale for all instances of variation.
- Infrastructure Plan showing details of all service infrastructure, including:
 - location of underground infrastructure, including connections to energy microgrid, WEV sewerage service, and NBN;
 - location and sizing of PV's;
 - inverter type and location;
 - rainwater tanks, downpipes, overflow pathway, greywater system & builder's kit;
 - energy and water ratings for all fixtures and appliances; and
 - monitoring devices.
- Fencing concept design for front and rear fences
- Energy and Water Budget, including energy rating and WELS star rating information for all major appliances, demonstrating that estimated average daily energy and water consumption will be supplied. (See Appendix H, Energy and Water Budget template.)
- Construction Agreement. (See Section 10.1, Standards During Construction, and Appendix I, Construction Agreement Form.)
- Construction Waste Management Plan. (See Section 10.4, Construction Waste, and Appendix J, Waste Management Plan Template).

All checklists, templates and documentation guidelines can be downloaded from the Witchcliffe Ecovillage website.

<https://www.ecovillage.net.au/library/document-library/>

Please ensure all required documentation is included when submitting for formal assessment and Letter of Design Compliance. This will assist in expediting the approval process. Application will not be processed until all required documents are submitted

9.5 Building Permit

A Building Permit is required for all structures (residential, commercial or industrial) including but not limited to new works, alterations, additions, swimming pools, spas (below and above ground), pool safety barriers / fence for pools & spas, patios, retaining walls and sheds. Building Permits must be obtained prior to the commencement of any building work. To obtain a Building Permit, an application form (BA01 or BA02, see below) together with one copy of all plans and specifications must be submitted to Augusta-Margaret River Shire Building Services.

Submission requirements can be found on the Department of Commerce website <http://www.commerce.wa.gov.au/building-commission/building-approval-forms-0>.

Assessment Timeframes

To speed up the approval process, applicants can engage a private building surveyor to certify plans prior to lodging with the Shire for approval.

- Certified applications - BA01 - approval timeframe 10 business days
- Uncertified applications - BA02 - approval timeframe 25 business days

9.6 Mid and Post Construction Inspection

The correct installation of sustainability infrastructure is vital to its functional operation. In order to ensure the sustainability outcomes of the Ecovillage are being met the Design Team will conduct the following inspections:

- a mid-construction inspection to confirm correct installation of insulation; and
- a post-construction inspection to confirm all sustainability infrastructure is installed correctly and to the specifications of the submitted Infrastructure Plan.



10. Construction Management



10.1 Standards During Construction

In order to ensure a quality build, an orderly construction process and to reduce impact on neighbours, the following requirements must be met during construction:

- Construction works must comply with all Shire policies, regulations, and strata bylaws.
- Ensure all trades and contractors are aware of sustainability infrastructure requirements, e.g., correct installation of insulation, correct location of rainwater tank inlet, correct placement of PV array, etc.
- The site must be kept clean at all times during construction to minimise impact on neighbours. All rubbish must be disposed of off-site.
- The lot must be maintained prior and during construction, with grass cut, weeds and rubbish removed.
- Earthworks are to be managed carefully, and dust is to be controlled.
- Storage of all plant and materials to be on the subject lot only (not on adjoining lots, open space or common property even if unoccupied).
- Vehicle parking is not permitted on other lots, open space, median strips or other landscaped areas.
- Existing vegetation is to be protected with tree protection barriers.
- Stormwater is to be appropriately managed (sediment to be controlled and managed so it does not impact downstream swales).
- Swales along road verges must be maintained and not obstructed or filled in, and cross-overs / culverts over swales must not be damaged.

After receiving formal approval of building plans (Building Permit) from the Shire but before commencing construction, lot purchasers and their selected builders will be required to sign a Construction Agreement (Appendix I). This will acknowledge that the purchaser and builder are aware of the requirements for building in the Ecovillage, and that the builder and all trades will comply in an orderly and courteous way.

Owners of lots must also commit to making every effort to ensure minimum damage to roads, paths, landscaping on verges and in community gardens during construction.

PLEASE NOTE: Owners will be liable for replacement and repair costs of any damage (enforced via each cluster's strata bylaws).

10.2 Waste Management

Avoiding and reducing waste directly benefits builders and owners in reducing costs and should be standard practice as part of every building project. Prior to commencement of construction, the owner and/or builder must submit a Waste Management Plan (Appendix J) to the Design Team to demonstrate that sustainable waste management requirements are understood and fulfilled.

At the Ecovillage, best practice construction waste management will be achieved in the following ways:

- With the assistance of your designer and builder, apply the best practice principles of AVOID, REDUCE, REUSE and RECYCLE to the construction of your home.
- The Ecovillage encourages the reuse of materials in new buildings and supports property owners who wish to utilise recycled/repurposed materials provided they meet building code standards and do not compromise the performance of buildings.
- The Ecovillage will provide a temporary site for storage and recycling of surplus building materials such as off-cuts, over orders, and incorrect materials to increase the reuse of materials on site and to help increase the availability of reusable materials.
- To maximise the recycling of building waste that cannot be reused on site, builders will be required to separate materials into waste streams that can be best handled at the local waste management facility operated by the Shire on Davis Road:
 - Rubble, including broken bricks, concrete waste, broken tiles, small offcuts of plasterboard;
 - Metals; and
 - Timber offcuts and timber waste.

For more information, please see the *Master Builders' Association of WA Smart Waste Guide (2014)*:

<https://www.mbawa.com/wp-content/uploads/2014/09/Smart-Waste-Guide-resized.pdf>

and the *WA Local Government Associations' Construction Waste Management Plan Guidelines*:

https://www.wastenet.net.au/Profiles/wastenet/Assets/ClientData/Document-Centre/WAL2708_Construction_waste_A4_v2_singles.pdf.

Appendices

(All appendices are located in the Witchcliffe Ecovillage Document Library: <https://www.ecovillage.net.au/library/document-library/>)

Information:

A: Witchcliffe Ecovillage Local Development Plans

B: Rural Hamlet Design Handbook Extract

C: Bushfire Management Plan

D: WEV Residential Energy Handbook

E: WEV Residential Water Handbook

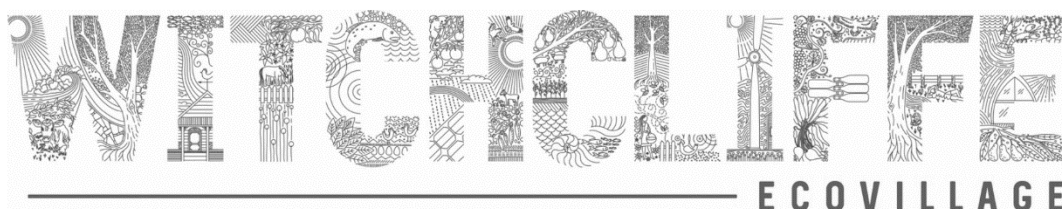
Templates and Checklists:

F. Local Development Plan / R- Code Checklists

G. Building Design Guidelines Checklist

H. Energy and Water Budget Calculations Template

ANNEXURE C - RESIDENTIAL WATER SUPPLY HANDBOOK



Water Handbook 2020

SUSTAINABLE SETTLEMENTS

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Introduction

The Ecovillage

The Witchcliffe Ecovillage is a unique sustainable housing development in Western Australia which aims to be 100% self-sufficient in renewable energy, water and organic fresh produce.

This guideline provides advice and sets out the minimum requirements to ensure that all new dwellings in the Ecovillage are reliably provided with a potable water supply.

Water Supply in Witchcliffe

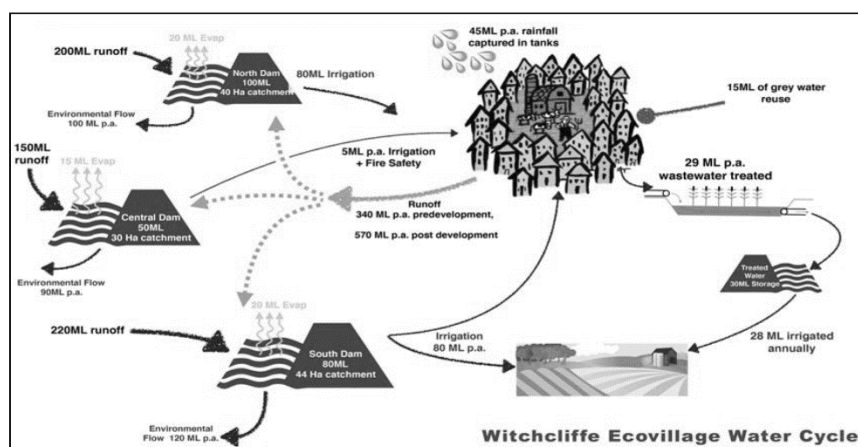
A mains water supply is not provided by WaterCorp in Witchcliffe, so each Witchcliffe Ecovillage dwelling must be designed to collect and store enough rainwater to provide for all household and private garden water requirements.

Residents in regional WA have reliably used rainwater tanks for their water requirements for many decades. The supply of rainwater makes use of a resource created by the roofs of houses, which in a conventional urban environment is simply drained away to the nearest water body, often causing environmental impacts downstream. Collecting rainwater for household use avoids the “hidden” offsite impact of many Australian scheme water supplies, including groundwater extraction, water treatment, extensive pipelines, pumping stations and dam infrastructure, energy for pumping and desalination, and impacts on water catchments, streams and wetlands. There are a number of excellent resources available to guide you in providing and managing your own water supply (see References, p. 11) however, we strongly recommend that you read the Australian Government Department of Health publication, “Guidance on use of rainwater tanks.”

Water Supply in the Ecovillage

All water required by the Ecovillage community will be captured from natural rainfall and stored onsite in household tanks and dams. Water modelling for the project has been based on 30-year worst case rainfall data, from data recorded onsite by the Bureau of Meteorology weather station. Water for the community gardens (including your exclusive use veggie garden area), agricultural lots and public landscaping irrigation requirements is supplied by the Ecovillage Commons Ltd from the Ecovillage’s three dams, which capture all of the additional stormwater created by the urban footprint of the Ecovillage.

Figure 1. Witchcliffe Ecovillage Water Cycle



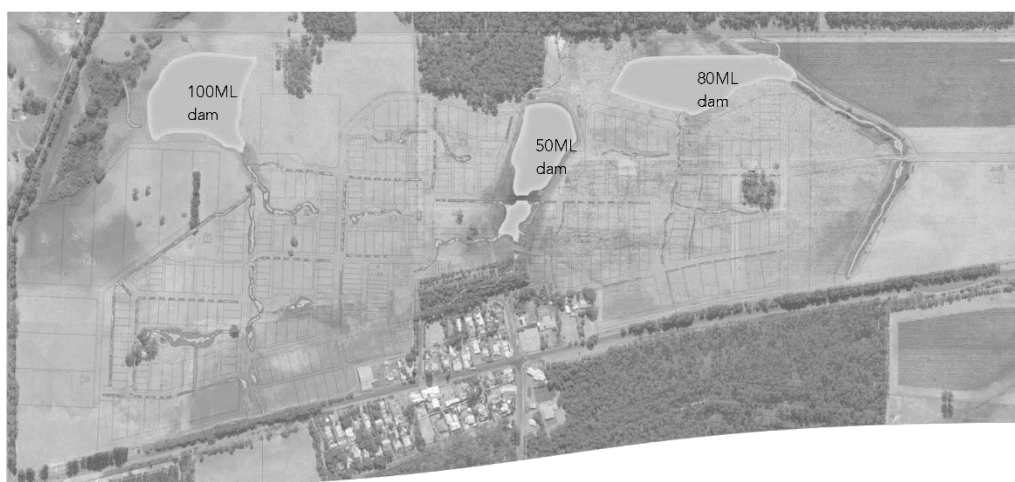
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Stormwater

Stormwater in the Witchcliffe Ecovillage will be collected and conveyed in surface water features that have been created to mimic natural ponds and streams, planted with native reeds and plants. Run-off from roads will be collected in landscaped swales, which provide biofiltration to remove pollutants, and will be directed via reconstructed streamlines through the community gardens where further treatment areas incorporating biofilters, riffle and wetlands will provide additional cleansing.

Treated stormwater collected and stored in dams will be used for irrigating community gardens, recreation areas, landscaping and agriculture throughout the Ecovillage. Extensive modelling has been carried out to ensure the Ecovillage has plenty of water, even in low rainfall years, to grow food in our community gardens and agricultural lots.



Wastewater Recycling

The Witchcliffe townsite does not currently have a connection to a centralised wastewater service, so the Ecovillage will provide a state-of-the-art small-scale wastewater treatment plant at the southern end of the project, on Davis Rd. It is located on Ecovillage Commons Ltd owned land and will be operated by an Economic Regulatory Authority (ERA) licenced wastewater provider, TMC Witchcliffe. The ERA is a WA State authority which regulates the annual fees of private service providers to ensure that households are charged fairly and provided with a perpetual service which complies with all regulations. The plant will use renewable energy to clean the Ecovillage's wastewater using a treatment system designed around a modular bioreactor that will expand as the Ecovillage grows. The system comprises screening, treatment in a bioreactor to remove nutrient and organic matter, a lagoon to store cleaned agricultural "A" grade recycled water for seasonal use, and re-use of treated water for horticulture and agroforestry areas located at the south western end of the project. The irrigation areas have been planted with a trial avocado orchard and a coppiced eucalypt, casuarina and poplar plantation for providing mulch to the future Ecovillage community gardens.

Education and resources will be provided to the community to ensure the use of environmentally friendly cleaning products throughout the Ecovillage. Wastewater costs will be similar to Water Corp's wastewater fees in Margaret River, which are approximately \$1,200 per house per annum. As a comparison, new houses in the Witchcliffe area without a deep sewerage service must install a stand-alone treatment system (ATU) which costs approx. \$15,000, and pay to have the system serviced every 3 months and pumped out every 2 to 5 years.

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Planning for Your Water Needs

Rainwater Tanks

Individual tanks are required for each Ecovillage property to comply with state legislation, as it is illegal in Western Australia to supply water for domestic use from one property to another without a license from the Economic Regulation Authority. This requirement ensures that each property owner is responsible for their own water quality and adequate storage volume.

The Witchcliffe Ecovillage Building Design Guidelines specify Zinalume tanks for all tanks visible from streets, path networks and community gardens, to ensure a common aesthetic. Poly tanks are a slightly cheaper option but may not be as durable when exposed to direct sun and will require screening in visible locations. Below ground concrete tanks are more costly due to excavation and construction costs, however, they are an option to explore for anyone wanting to maximise their garden space. Slimline tanks and bladder storage are also relatively expensive options; however, they can provide supplementary storage under decks and eaves if needed.

How Much Water Is Required?

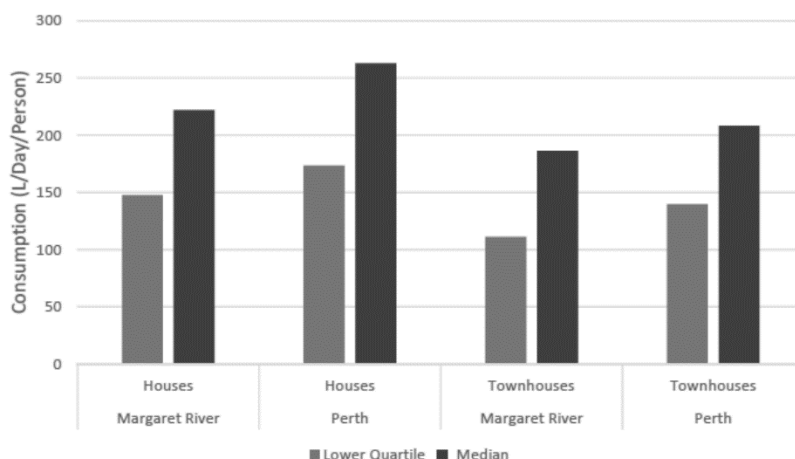
Our minimum water storage recommendations reflect the aspirations of the Witchcliffe Ecovillage community to be water efficient households. The recommendations assume that all households will be constructed with water efficient fixtures and fittings, and that household water consumption will be monitored via tank level indicators and flow meters. These water efficiency measures are specified in the Witchcliffe Ecovillage Building Design Guidelines (2020).

The minimum quantity of water recommended for a water efficient household connected to a rainwater tank in the Witchcliffe Ecovillage is 100 litres per person per day.

This is the amount of water recommended for internal household use and does not include an allowance for gardens and lawns. This is substantially lower than the average Perth water consumption figures of 246 litres per person per day (L/p/d), however, this figure combines all household and garden use (including pools and spas). Unfortunately, there is currently no data available that provides the average water use of households which are reliant on rainwater tanks for 100% of their water supply, but there is sufficient evidence to assume that:

- water usage is substantially lower in the Margaret River region than in Perth (see Figure 1 below);
- water usage by residents supplied from rainwater tanks is lower than residents supplied from scheme water; and
- water usage in dwellings constructed with water efficient fixtures and appliances is less than the average dwelling connected to scheme water (e.g., "Josh's House," see Appendix 1, which uses approx. 50 L p/p/d.)

Figure 2. Water Consumption Comparison, Margaret River and Perth Regions, (Sustainable Trust).



The amount of water your household will require will be determined by:

- the number of bedrooms/occupants,
- water use practices within the household
- the efficiency of household fixtures such as taps, showers, toilets and appliances,
- the water you require for your garden, and
- whether you provide a greywater system.

The following table breaks down average household water use and demonstrates that 100 L per person per day (L/P/D) is easily achievable in a thoughtfully designed house. In reality, water use in houses may not be a constant 100 L/person/day through the year, as people with water tanks tend to use water more freely in winter when their tank is overflowing and naturally conserve water more diligently during a dry summer.

Table 1. Standard vs Efficient Household Water Consumption*

Water use (excluding garden use)	Standard water consumption L / Person / Day	Efficient water consumption L / Person / Day
Shower: 1 shower per day	63	42
Washing machine: 1/4 load per day	20	7.5
Dishwasher: 1 load per day	19	9
Toilet: 4 flushes per day	14	14
Taps: 5 mins running time per day	45	20
Other:	5	5
Total	166	97.5
Calculations based on:		
Shower time	7 mins	7 mins
Shower 3 WELS star	9 L / min	
Shower 4 WELS star		6 L / min
Taps 3 WELS star	9 L / min	
Taps 4 WELS star		4 L / min
Dishwasher 2 WELS star	19 L per load	
Dishwasher 6 WELS star		9 L per load
Washing Machine 6 kg top loader 3 WELS star	80 L / load	
Washing machine 6 kg front loader 6 WELS star		30/ load
Toilet 4 WELS star	3.5 L	3.5 L

* Based on information provided on the Australian Government Water Rating website:
<https://www.waterrating.gov.au/choose/compare>

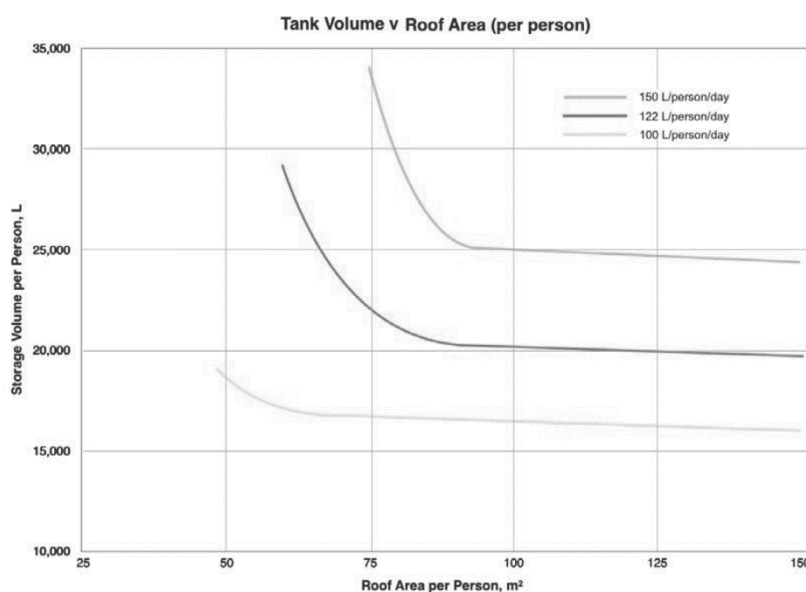
Roof Area and Tank Sizes

The Water Storage Guide (Figure 2, below) provides roof area and tank size recommendations based on:

- The daily rainfall patterns recorded at the Witchcliffe Bureau of Meteorology recording station over the previous 15 years.
- Losses of 10% from splashing and first flush diverters.
- 10% additional provision to allow for potential rainfall reduction or drought events.
- Regular daily water use patterns consistent with internal household use.
- 100% of water supply inside the house being provided from the rainwater tank.
- No allowance being made for external garden use.
- The usable water tank storage volume (excluding any volume below the outlet pipe or above the overflow level).
- Provision of gutters that are sized adequately to capture rainfall without overflowing.

As a rough guide, all dwellings in the Witchcliffe Ecovillage must provide a minimum roof area of 50m² per person and a storage volume of 18,750 L/person. The Water Storage Guide provides tank and roof sizing to supply the minimum 100L/person/day, as well as 122 L and 150 L, to assist owners who may wish to provide a larger water supply.

Figure 3. WEV Water Storage Guide



The total roof area may include the carports, eaves, sheds, pergolas and other structures, however these roof areas must be guttered effectively and connected to the tank.

If you choose to provide the minimum roof area and tank size, you should aim to manage your water supply efficiently by using high efficiency fixtures and appliances where possible (with a focus on the big water consuming items like showers and washing machines). Installing an advanced greywater system can also extend your water supply by re-using treated greywater to flush toilets (see p. 9, Innovative Solutions).

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Number of Occupants and Dwelling Requirements

The water collection and storage provision for new dwellings needs to cater for the current owners' needs and also needs to give consideration to future requirements. In order to ensure that there is adequate water supply available for current and future needs, and to satisfy local government requirements, dwellings at the Witchcliffe Ecovillage should:

- Provide minimum storage volume to meet **their proposed occupancy** rates;
- Provide sufficient roof area and demonstrate that additional storage can be provided if required in the future for above ground tanks to meet **standard occupancy** rates;
- Show the maximum occupancy permissible for the dwelling on the building plans based on the actual roof area and storage volume area provided and to disclose this information to future purchasers on sale of the property.

The Residential Water Supply Guide assumes two occupancy rates:

- **proposed occupancy:** the actual number of residents that will occupy the dwelling when it is built; and
- **standard occupancy rates** (that relate to the number of bedrooms per dwelling) for which adequate roof catchment area must be provided and sufficient space provided to allow future additional tank storage to be installed (see Table 2, WEV Minimum Roof Areas / Water Storage Volumes).

Please note, if you have frequent long-term visitors, you may wish to provide additional storage capacity at your discretion.

Table 2. WEV Minimum Roof Areas and Water Storage Volumes

Bedrooms	Standard Occupancy	Recommended minimum storage volume provided	Minimum Storage Volume which must be planned for (area for tanks)	Minimum Roof Area to be provided
1	2	18,750 L	37,500 L	100 m ²
2	3	37,500 L	56,250 L	150 m ²
3	3	37,500 L	56,250 L	150 m ²
4	4	56,250 L	75,000 L	200 m ²
5	5	75,000 L	93,750 L	250 m ²

These guidelines allow you to provide a lesser water storage volume initially as long as you can demonstrate that adequate space is allowed for additional tank storage to be provided in the future to cater for standard occupancy rates. The rationale for this approach is that tank storage can readily and economically be expanded in future if required if sufficient undeveloped space is provided on the lot.

This allows a degree of flexibility for the original household while ensuring that the dwelling's future residents' water requirements can be met. Therefore, if you are 2 people living in a 3 bedroom house, you can provide 150m² of roof space, 37,500 L of tank storage, and space on your lot where an additional 18,750 L of tank storage could be installed in the future if your household size increases.

The area set aside for future tank expansion must be located in accordance with the requirements of Local Development Plans and the building design guidelines applying to the lot. The provisional storage area must be for above ground tanks as underground tanks are considerably more costly and access for excavation and installation of underground tanks may be difficult and highly disruptive in the future. (Note that this does not prevent the required storage volume being provided in underground tanks.)

A Water Budget template to assist with your calculations is provided at Appendix 2.

A basic plan showing an example layout for a 2-bedroom dwelling with tanks on a Groupie lot is attached at Appendix 3.

Higher Than Standard Occupancy

The maximum occupancy of dwellings is more difficult to determine. While the Augusta Margaret River Shire's health local laws provide some guidance based on minimum air volumes, these provide for very high occupancy rates that are rarely, if ever, experienced for extended periods. Maximum occupancy rates have therefore not been included in these guidelines.

Occupancy rates that are higher than the standard occupancy rates specified in Table 1 are not uncommon in the region and typically occur with large families or large houses designed for shared use or short stay accommodation. Occupants of dwellings that wish to inhabit dwellings at higher than the standard occupancy rates specified above need to make their own determination of whether the roof area and water storage volume provided will meet their individual circumstances, using the WEV Water Storage Guide (figure 2) to assist their calculations.

Water Use Outside of the Home

The minimum water guidelines for dwellings at the Witchcliffe Ecovillage do not provide any allowance for water use outside of the house for garden and lawn irrigation, car washing, swimming pools, spas, etc.

Residents are provided with irrigated vegetable beds, orchards and recreation areas within their community garden, but the Ecovillage Commons company is not licenced to provide water to private lots. Where residents wish to have irrigated gardens or lawn on their lot, they will need to source this water within their own lot. This may require the provision of additional rainwater collection and storage or the installation of a greywater reuse system.

Around 75 litres of water per person per day is likely to be available from greywater reuse systems. This will provide sufficient water for irrigating approximately 40m² of garden or lawn per person based on a maximum summer irrigation rate of 2mm per day. Native and hardy Mediterranean plants do not need summer irrigation in the Margaret River area once established, so it is possible to create a beautiful low water garden, with the added benefit that native gardens provide habitat for native birds, insects and marsupials.

Greywater reuse systems approved for use in Western Australia are listed on the WA Department of Health web site at http://ww2.health.wa.gov.au/Articles/A_E/Approved-greywater-systems. The installation of greywater systems requires approval from the local government health officers. All dwellings at the Witchcliffe Ecovillage are required to have plumbing that will facilitate the installation of greywater reuse systems. It is recommended that property owners considering the installation of a grey water reuse system include an application for greywater reuse approvals with their building approvals.

A code of practice for the use of greywater systems is also provided by the Department of Health and is available on their website at http://ww2.health.wa.gov.au/~media/Files/Corporate/general%20documents/water/PDF/Code_of_practice_for_the_reuse_of_greywater_in_WA_010_v2_130103.ashx

The installation of groundwater bores on private lots may be permissible, however groundwater bores are unlikely to provide a reliable or sufficient water supply in this location given the soil profiles on the site.

The supply of dam water to private lots is not permitted. Dam water allocations are provided exclusively for irrigation to community gardens, landscaping, public open space and agricultural production. The Ecovillage Commons Pty Ltd is not licensed to provide water to private residential lots.

Innovative Solutions

Roof areas or water storage volumes less than the minimum requirement will be permitted where an alternative or innovative solution is provided. An example is installation of an **advanced greywater treatment system** that recycles greywater for toilet flushing and laundry use. Such a system could reduce the rainwater requirement for a dwelling to around 60 L per person/per day with corresponding reductions in the minimum roof area and tank storage volume.

For more information on advanced greywater systems, see the Josh's House Water System Design Factsheet (<http://joshshouse.com.au/wp-content/uploads/2013/10/131004-Joshs-House-Water-System-Design-Factsheet1.pdf>) and the Greywater and Wastewater Industry Group website (<https://www.gwig.org/>).

Lower than minimum roof area and storage volumes due to innovation will be considered on a case by case basis and should be submitted with your water budget to the Ecovillage Design Team during your house approval process (see Witchcliffe Ecovillage Building Design Guidelines).

Managing Your Water Supply

Residents of the Witchcliffe Ecovillage will take an active role in managing their own water supply and in return will have no ongoing water bills, a high quality rainwater supply, reduced exposure to chemicals used for water treatment, and the satisfaction that their water supply does not have an off-site impact on natural streams and wetlands.

Managing Water Quality

To maintain a high quality of water fit for drinking in your rainwater tank, there are a few simple maintenance tasks that are required. These include keeping your gutters clean, ensuring pre tank filtration measures such as first flush devices and strainer baskets are clean and functional, and that post-tank filtration devices (membranes, UV filters, etc.,) are maintained and serviced as required.

The Australian Government Department of Health has compiled an comprehensive guide on managing water quality from rainwater tanks and is available on their website at [https://www.health.gov.au/internet/main/publishing.nsf/Content/0D71DB86E9DA7CF1CA257BF0001CBF2F/\\$File/enhealth-raitank.pdf](https://www.health.gov.au/internet/main/publishing.nsf/Content/0D71DB86E9DA7CF1CA257BF0001CBF2F/$File/enhealth-raitank.pdf).

The guide highlights that simple preventative maintenance actions will maintain the quality of your water supply and is recommended reading for owners and residents with water supplied from rainwater tanks.

Please note that rainwater stored in non-concrete tanks is naturally slightly acidic, so to avoid the potential for copper to leach into drinking water from water pipes, the [Witchcliffe Ecovillage Building Design Guidelines](#) require the use of HDPE and/or butelane piping throughout your home. While the natural pH of rainwater is of no risk to health, simple measures can be taken to re-mineralise your water and raise the pH of your drinking water if you have any concerns (e.g., through adding bicarbonate of soda periodically to the tank, using an alkalising filter system, or hanging a bag of limestone chips in the tank).

Managing Water Quantity

Just as you have a gauge on your car to ensure you don't run out of fuel or battery charge, a system to measure water usage and available tank storage will help you manage your water use to ensure you do not run out of water and to alleviate any worry about your water supply. There are a number of ways that this can be done:

- Probably the least sophisticated, but still one of the most common methods on rural properties around the region, is to keep an eye on your tank water level by looking in the opening at the top of the tank. Even with other methods, looking in the hatch is still a good backup system.
- A simple tank indicator which reads water level via a float and raises and lowers a big red arrow on the outside of the tank accordingly provides a quick visual indication of your tank water level. This is highly recommended, as a well-located tank gauge gives regular feedback for minimal effort and when tank levels are low it helps to support and reinforce efficient use of water in the house.
- Electronic water meters and tank level gauges are now available at affordable prices and can be combined with solar energy monitoring systems so that you can have real time information about your energy and water use and storage levels on your phone or computer.

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Appendix 1. Examples of Water Efficient Dwellings with Rainwater Supply

To help residents have a better understanding of how rainwater tanks have been successfully included as the water supply for other highly water efficient dwellings in an urban setting, the following examples are provided.

Josh's House

Josh Byrne lives with his young family of four in the house he built to demonstrate how sustainability can be incorporated into a regular house within a reasonable budget. Josh has also installed an extensive array of meters to record how water and energy is used in the house and he provides this information in both real time and in reports of historical usage on his website. Josh's House is one of the most extensively monitored and reported houses for water and energy in Australia. In his first annual performance report, Josh recorded an average water consumption of 50L/person/day.

<https://joshshouse.com.au>

<https://joshshouse.com.au/wp-content/uploads/2014/11/141121-JH-Year-1-Performance-Report-Design-Version.pdf>

Sustainable House, Michael Mobbs

Michael Mobbs and his family of four including two teenage kids lived in a terrace house in Sydney and disconnected from scheme power and water in 1996. The Mobbs family monitored their water use for many years and reported using approximately 88L/person/day. This included using recycled water for toilet flushing and clothes washing. The family collected all of their rainwater from the tiny roof of an inner-city terrace house.

www.sustainablehouse.com.au

<https://www.sustainablehouse.com.au/water>

Appendix 2 - Household Water Budget Template

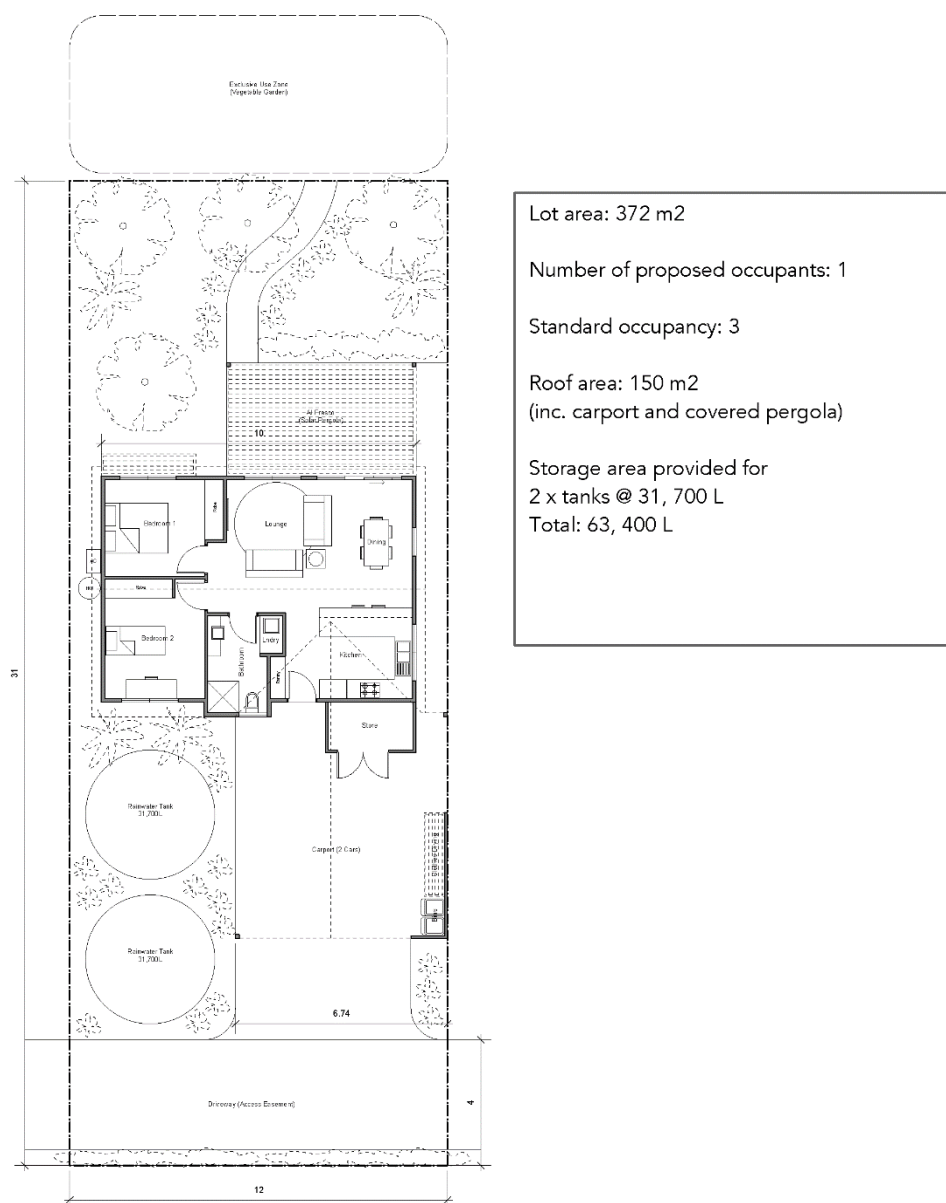
This template references the Witchcliffe Ecovillage Residential Water Supply Handbook 2020, in particular Figure 2, WEV Water Storage Guide (p.6) and Table 2, WEV Minimum Roof Areas and Water Storage Volumes (p.7). An accurate Household Water Budget must be provided to the WEV Design Team during the building application process, as well as to prospective purchasers if the house is sold in the future.

Property details	
1.1 Lot number	Lot
1.2 Cluster number	Cluster
1.3 Address	
2. Dwelling details	
2.1 No. of bedrooms	beds
2.2 Standard occupancy rate (see Table 2, p. 7)	people
2.3 Total roof area (including carports, sheds)	m ²
2.4 Roof area connected to rainwater tanks	m ²
2.5 Greywater system (if provided) (e.g., advanced treatment, greywater diverter, or N/A)	
3. Owner/Occupant Details	
3.1 Proposed permanent occupants	people
4. Water Consumption	
4.1 Consumption target (not less than 100 L/person/day)	L/p/d
5. Required Roof Area	
5.1 Minimum roof area required (based on bedrooms / standard occupancy rate, Table 2, p. 7)	m ²
5.2 Proposed roof area (calculated from WEV Water Storage Guide (p.6) using proposed permanent occupancy rate in 3.1 and daily water consumption target in 4.1)	m ²
5.3 Required Roof Area (greater of 5.1 and 5.2)	m ²
6. Water Storage	
6.1 Actual water storage capacity required (based on proposed permanent occupancy and roof area, using WEV Water Guide @ 100 L/p/d)	L
6.2 Standard water storage capacity required (based on standard occupancy and roof area using WEV Water Storage Guide @ 100 L/p/d)	L
6.3 Required water storage to be planned for on lot layout (greater of 6.2 and 6.3)	L
6.4 Water storage provided in design: _____ x tank/s @ _____ L	L
6.5 Water storage capacity provided in lot layout: Space for an additional _____ x _____ L tank/s	L

Appendix 3. Example Water Budget, Groupie Lot

1. Property Details	
1.1 Lot number	Lot 24
1.2 Cluster number	1 A
1.3 Address	
2. Dwelling details	
2.1 No. of bedrooms	2 bedrooms
2.2 Standard occupancy rate (see Table 2, p. 7)	3 people
2.3 Total roof area (including carports, sheds)	150 m ²
2.4 Roof area connected to rainwater tanks	150 m ²
2.5 Greywater system (if provided) (e.g., advanced treatment, greywater diverter, or N/A)	N/A
3. Owner/Occupant Details	
3.1 Proposed permanent occupants	1 person
4. Water Consumption	
4.1 Consumption target (not less than 100 L/person/day)	100 L/person/day
5. Required Roof Area	
5.1 Minimum roof area required (based on bedrooms / standard occupancy rate, Table 2, p. 7)	150 m ²
5.2 Proposed roof area (calculated from WEV Water Storage Guide (p.6) using proposed permanent occupancy rate in 3.1 and daily water consumption target in 4.1)	150 m ²
5.3 Required Roof Area (greater of 5.1 and 5.2)	150 m ²
6. Water Storage	
6.1 Actual water storage capacity required (based on proposed permanent occupancy and roof area, using WEV Water Guide @ consumption target of 100 L p/p/d)	18,750 L
6.2 Standard water storage capacity required (based on standard occupancy and roof area using WEV Water Storage Guide @ 100 L p/p/d)	56,250 L
6.3 Required water storage to be planned for on lot layout (greater of 6.2 and 6.3)	56,250 L
6.4 Water storage provided in design: 1 Tank @ 31,700 L	31,700 L
6.5 Water storage capacity provided in lot layout: Space for an additional 31,700 L Tank	63,400 L

Appendix 3 - Example 2 bed cottage lot layout with one occupant





ANNEXURE D – SUSTAINABILITY COMMITMENT AND CODE OF CONDUCT

As a resident and/or member of Witchcliffe Ecovillage Cluster 4D, I have read and understood the Witchcliffe Ecovillage Cluster 4D by-laws, and hereby agree to abide by the by-laws and uphold the Witchcliffe Ecovillage principles of sustainability, inclusivity, responsibility, and respect in all of my actions and relationships with others.

I will follow all grievance, decision making and/or conflict resolution procedures endorsed by the Cluster 4D Strata Company to the best of my ability to resolve any disputes with fellow members, residents and the strata company.

Signed:

Date:

ANNEXURE E – WITCHCLIFFE ECOVILLAGE SUSTAINABILITY INFRASTRUCTURE DISCLOSURE FORM

Please provide this completed form to your selling agent or potential purchasers of your Ecovillage home. Where possible, please provide copies of manuals, warranties, servicing history, etc.

1. Property details		
Address		
Owner		
Builder		
Completion date		
2. Household details		
Bedrooms	bedrooms	
Standard* occupants	occupants	
3. Energy production	Purchase date / warranty (years)	
Solar PV brand / type		
Total kW	kW	
Orientation and angle of panels		
North	kW @ _____°	
West	kW @ _____°	
East	kW @ _____°	
Inverter brand Purchase date Warranty		
kW capacity	kW	
NMI Smart Meter brand / type Purchase date Warranty		
4. Electrical Fixtures	Brand / Type	Star rating / capacity / specifications
Hot water system Purchase date		

Warranty		
Air conditioner		
Underfloor heating		
Wood pellet heater		Efficiency: Particulates:
Stove top		
Oven		
Lights		
5. Water supply	Brand / Type	Size / capacity
Roof area connected to tanks		m2
Rainwater Tank Provided tank size* Potential tank capacity*		kL kL
Greywater system Purchase date Warranty		
Pump Purchase date Warranty		
6. Water consumption	Star rating / capacity / specifications	
Taps		
Showers		
Toilets		
7. Other	Brand / Type	Star rating / capacity / specifications
Wood fuel heater:		Particulates: Emissions:

*** as per Water Capacity table below**

Bedrooms	Standard Occupancy	Recommended minimum rainwater storage volume provided	Minimum rainwater storage volume (undeveloped area for tanks)	Minimum connected roof area to be provided
1	2	18, 750 L	37, 500 L	100 m ²
2	3	37, 500 L	56, 250 L	150 m ²
3	3	37, 500 L	56, 250 L	150 m ²
4	4	56, 250 L	75, 000 L	200 m ²
5	5	75, 000 L	93, 750 L	250 m ²

Part 2 – By-laws of Significance

☐ I / ☒ **We**⁴ acknowledge that the following Governance by-laws need consent from a party other than the strata company if they are to be amended or repealed. For more information about who these parties are, refer to the *Strata Titles Act 1985* and the *Strata Titles (General) Regulations 2019*:

By-law number(s)

Staged subdivision by-laws⁵: **N/A**

**By-law under planning
(scheme by-laws) condition⁶:** **15**

Exclusive use by-laws⁷: **N/A**

Western Australian Planning
Commission approval number
(if applicable)⁸:

Leasehold by-laws⁹: **N/A**

⁴ Select one.

⁵ Refer *Strata Titles Act 1985* section 42.

⁶ Refer *Strata Titles Act 1985* section 22.

⁷ Refer *Strata Titles Act 1985* section 43.

⁸ Refer *Strata Titles Act 1985* section 20.

⁹ Refer *Strata Titles Act 1985* section 40.



Part 3 – Accompanying documents

- ☐ **Consent Statement**, if applicable
- ☐ **Consent of the Owner of the Leasehold Scheme¹⁰** to leasehold by-laws or staged subdivision by-laws

Part 4 – Execution

Date of Execution: _____

Executed by PERRON DEVELOPMENTS PTY LTD (ACN 000 230 446):

Sign here: _____

Sign here: _____

Print full name: _____
Director/Secretary

Print full name: _____
Director/Secretary

Executed by SUSTAINABLE SETTLEMENTS PTY LTD (ACN 169 286 337):

Sign here: _____

MICHAEL JAMES HULME
Sole Director & Sole Secretary

¹⁰ Owner of the leasehold scheme has the meaning in section 3(1) of the Act.



OFFICE USE ONLY

SB Scheme By-laws – New Scheme

Lodged by:¹¹

Address:

Phone Number:

Fax Number:

Reference Number:

Issuing Box Number:

Instruct if any documents are to issue to other than Lodging Party

Prepared by: **Torrens Legal**

Address: **PO Box 7320**
Cloisters Square WA 6850

Phone Number: **08 9235 3500**

Fax Number: **08 9235 3501**

Reference Number: **200064; Cluster 4D**

Titles, Leases, Evidence, Declarations etc. lodged herewith

- 1.
- 2.
- 3.
- 4.
- 5.

OFFICE USE ONLY

Landgate Officer

Number of Items Received: _____

Landgate Officer Initial: _____

¹¹ Lodging Party Name may differ from Applicant Name.