Department of Environment, Land, Water and Planning
Final Report | 19 February 2018

Fishermans Bend
Review of sustainability standards

ARUP

Contents

Appendices

Appendix A

Recommended Green Star Design and As Built pathways

Appendix B

Technical feasibility analysis of selected credits

Executive Summary

The Fishermans Bend vision articulates eight sustainability goals that cross environmental social and economic themes. The goals are:

- An inclusive and healthy community
- A prosperous community
- A low carbon community
- A water sensitive community
- A climate adept community
- A connected and liveable community
- A low waste community
- A biodiverse community

Arup has prepared this report to review the sustainability standards proposed for new buildings in the Fishermans Bend urban renewal area. In this report, we also develop the evidence base to recommend pathways for buildings to achieve a Green Star Design and As-Built certification.

Achieving Green Star certification, or certification under an alternative third party scheme, is a policy under the proposed planning controls. The requirements for Green Star Design and As-Built are well aligned with the Fisherman's Bend sustainability goals. Of the total 110 points available in the Green Star Design and As-Built scheme, approximately 59 points are aligned in intent with the goals, targets and strategies outlined in the Framework. The total number of credits aligned with the Framework is almost sufficient for a 5 Star Green Star rating.

The draft sustainability standards in planning controls and the precinct-wide commitments enables delivery of approximately 30% of the Green Star credits.

Our view is that the 4 Star standard is most appropriate to Fishermans Bend. It is likely that for residential developers at Fishermans Bend, it will be the first time they have participated in the Green Star scheme. The 4 Star standard is an important starting point.

Over time and with increased familiarity with sustainable design processes, materials and products, it is possible that an increasing proportion of buildings and developers could be prepared to achieve 5 Star Green Star.

We believe that setting a 5,000 sqm minimum threshold for independent sustainability certification will capture most of the development at Fishermans Bend. For developments smaller than 5,000 sqm, we recommend that applicants be required to provide a Sustainability Management Plan that:

- Describes how the building will achieve the equivalent of 4 Star Green Star certification
- Describes how the sustainability measures will be managed and implemented as the building is designed, constructed and commissioned
- Is prepared by a suitably qualified person.

There will be certain developments for which Green Star is not an appropriate rating tool, is not feasible, or for which the applicant prefers an alternative standard.

We set out an assessment process that considers the suitability of a third party rating scheme for use as part of the Fishermans Bend planning process. Our criteria encompass the objectives, governance processes and procedures, and the documented evidence required for certification.

As shown in Table ES1, we largely support the sustainability standards as drafted in the planning controls, with 16 recommendations that focus on:

- Improving alignment with Green Star (therefore reducing the documentation requirements across Green Star and planning submissions)
- Widening some standards to reflect the sustainability goals
- Developing guidance, templates and processes that support applicants in demonstrating achievement of the sustainability standards.

Table ES1 Summary of recommendations

	Recommendation	**Prior to finalising planning control**	**Following finalisation of planning controls**	**During implementation phase**
1	Improve alignment of Transport-related standards in draft planning controls with Green Star Design & As-Built	×		
2	Provide a quantified standard for renewable energy generation in supporting guidance		×	
3	Increase metric to 75% of total site area for reducing urban heat island effect.	×		
4	Provide a quantified standard for low solar absorptance façade materials in supporting guidance		×	
5	Amend reflectivity standard in planning controls to reflect typical Victorian council requirements	×		
6	Provide additional standards in planning controls relating to water efficiency and landscape irrigation systems	×		
7	Build industry capacity to delivery Smart Cities measures by providing further detail in supporting guidance		×	
8	Retain the proposed 4 Star Green Star standard for new buildings in Fishermans Bend.	×		

	Recommendation	Prior to finalising planning control	Following finalisation of planning controls	During implementation phase
9	Recommend that applicants adopt the credits nominated in Table 6 as part of the supporting guidance for planning controls.		×	
10	Amend the planning control to apply the 4 Star Green Star standard or equivalent for buildings greater than 5,000 sqm gross floor area.	×		
11	In planning controls, require the development of a Sustainability Management Plan to be developed for buildings up to 5,000 sqm.	×		
12	Prepare a template for a Fishermans Bend Sustainability Management Plan, with supporting guidance on demonstrating equivalent performance to 4 Star Green Star.		×	
13	Prepare a template to be completed by the applicant at each project review stage. The template should demonstrate the means by which the project will achieve the 4 Star Green Star certification, or equivalent.		×	
14	Amend the planning controls to require the applicant to complete the Green Star Design Review prior to commencement of works.	×		
15	Discuss with the Green Building Council of Australia an agreed approach for precinct-wide documentation to be included in development-specific Green Star applications.		×	
16	Update supporting guidance with recommended pathway, once National Construction Code confirms the inclusion of Green Star Design and As-Built as an alternative verification method.			×

1 Purpose of this report

Arup has developed this report to review the sustainability standards proposed for new buildings in the Fishermans Bend urban renewal area. The key sources we reviewed are:

- Melbourne Local Policy 22.27 and Port Phillip Local Policy 22.15 Fishermans Bend Urban renewal area – dwelling diversity, employment outcomes, design excellence and preferred future character and built form typologies
- Melbourne Clause 43.02 Design and Development Overlay (DDO) Schedule 67 and Port Phillip Clause 43.02 DDO Schedule 30.

The versions we reviewed were provided to us by the Fishermans Bend Taskforce on 1 November 2017 and published for consultation.[1]

We provide comment on the proposed standards, on the basis of the following principles:

- Standards should support the Fishermans Bend policy objectives, as set out in the Framework.
- Standards should be streamlined to the extent practicable and in line with the scale and nature of the development.
- Standards should be consistent with industry practice and reflect industry knowledge where possible.
- Standards should be able to be met through shared infrastructure and planning in the precinct, or resulting from reasonable investments by the developer.
- Standards should be performance-based to support innovation and allow developments to propose context specific solutions to meet policy objectives.

In particular, we develop the evidence base to recommend pathways for buildings to achieve a Green Star Design and As-Built certification. Achieving Green Star certification, or an equivalent certification, is a policy under the proposed planning controls.

Our report is structured as follows:

Section 2 summarises background information for the project.

Section 3 sets out Arup's recommendations for the sustainability standards in the draft planning controls.

Section 4 addresses key questions about the use of Green Star Design and As-Built as part of the planning process.

Section 5 provides an approach to assessing the suitability of alternative third party sustainability certification schemes.

[1] Department of Environment, Land, Water and Planning (2017), Fishermans Bend: Australia's largest urban renewal project, document library at http://www.fishermansbend.vic.gov.au/documents, accessed on 19 February 2018

Section 6 brings together our recommendations.

Summary of scope of work

This report covers both the Design Standards Review (Stage 3) and the Design & As-Built Guidance Development (Stage 4) of Arup's scope of works.

Design Standards Review

Stage 3 includes an initial review of the likely Green Star pathways to be taken by different developments to achieve both a 4 and 5 Green Star rating. We investigate the feasibility of different credit types, subject to planned infrastructure and context. We recommend amendments to the draft design standards based on this Green Star Design & As-Built pathway development and Arup's past experience.

Design & As-Built Guidance Development

Stage 4 builds identifies credits that align with the Fishermans Bend vision. We analyse the feasibility of key credits. We also develop a process for assessing the equivalence of alternative sustainability rating schemes to Green Star.

2 Background

2.1 What are the sustainability-related building standards that apply to Fishermans Bend and how do they relate to each other?

The Fishermans Bend vision articulates eight sustainability goals that cross environmental social and economic themes. The goals are:

- An inclusive and healthy community
- A prosperous community
- A low carbon community
- A water sensitive community
- A climate adept community
- A connected and liveable community
- A low waste community
- A biodiverse community

Sustainability standards for buildings have traditionally focused largely on environmental performance (hence, the *Environmentally* Sustainable Development policies of local councils). Table 1 sets out the sustainable building relevant to new buildings at Fishermans Bend; these are typically related to resource efficiency or occupant amenity.

Our review focuses on the new standards that are specific to Fishermans Bend. However, where they overlap with other standards, we have made recommendations to improve consistency (e.g. by setting similar performance standards or consistent measurement methods).

Table 1 Overview of building sustainability standards for Fishermans Bend

Standard	Specific to Fishermans Bend?	Purpose and scope	Sustainability features
Fishermans Bend Framework	Yes	Planning strategy that responds to the Fishermans Bend Vision. The purpose of the Framework is to guide the urban renewal of Fishermans Bend.	The Framework has extensive sustainability aspirations. Green Star Communities has been adopted as a tool to monitor the development of the precinct. In addition, the Framework outlines eight Sustainability goals, each with targets for 2050, objectives, and strategies.
Local Policy 16 Fishermans Bend Urban Renewal Area	Yes	Implements the vision for Fishermans Bend. Outlines objectives and policy to guide the assessment of planning permit applications within the Capital City Zone Schedule and the Design and Development Overlay Schedule.	Addresses the intent for the precinct to be a benchmark for sustainable and resilient urban transformation, and outlines standards for the following aspects of sustainability: • Energy • Urban heat island effect • Sea level rise, water recycling and management • Waste management • Public space • Smart cities • Sustainable transport
Planning Control – Schedule 4 to Clause 37.04 Capital City Zone (CCZ)	Yes	Outlines the application requirements for development permits and decision guidelines for development in this zone.	References Local Policy for the Fishermans Bend Urban Renewal Area. Contains the standard for building projects to attain a 4 Star Green Star Design & As-Built Rating.
Schedule 67 to clause 43.02 Design and Development Overlay (DDO)	Yes	Sets out the built form standards providing further detail on building and infrastructure design and construction standards.	Describes Design Measures for achieving specified Design Outcomes. A number of sustainability standards are specified, addressing the following aspects of sustainability: • Comfortable wind speeds • Urban heat island effect • Overshadowing • Transport • Water
Parking Overlay – Schedule 13 to Clause 45.09 (PO)	Yes	Outlines the standards for the Fishermans Bend Urban Renewal Area around car parking and active transport.	Sets maximum limits for car parking allocation and specifies criteria for active transport facility provision, including bicycle parking standards.

Standard	Specific to Fishermans Bend?	Purpose and scope	Sustainability features
Better Apartments Design Standards	No	Design standards for apartments in Victoria, following Amendment C136 to the Victorian Planning Provisions.	Specifies a number of sustainability standards, covering: • Daylight • Energy efficiency • Overshadowing of communal open space • Ventilation • Landscaping • Waste • Water
ResCode	No	Design standards for low density residential development, embedded in Clauses 54, 55 and 56 of the Victorian Planning Provisions.	Building-related sustainability aspects focus on impacts to amenity, including access to daylight, open space, permeability
National Construction Code 2016: Building Code of Australia	No	Technical provisions for design and construction of buildings, structures, plumbing and drainage systems in Australia. Represents the minimum level of compliance for buildings in Australia.	Section J of the NCC 2016, BCA Volume 1 lists minimum requirements for building energy efficiency. This covers prescriptive and performance requirements for: • Building fabric • Glazing • Building sealing • Air conditioning and ventilation • Artificial lighting and power • Heated water supply • Energy monitoring
Green Star Communities	No	Green Star Communities is an independent third party sustainability certification scheme for master plans. The tool, along with other Green Star tools, has been developed by the Green Buildings Council of Australia. Points are awarded for achievement against various categories, and a Star rating is awarded depending on the number of points awarded. Four Stars (45-59 points) corresponds to Australian Best Practice, Five Stars (60-74 points) corresponds to Australian Excellence, and 6 Stars (75+ points) corresponds to World Leadership in sustainable master planning.	Green Star Communities covers the following areas of sustainability: • Governance • Liveability • Economic Prosperity • Environment • Innovation The certification of individual buildings for Green Star Design & As-Built contributes to the achievement of Green Star Communities for the overall precinct.
Green Star Design & As-Built	No	Green Star Design & As-Built is an independent third party certification tool developed by the Green Buildings Council	Green Star Design & As-Built addresses the following aspects of sustainability:

Standard	Specific to Fishermans Bend?	Purpose and scope	Sustainability features
		of Australia. This tool assesses the sustainability of individual buildings. Points are awarded for achievement against different sustainability criteria, and star ratings are awarded on the same scale as for Green Star Communities.	• Management • Indoor Environment Quality • Energy • Transport • Water • Materials • Land Use & Ecology • Emissions • Innovation

2.2 What are the precedents for sustainability standards in planning systems?

2.2.1 Precedents in Victoria

Until relatively recently, building-related sustainability was not strongly represented in the Victorian planning scheme. If sustainability or its underlying principles of environmental, social and economic integration were addressed, it was generally at the level of principles in the Victorian Planning Provisions (including ResCode for low density residential buildings) and individual councils' municipal strategic statements.

In 2009, the City of Melbourne was the first to introduce quantitative benchmarks related to sustainable building performance through Clause 22.19 Environmentally Sustainable Office Buildings. This set a standard for large office buildings in the municipality to achieve the equivalent of 4 Star Green Star, amongst other measures.

In 2013, the City of Melbourne updated Clause 22.19 to include specific energy, water and waste benchmarks, and also expanded the Green Star standard to buildings of most types (beyond office), and to the higher level of 5 Star Green Star. The policy basis for this expansion was to enable the municipality to meet its community plan (Future Melbourne and the eco-city goals). Furthermore, as the capital city, it was appropriate for large new buildings to demonstrate 'Australian Excellence' (5 Stars) for sustainability.

In 2015, six additional councils (Banyule, Monash, Moreland, Port Phillip, Stonnington, Whitehorse and Yarra) introduced Environmentally Sustainable Development policies in their planning schemes. Each of these were local policies that set sustainability objectives for new development and required certain assessments and management plans.

As with the City of Melbourne's Clause 22.19, these new policies set differing standards for large developments compared to small developments. The thresholds for 'large' versus 'small' development varies between municipalities, reflecting the scale of development typical for those councils.

Arup provided expert witness input to all seven local policies. Some of lessons we learned from the development of these policies include:

- The need for clear decision guidelines, supporting guidance and sustainability expertise in the approval authority to ensure the consistent and robust implementation of the policy.
- The value of identifying third party rating tools to set benchmarks, as this provides a clear methodology for assessing performance, enables standards to track industry changes, and provides applicants the additional support/guidance of an independent administrative body.
- The need to navigate the potential overlap between planning and building regulations (e.g. whether or not energy efficiency can be addressed directly

through the local policy – this is a rapidly changing policy area driven by decisions at the Victorian Civil and Administrative Tribunal, changes in the Green Star scheme, NABERS, as well as the National Construction Code).

- The practical task of setting thresholds, which should ensure that the policy captures the majority of development with stringent evidence requirements, without imposing onerous documentation requirements on less resourced developments.
- The need for benchmarks to be outcome or process-based, rather than specifications, as this allows developments to respond to their site context and support innovation in design/construction.

Since the seven local policies above were adopted, the Victorian Government released the Better Apartment Design Standards, which complements ResCode by setting quality expectations for multi-unit residential developments. The Standards cover aspects of sustainable building design.

As a topic, sustainability in the planning system might evolve quickly in the coming years. The Department of Environment, Land, Water and Planning is currently consulting on industry experiences of the seven local planning policies. This is part of Action 80 of the Plan Melbourne Implementation Plan:

> 'Review the Victorian planning and building systems to support environmentally sustainable development outcomes for new buildings to consider their energy, water and waste management performance.'

Key tasks for the Fishermans Bend building control standards include:

- Consistency with future Victoria-wide sustainability standards,
- Adopted lessons from previous building sustainability local policies,
- Setting the foundation for providing support to applicants in understanding and responding to the standards, and
- Drawing on the unique advantages of Fishermans Bend as a planned urban renewal area so that the sustainability of individual developments benefit from the integrated whole.

2.2.2 Precedents in other jurisdictions

As part of the evidence base for the City of Melbourne's Planning Scheme Amendment C187, Arup conducted an extensive review of best practice sustainability approaches in planning around the world.[2] The examples below are drawn from our report, as well as developments in recent years.

[2] Arup on behalf of City of Melbourne (2011), *Energy, Water and Waste Efficiency Review*, Chapter 2: Literature review, available at https://www.melbourne.vic.gov.au/about-council/committees-meetings/meeting-archive/MeetingAgendaItemAttachments/540/9147/5.2.pdf, accessed on 10 February 2018.

Policies based on targets or specified technologies

- City of Santa Monica – new buildings to install solar electric photovoltaic systems, corresponding to 2 watts per square foot of building footprint.
- Vancouver, Canada – 20% of parking stalls in new multi-family buildings to contain charging receptacles
- Seoul (various jurisdictions), Korea – Mandatory installation of automated waste collection systems above particular development thresholds. Similar requirements exist in Stockholm, Sweden.
- Copenhagen, Denmark – Requires new buildings with a scope of less than 30 degrees to introduce a green roof.
- Changxindian, Fentai District, Beijing, China – Statutory Regulatory Plans to incorporate low carbon planning conditions for individual sites
- In Denmark, local authorities can regulate the connection of properties to the district heating networks.

Policies requiring or rewarding independent building certifications

- Since 2015, the City of London Local Plan requires formal certification under the Building Research Establishment Environmental Assessment Method (BREEAM) or the Code for Sustainable Homes for all major new developments. Particular credits under these schemes are prioritised or required, to meet the sustainability goals of the City of London.[3]
- The City of Portland Green Building Policy has required building certification against the Leadership in Energy and Environmental Design (LEED) rating tool since 2001. This has since been updated to require new buildings to obtain a LEED NC Gold certification, and to require existing buildings to achieve LEED EBOM Silver certification.[4]
- Seattle, USA – Downtown Zoning Ordinance that awards proponents greater floor area density if LEED Silver certification is achieved
- Singapore's Green Mark gross floor area enhance allowance incentive is clearly described in a development control matter circular; applicants can be awarded 1-2% gross floor area bonus above masterplan gross plot ratio if they achieve Green Mark certification of Goldplus or Platinum.
- New South Wales uses BASIX to regulate issues other than energy for residential buildings.

Policies requiring the provision of specific information

- England and Wales UK – Site Specific Allocations and Area Action Plans to give status to heat maps and require consumers to connect to heat networks.

[3] City of London Local Plan, January 2015
[4] City of Portland Green Building Policy Status Report, 2005-2009

- London, England – An assessment of the energy demand and carbon dioxide emissions from proposed major developments, which should demonstrate the expected energy and carbon dioxide emission savings from the energy efficiency and renewable energy measures incorporated in the development, including the feasibility of combined heat and power (CHP) and community heating systems;
- Southampton, England – New city centre developments are required to justify why they should not connect to the district energy supply
- Abu Dhabi, UAE – Provision of narrative and data to detail how the development responds to regional sustainability objectives.

The conclusions of that review are relevant to the Fishermans Bend review. Our review showed successful approaches to:

- Translating precinct or region-wide targets to particular zones or blocks
- Setting targets for on or near site renewable energy, or else requiring analysis to demonstrate why these are not appropriate
- Inclusion of precinct technologies as an essential utility, for which connections and corridors should be safeguarded in new development
- Requiring energy assessments as part of planning submissions
- Providing incentive mechanisms that apply to sustainable buildings developed in specific precincts
- Developing waste management guidelines for different development types, which could be informative or referred to in planning policy.

We concluded:

> ‘Globally, it is clear that there is preference to link requirements or incentives to widely accepted building rating schemes. The challenge will be linking up the planning application process with the availability of data and feedback from scheme administrators.’

We acknowledge that it is difficult to make direct comparisons between the planning requirements of different jurisdictions due to the different powers and levers available to planning authorities. However, interstate and international case studies illuminate possibilities for sustainability in Victoria’s planning provisions.

3 Review of sustainability standards in draft planning controls

In this section, we provide our advice on the sustainability standards specified in the draft Fishermans Bend planning controls.

Our key questions are:

- Are the sustainability-related design standards in the draft planning controls feasible and beneficial in achieving the Framework?
- What are the examples and precedents for these standards?
- Do the various standards support each other? Are they consistent? What aspects are mandatory versus flexible?

Table 2 summarises our recommendations.

Table 2 Summary of recommendations for draft planning controls

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
Overshadowing DDO, 2.0 Overshadowing of public open space	New developments to not cast any additional shadow across specified parks during specified hours on the autumn and spring equinoxes.	None, comment only	Simulations are now quick enough to quantify the amenity of outdoor space in terms of annual sun hours or useful daylight illuminance (UDI). However, as we are not in a position to set a locally relevant benchmark for hours, so it is appropriate to retain the overshadowing standard as proposed.	Annual sun hours or useful daylight illuminance may be more informative than solstice/equinox shadow diagrams.
Transport Local Policy – Sustainable Transport	Development design to encourage 80% of movements to be made via active and public transport. Identifies the need to include bicycle parking and end of trip facilities, and to discourage developments from providing more than the maximum number of car spaces.	Improve alignment with Green Star Design & As-Built	Bicycle park provision and car parking caps are covered by Green Star Credit 17: Sustainable Transport. There is the opportunity to streamline applicant responses to parking overlay and Green Star credit requirements. In particular: • Expressing car share space provisions in terms of spaces per building occupant. • Setting a benchmark for the provision of car charging stations in terms of percentage of car parking spaces. • Setting separate bicycle parking provision for school and university buildings. This would align with the Framework target for 90% of school related trips to be made via sustainable transport. For reference: • Car share spaces for residential buildings are awarded Credit 17B.3 where dedicated car share spaces and vehicles are provided at the rate of 1 per 70 occupants • Credit 17B.3 is awarded if 5% of car parking spaces for electric vehicles are provided. • Credit 17B.4 nominates additional bicycle parking allocation for school and university buildings.	There is the opportunity to develop shared documentation between planning and Green Star submissions, and therefore reduces administrative costs for the applicant.
Parking Overlay PO, Section 3.0	Specifies the maximum number of car parking spaces for each use type: • Residential: 0.5 spaces/dwelling • Supermarket: 2 spaces/ 100m^2 GFA • Industry: 1 space/150m2 GFA • Office, place of assembly, retail: 1 space/100m^2 GFA Notes that a permit is required to exceed these maximum provisions.			
Parking Overlay PO, Section 6.0	Specifies the alternative transport standards to be indicated on a car parking plan for new developments. Motorised vehicles			

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
	• 1 car share space per 60 car parking spaces, or 1 car share space per 90 dwellings, whichever is higher • 1 motor-cycle space per 100 car parking spaces, or 1 per 50 dwellings, whichever is higher Bicycles • Residential: 1 space per dwelling, 1 visitor space per 10 dwellings • Non-Residential: 1 space per 50 m^2 and 1 visitor space per 1000 m^2		We note also that Green Star Design & As-Built provides benchmarks for the end of trip facilities (Credit 17B.3), which aligns with local policy objectives. This benchmark is available, should DELWP wish to specify expectations for the provision of end of trip facilities.	
Parking Overlay PO, Section 7	Specifies design standards for car parking include the requirement to provide dedicated parking for car share and car charging stations.			
Wind		No change	None	Not applicable
Capital city zone CCZ	Wind impacts assessment demonstrating safe and comfortable wind conditions are achieved.			
DDO, 2.0 Wind effects on public realm	Precludes permits from being granted to buildings that have a total building height in excess of 40 metres, and which do not achieve safe and comfortable wind conditions in publicly accessible areas within a specified distance from the building.			
Energy, thermal comfort and climate adaptability		No change, comment only	Of all the sustainability categories, energy efficiency is the most regulated. Precedents in Victoria (through VCAT cases in particular) suggest that the planning system should not require improvements on building regulations. The draft local policy on energy, setting a benchmark in terms of improvement on the National Construction Code, is a new approach that has	We have no technical concerns regarding the standard as drafted. From a planning point of view, the draft local policy is a
Local Policy – Energy	Development are encouraged to demonstrate ability to achieve a 20% improvement on current National Construction Code energy efficiency standards. This includes energy efficiency standards for building envelope and for lighting and building services.			

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
National Construction Code, as enacted by Building Regulations 2006 Building Apartment Design Standards	Residential developments are encouraged to achieve an average 7 star NatHERS rating for each building. Requires Class 2 buildings (residential apartments) to collectively achieve an average NatHERS rating of not less than 6 stars, and to achieve at least 5 stars individually. Class 1a buildings (detached houses) are required to achieve at least a 6 star NatHERS rating. The proposed revision to the National Construction Code 2019 will include Green Star Credit 15D/E as an alternative verification method. Specifies a maximum cooling load only, as compared with NatHERS which reflects both heating and cooling loads. In certain scenarios, meeting Better Apartment Design Standards is the equivalent of 6.5 Star NatHERS.		not been recently tested. The use of 'encourage' rather than should might make this benchmark acceptable. Local governments in Australia have successfully implemented the following approaches to encourage energy efficient new buildings at the planning stage: • Targets for improved energy efficiency (as measured by NCC methods) as part of a mix of standards – not mandatory, but optional (e.g. through the Built Environment Sustainability Scorecard) • Expectations of improved performance in terms of greenhouse gas emissions, which are not currently directly regulated by building regulations. This provides applicants with the flexibility to address efficiency and/or energy supply measures. • Planning incentives such as additional floor area, expedited consideration etc. Should the current drafting of the local policy on energy be unacceptable, then the above approaches are available to DELWP.	new approach to improving energy performance across a precinct. Its acceptability and effectiveness in achieving the low carbon and climate adept goals is not yet known. It is an approach worth testing.
Renewables Local Policy – Energy	Encouragement of development to incorporate renewable energy generation, on-site energy storage, and opportunities to connect to a future precinct-wide or locally distributed low-carbon energy supply.	Provide a quantified standard for renewable energy generation	There is international precedent for quantitative standards for renewable energy provision, beginning from the 2003 Merton Rule in London.[5] This approach was adopted across the UK and is credited with driving energy efficiency improvements and supporting the growth of the renewable energy industry. We believe that setting firm quantitative standards could have a similar beneficial effect in Victoria. Quantitative renewable energy standards at building scale with any kind of statutory standing would be are a new approach in Victoria.	There is an opportunity for innovation to delivery significant benefits. This is a policy area to be tested.

5

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
			The renewable energy standard could be set in: 1. The Local Policy 2. In the DDO 3. In supporting guidance to the local policy We recommend that at minimum, a quantitative expectation for renewable energy provision is provided in the supporting guidance to the local policy.	
Urban heat island effect Local Policy – Urban heat island	Non glazed facades materials exposed to summer sun to have a low solar absorptance. At least 70% of the total site area in 'plan view' should comprise building or landscaping elements that reduce the impact of the urban heat island effect.	Increase metric to 75% of total site area for reducing urban heat island effect. Provide a quantified standard for low solar absorptance façade materials in supporting guidance	This standard is closely aligned with the corresponding Green Star Design & As-Built Credit 25. The Green Star requirement requires 75% compliant site area. Setting the same standard in planning controls will enable applicants to achieve the urban heat island credit in Green Star. The expectation that non-glazed façade materials have low solar absorptance is not a commonly used metric. We recommend that this standard is modelled in order to develop an evidence based standard. We recommend that this quantified standard is provided in supporting guidance.	Consistency in the standard will ensure planning control and Green Star standards are mutually supportive. The effectiveness of the policy to reduce urban heat island from building façades could be improved with further guidance.
Reflectivity DDO – Building Finishes	Building materials should be selected with regard to potential impacts of reflectivity of development along main roads and should not exceed 15% perpendicular reflectivity, measured at 90 degrees to the façade surface.	Amend standard to reflect typical Victorian council requirements	We note that typical council requirements limit perpendicular reflectivity to 20%. These requirements have been developed as a result of historical analysis across a number of years. We recommend that the planning control be amended to be consistent with past practice: • Perpendicular facades to not exceed 20% reflectivity. • For angled facades, applicants are required to undertake a reflectivity study.	Our proposed standard is consistent with tested practice.
Waste Local Policy – Waste Management	Development should include best practice waste management, and where practicable, opportunities for:	None, comment only	This standard aligns with the prescriptive pathway for Green Star Credit 8: Operational Waste. Other waste-related credits include:	Draft planning control and Green

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
	• Optimised waste storage and efficient collection methods • Combined commercial and residential waste storage • Sharing storage or collection • Separate collection for different waste streams, • Waste management innovation		• Credit 5.2: End of Life Waste Performance – requires 80% of the project's gross floor area (GFA) to have a formal commitment in place to reduce demolition waste at the end of life of the development. • Credit 22: Construction and Demolition Waste – offers both a fixed benchmark and percentage benchmark compliance pathway for demonstrating a reduction in waste to landfill during construction. The scope of Victoria's planning provisions does not cover the above issues. Typically, councils issue permits that require a construction waste management plan. These plans do not usually set quantified benchmarks for construction and demolition waste. In parallel to the sustainability standards currently drafted, we suggest that the Fishermans Bend responsible authority develop guidelines for construction waste management plans that refer to Green Star. This would enable mutual reinforcement of planning and Green Star standards.	Star standards are mutually supportive.
Water management Local Policy – Sea level rise and water recycling and management	Buildings should install a third pipe network for recycled water: • To supply non-potable uses including toilet flushing to all properties and commercial spaces, irrigation and laundry, unless otherwise agreed by the relevant water authority. • With an agreed building connection point designed in conjunction with South East Water to ensure readiness to connect to future precinct scale recycled water supply. Rainwater should be captured from 100% of suitable roof harvesting areas, and retained in a rainwater tank with a capacity of 0.5 m^3 for every ten square metres of catchment area.	Provide additional standards relating to water efficiency and landscape irrigation systems	We note that the planning controls focus primarily on reuse and recycling of water. We recommend that this is expanded to emphasise the efficiency of fixtures and fittings. The efficiency of fixtures and fittings is not covered by the National Construction Code. Possible benchmarks could be drawn from the Green Star Credit 18B prescriptive potable water requirements (the approach taken by the City of Melbourne's Clause 22.19). We also recommend that the policy sets standards for the efficiency of landscape irrigation systems, for example by requiring the use of drip irrigation with moisture sensor override, as per the Green Star requirements.	This would strengthen the Local Policy's coverage of the 'water sensitive community' sustainability goal in the Framework.

Category and planning control	Standard	Arup recommendation	Detailed recommendation or comment	Rationale
	Rainwater captured from suitable harvesting areas is re-used for toilet flushing, laundry and irrigation or, as a last option, controlled release.			
Smart Cities Local Policy – Smart Cities	It is policy to encourage developments to include smart city technology, by: • Embedding smart technology and installing digital sensors and actuators into built form to collect digital data. • Embedding opportunities for 'smart' and responsive urban management and practices into the design and operation of infrastructure and buildings and services. • Encouraging smart infrastructure to be installed on existing infrastructure. • Integrating 'smart' management and design of energy, water, and waste infrastructure that supports efficient use of resources. • Ensuring developments provide provision for the delivery of high speed data networks. • Ensuring that all technology and data systems comply with best practices.	Build industry capacity by providing further detail in supporting guidance	We recognise that this standard provides the means to monitor and feedback on the performance of all other sustainability standards. Smart Cities is not typically covered by planning controls. This is an area of innovation for Fishermans Bend. In order to build industry capability, we recommend that additional guidance is provided to applicants. This includes identifying the extent to which the achievement of Green Star Credit 6 (Metering and Monitoring) and Green Star Credit 4 (Building Information) meets the requirements of the Local Policy.	This is a new area for planning controls. Green Star Credits 4 and 6 provides additional guidance to applicants and therefore provides clarity to applicants.

4 Alignment of Green Star with Fishermans Bend planning controls

4.1 What is the role of Green Star in Fishermans Bend planning controls?

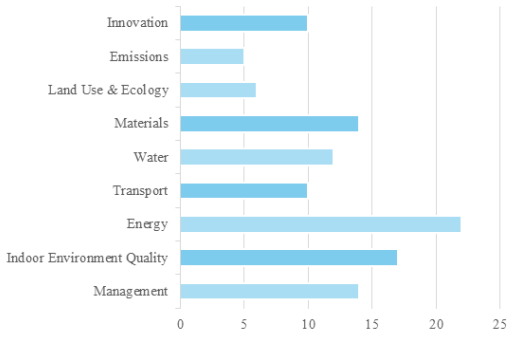
The Green Building Council of Australia administers two tools relevant to the Fishermans Bend urban renewal:

- Green Star Communities – responsibility for achieving certification is held by DELWP
- Green Star Design & As-Built – responsibility for achieving certification is held by project developers

The Communities and Design and As-Built tools have some similar elements, but in general the Communities credits require compliance for public infrastructure or over the entire urban renewal, whereas Design and As-Built credits address elements of individual buildings. The two elements work together to respond to the Fishermans Bend Sustainability goals.

The Schedule 4 to Clause 37.04 Capital City Zone planning policy requires projects to seek a minimum 4 Star Green Star Design & As-Built rating or equivalent alternative third party rating scheme.

In this section, we review the Green Star Design & As-Built standards in detail, and the extent to which the tool is aligned with and supported by other sustainability requirements and the Fishermans Bend Framework.



Overview of Green Star Design and As-Built v1.2

The Green Star Design & As-Built rating tool provides a framework to assess the sustainability of a building's design and performance. The current is Green Star Design & As-Built v1.2.

The rating framework can be applied to all building types, and awards a maximum of 110 points, which are divided among 30 credits. The 30 credits fall under 9 broad sustainability categories.

Depending on the number of points awarded, the project will be awarded a rating as follows:

- >=45 points : 4 Stars – Australian Best Practice
- >=60 points: 5 Stars – Australian Excellence

- >=75 points: 6 Stars – World Leadership

Depending on the priorities of the developer, the nature of the building, and the requirements of the end users, the Green Star points targeted to achieve certain ratings may differ. Some points may be easier to achieve for certain building types or end uses, while others may be more difficult to achieve, but offer comparatively more value to the end user.

4.2 To what extent does Green Star support the Fisherman's Bend Framework?

The requirements for Green Star Design and As-Built are well aligned with the Fisherman's Bend sustainability goals. In particular, the categories of Energy, Transport, Water, Land Use and Ecology align directly with the Framework's Sustainability Goals, and together make up 50 of the total available 110 points under the rating scheme.

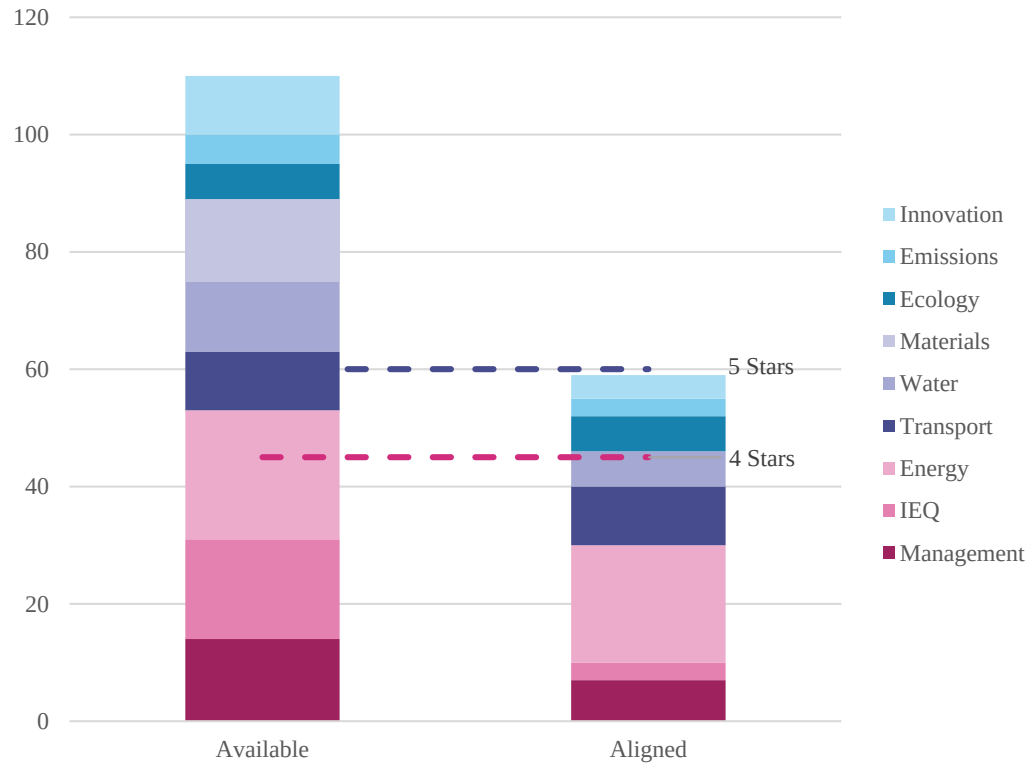
In reverse, of the eight Fishermans Bend sustainability goals, all but the goal for 'a prosperous community' can be considered to be explicitly covered by the intent of one or more Green Star credits. Table 3 shows the relationships between the Fishermans Bend sustainability goals and Green Star credits.

Table 3 Mapping Fishermans Bend sustainability goals to Green Star Design and As-Built credits

Sustainability goal	Relevant Green Star credits
A connected and liveable community	Credit 17: Sustainable Transport Credit 12: Visual Comfort
A prosperous community	Innovation credits could be used to emphasise the contribution of, and connection between sustainability to/and prosperity.
An inclusive and healthy community	Credit 17: Sustainable Transport
A climate adept community	Credit 3: Adaptation and Resilience Credit 25: Heat Island Effect
A water sensitive community	Credit 18: Potable Water Credit 26: Stormwater
A biodiverse community	Credit 23: Ecological Value Credit 24: Sustainable Sites
A low carbon community	Credit 2: Commissioning and Tuning Credit 15: Greenhouse Gas Emissions Credit 16: Peak Electricity Demand Reduction
A low waste community	Credit 8: Operational Waste Credit 5: Commitment to Performance Credit 22: Construction and Demolition Waste Credit 20: Responsible Building Materials Credit 19: Life Cycle Assessment

Of the total 110 points available in the Green Star Design and As-Built scheme, approximately 59 points are aligned in intent with the goals, targets and strategies outlined in the Framework. This can be seen in Figure 1, broken down by Green Star category. The total number of credits aligned with the Framework is almost sufficient for a 5 Star Green Star rating. Figure 1 also shows that the Green Star categories for Materials and Indoor Environment Quality are not addressed by the Framework.

Figure 1 Credits available under the Green Star Design and As-Built scheme, and those aligned with the Fishermans Bend sustainability goals



4.3 How do the other sustainability standards help applicants achieve Green Star certification?

In this section, we discuss the extent to which applicants could fulfil Green Star criteria through:

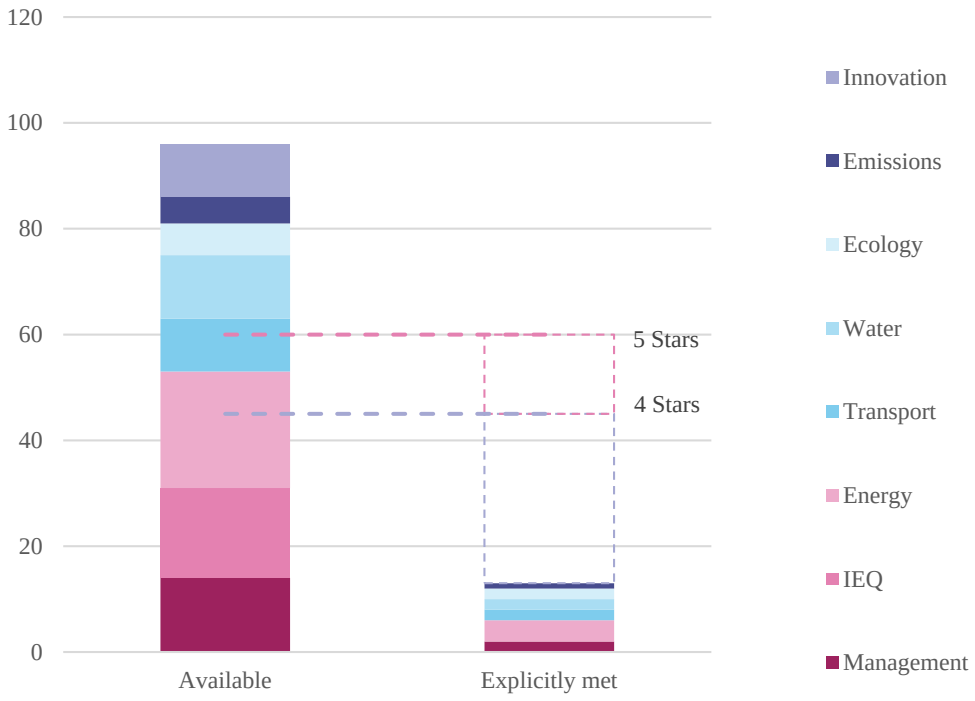
- Sustainability standards specified in planning controls
- Precinct-wide commitments in the Framework.

In Table 2, we noted the mutual support and discrepancies between Green Star credits and draft sustainability standards.

Our detailed review is documented in Appendix A. Our key findings are:

- The draft sustainability standards in planning controls and the precinct-wide commitments enables delivery of approximately 30% of the Green Star credits (13 points) required for a 4 Star rating. The distribution of points is shown in Figure 2.
- Some buildings will not be able to achieve certain credits current conditions. For example, early developments may not meet the Green Star 'Access by Public Transport' and other sustainable transport requirements under Credit 17A, until further infrastructure is built.
- There is minimal overlap between Green Star Communities and Green Star Design and As-Built. The exceptions are the Communities Sustainable Buildings credit (Credit 11), and transport (Credit 27) and walkability (Credit 13) credits. We highlight areas of overlap in Appendix A.

Figure 2 Credits available under the Green Star Design and As-Built scheme, and those explicitly met through standards in planning policy documents



4.4 Is the 4 Star Green Star standard reasonable? Would 5 Stars be an appropriate standard?

We believe that the 4 Star standard is most appropriate to Fishermans Bend because a majority of development applications in the urban renewal area will be multi-unit residential buildings. While commercial office buildings have taken up Green Star in substantial numbers (37% of Australia's office space is Green Star

certified[6]), the residential market has taken up Green Star more slowly. The Green Building Council of Australia noted that: 'In the case of the residential tool, the consumer market is yet to understand the value of a Green Star rating.'[7] In fact, the Green Building Council of Australia's strategic plan identifies the following as a priority for market transformation: 'We will develop a strategy to drive change in the challenging residential sector.'[8]

It is likely that for residential developers at Fishermans Bend, it will be the first time they have participated in the Green Star scheme. The 4 Star standard is an appropriate starting point.

In 2016, based on a small sample of 30 projects providing reliable data, the Green Building Council of Australia identified additional costs for achieving different Green Star levels in different sectors (Table 4 and Table 5Table 5). This data suggests that there is material cost difference in moving from 4 to 5 Stars.

Over time and with increased familiarity with sustainable design processes, materials and products, it is possible that an increasing proportion of buildings and developers could be prepared to achieve 5 Star Green Star.

Table 4 Cost of Green Star per square metre and as a percentage of the overall project cost, by Green Star rating achieved[9]

Green Star rating	Green star cost per square metre (AUD)	Green Star cost as proportion of project cost	Sample size
4 Star	45	1.5%	3
5 Star	96	2.7%	15
6 Star	147	3.2%	12

Table 5 Cost of Green Star per square metre and as a percentage of the overall project cost, by sector

Green Star rating	Green star cost per square metre (AUD)	Green Star cost as proportion of project cost	Sample size
Custom	84	4.5%	1
Design & As-Built	165	3.5%	3
Education	25	0.5%	3
Industrial	86	10.4%	2

[6] GBCA (date unknown), 'Green Star', available at http://new.gbca.org.au/green-star/, accessed on 11 Feb 2018
[7] GBCA (2012), 'Multi Unit Residential rating tool Marketing kit proposal', available at https://www.gbca.org.au/be-involved/become-a-sponsor/green-star-multi-unit-residential-rating-tool-marketing-kit-proposal/, accessed on 11 Feb 2018
[8] Green Building Council of Australia (2016), 'Strategic Plan 2016-2019', available at https://gbca-web.s3.amazonaws.com/media/documents/strategic-plan-poster-infographic-a3-v4.pdf, accessed on 11 Feb 2018
[9] GBCA (2016), 'Green Star Financial Transparency: Research paper', available at https://gbca-web.s3.amazonaws.com/media/documents/gbca-research-paper---financial-transparency-2016.pdf, accessed on 13 Feb 2018

Green Star rating	Green star cost per square metre (AUD)	Green Star cost as proportion of project cost	Sample size
Multi-unit residential	150	4.0%	5
Office	58	1.8%	11
Public building	343	4.7%	3
Retail	53	1.3%	2

For the majority of building types, our view is that 4 Star Green Star certification is both feasible and reasonable, based on the following:

- Approximately 30% of the credits required for a Green Star rating are explicitly met by the Framework commitments or other sustainability requirements in the building standards and planning policy.
- There is local and international precedents for using independent rating schemes in planning controls.
- There is opportunity to streamline documentation across the precinct to ease the documentation burden for formal certification.
- The recommended credits are feasible for achievement by developments
- The Green Star credits are directly aligned in intent with the sustainability goals outlined in the Framework. Approximately 59 out of 110 Green Star credits are directly aligned with one or more sustainability goal or precinct-scale commitment under the Framework. This is more than the required 45 points for a 4 Star rating.

Arup recommendation

Retain the proposed 4 Star Green Star standard for new buildings in Fishermans Bend.

4.5 What is the recommended pathway for Green Star certification?

A 4 Star rating requires 45 points, and it is generally recommended that a ‘buffer’ of points is targeted to reduce risk. This means applicants would need to seek 35-37 additional points, aside from the 13 points available through meeting sustainability standards in planning controls.

We have developed general 4 Star and 5 Star Green Star pathways for new buildings within Fishermans Bend. This pathway has been developed according to the following criteria:

- Ability to be achieved by most building types and relevant at most scales

- Typically lowest cost pathway to achieve the 4 Star benchmark. Costing is not included in Arup's scope of work, however, where possible we have provided indicative costs drawn from experience.
- Consideration of Framework commitments, objectives, and precinct context
- Consistency with other building control standards and thus policy objectives

Table 5 provides a summary of the recommended credits, and we provide further detail in Appendix A. In Table 5, we have categorised cost implications as follows:

- Low cost – reflects common industry practice and requires readily available materials and technologies
- Medium cost – requires careful planning and design throughout project and may require specific materials and technologies
- High cost – requires substantial capital cost investment above standard practice.

Building on our pathway analysis, in Table 6 we highlight specific credits that strongly support the Fishermans Bend sustainability goals.

Arup recommendation

Recommend that applicants adopt the credits nominated in Table 6 as part of the supporting guidance for planning controls.

As we noted in Section 4.3, Green Star places an emphasis on indoor environment quality and material selection, which are not currently in the scope of the planning controls, nor are focus areas for the Fishermans Bend Framework. Thus the pathways must consider these areas of sustainability, as well as those prioritised by the Framework.

As part of developing the pathway, we analysed the technical feasibility of certain credits in the Fishermans Bend context. These were:

- Credit 14.1: Thermal Comfort
- Credit 15E: Greenhouse Gas Emissions
- Credit 16: Peak Electricity Demand
- Credit 18: Potable Water
- Credit 19: Life Cycle Impacts
- Credit 23: Ecological Value
- Credit 26: Stormwater
- Innovation: Renewables

The methodology and results of our feasibility analyses are provided in Appendix B.

Relevance of planned precinct-wide infrastructure

In developing this recommended pathway, we have discussed certain credits with the Green Building Council of Australia. The following summarises the discussion on 24 October 2017, which focused on the relevance of future precinct-wide infrastructure to the credits available.

Sewer mine commitment and recycled water provision

Applicants would likely follow a similar procedure for Credit 18: Potable Water as is implemented for Credit 15: Greenhouse Gas Emissions. For this credit, off-site provision of green energy is rewarded only where building efficiency measures are incorporated. Points are awarded for off-site green energy in proportion to points that are earned for building energy efficiency.

Thus, points for recycled water use would be awarded only in as much as points are awarded due to water consumption efficiency. The number of points likely to be awarded will be further assessed during feasibility.

Public transport

It is unlikely that any points can be claimed for infrastructure that has not been formally committed to by the Government of Victoria. This will impact the number of points that can be claimed for Credit 17: Sustainable Transport. Should some public transport be committed to formally, within a reasonable timeline, discussions with the GBCA will need to be held to determine how best this can be incorporated into an applicant's Green Star strategy.

Table 5 Recommended 4 and 5 Star Green Star pathways for new buildings within Fishermans Bend

Green Star Credit	Requirement	Estimated cost	Cost implication
4 Star pathway			
Credit 1: Green Star Accredited Professional	Engagement of a Green Star Accredited Professional (GSAP).	This can be considered not to constitute additional project cost, as the process of including sustainable design features throughout design and construction, and submitting documentation would usually require the input of an ESD professional, who would typically have this qualification.	Low
Credit 3: Adaptation and Resilience	Climate Adaptation Plan	Could potentially have minimal cost, if documentation is streamlined so as to provide a precinct wide plan that would only need to be modified for building specific features. Recommendations from this plan would then need to be implemented, at varying cost for different building sizes and types.	Low
Credit 5: Commitment to Performance	Agreement for end of life waste management – requires make good clauses in project leases, or equivalent commitments	No up-front cost.	Low
Credits 2, 6, 7, 22: Commissioning and Tuning, Metering and Monitoring, Responsible Construction Practices, Construction and Demolition Waste	Construction contractor selection would need to take into account environmental management plans and systems	Potential premium for appropriate contractor. Building/development dependent.	Medium
Credits 13, Indoor Pollutants, Credit 21, Sustainable Products	Material selection: requirements would need to be met to minimise content of indoor pollutants, as well as for responsible and sustainable sourcing.	Building dependent. Low VOC finishes becoming business as usual. Other sustainably accredited products increasingly common, business as usual but some may attract a cost premium.	Low
Credit 20.1/20.3, Responsible Building Materials	20.1 requires structural steel to be sourced from a Responsible Steel Maker. 60% of steelwork in steel framed buildings to be supplied by fabricator meeting specified	Responsibly sourced steel is likely to attract a cost premium.	Medium

Green Star Credit	Requirement	Estimated cost	Cost implication
	certification standards. 60% of reinforcement in concrete framed buildings to be produced using energy reducing processes. 20.3 Requires permanent formwork, pipes, flooring, blinds and cables containing PVC to meet appropriate guidelines, or be certified to demonstrate that products do not contain PVC.		
Credits , 10, 11, 12, 14: Acoustic Comfort, Lighting Levels, Visual Comfort, Thermal Comfort	Attention to Indoor Environment Quality (IEQ), particularly the following: Noise levels Illuminance levels Thermal comfort Access to daylight and views	Modelling costs would be building dependent. There are deemed to satisfy methods of complying with these credits, in some cases. Daylight and Views access is building massing dependent, which can impact the development yield from the site.	Medium
Credits 15, 16: Greenhouse Gas Emissions, Peak Electricity Demand Reduction, and compliance with National Construction Code, Better Apartment Design Standards and proposed planning controls	High performance building facades and incorporation of passive design strategies.	Building dependent. Upfront capital cost premium associated with high performance building materials and systems, operational cost savings. No explicit Green Star cost – incorporated into design.	Medium
Credits 15, 16: Greenhouse Gas Emissions, Peak Electricity Demand Reduction, and compliance with National Construction Code, Better Apartment Design Standards and proposed planning controls	Efficient mechanical building systems		Low
Credit 18: Potable Water	Efficient fixtures and fittings	Minimal. Becoming Business as usual.	Low
Credits 15, 16, Innovation: Greenhouse Gas Emissions, Peak Electricity Demand Reduction, Innovation Renewables Credit	Consideration of renewables	Building and array size dependent. Assumed implemented if economically viable.	Low
Credit 19: Life Cycle Impacts	30% reduction in Portland cement content, Reduction in steel content compared to standard practice – or alternative prescriptive materials requirement such as building reuse,	Building dependent choice of prescriptive pathways – 2 points targeted. Alternatives to Portland Cement have an increased curing time, which increases construction costs. .	Medium

Green Star Credit	Requirement	Estimated cost	Cost implication
	use of structural timber. See Section 5.9.1 for feasibility discussion of these credits.		
Innovation Credits	Innovation Credits	Variety of options for achievement of these points. Recommended points in Appendix A. Some may be associated with additional cost for infrastructure or additional modelling or studies.	Medium
5 Star Pathway			
Credits 2.1-2.3; Commissioning and Tuning, Credit 7.2 High Quality Staff Support	Services and Maintainability Review, Building Commissioning and Building Systems Tuning, Provision of extra contractor staff support services	Building dependent. May incur higher contractor fee for top tier contractor.	Medium
Credits 9.1, 9.2,9.3: Indoor Air Quality	Credit 9.1: Requires mechanical design to allow for maintenance, cleaning, and minimum distances between pollution sources and outdoor air intakes, and for ductwork to be cleaned or managed accordingly. Credit 9.2: Requires the space to be naturally ventilated, or outdoor air to be provided at a rate 50% greater than that required by Australian Standards. Credit 9.3: Indoor pollutant sources to be directly exhausted: e.g. kitchens, carparks etc.	Building dependent. Cost may be incurred from extra outdoor air provision, as larger equipment sizes might be required. However, in commercial buildings this is becoming standard practice.	Medium
Credit 10.2: Reverberation	Acoustic absorption to be installed to reduce reverberation times below certain limits.	This is easy to incorporate into commercial design and should not impact cost. For residential buildings, this credit may be difficult to achieve.	Low
Credit 13.2 Engineered Wood Products, Credit 20.2 Responsibly sourced timber	Requires 95% of all engineered wood products to meet stipulated formaldehyde limits. 95% by cost of all timber also to be reused, or certified by an appropriate forest certification scheme.	Formaldehyde requirement is increasingly becoming business as usual. Can incur some increased construction costs from materials tracking and administration. Responsibly sourced timber can attract a cost premium.	Medium

Green Star Credit	Requirement	Estimated cost	Cost implication
Credit 22B: Construction and Demolition Waste	Requires construction and demolition waste to be diverted from landfill, to meet either an absolute or a percentage benchmark.	This credit can be challenging, particularly where sites have pre-existing buildings that are demolished, but compliance does not necessarily have cost implications.	Low
Credit 29: Refrigerant Impacts	Requires refrigerants used in the building to meet certain Total System Direct Environmental Impact (TSDEI) limits. Where refrigerants fall within a particular TSDEI band, a leak detection system and refrigerant recovery system must be installed.	Increasingly, refrigerants with a lower TSDEI are becoming available. These can be more expensive and less efficient, but don't require an expensive refrigerant recovery system.	Medium
Credits 15, 16: Greenhouse Gas Emissions, Peak Electricity Demand Reduction	Additional points for 5 Stars. Further improvements to façade, building systems. Renewables.	Cost for modelling, façade, systems and renewables installation.	Medium

Table 6 Recommended Green Star credits to support delivery of Fishermans Bend sustainability goals

Green Star credit	Rationale
2.0 Environmental Performance Targets	The requirement to set environmental performance targets is implicit to the Framework and planning controls.
3.1 Implementation of a Climate Adaptation Plan	This credit is directly aligned with the Green Star Communities Strategy, and the sustainability goal: A Climate Adept Community
5.1 Environmental Building Performance	The requirement to set environmental performance targets is implicit to the Framework and planning controls.
8.0 Operational Waste	Directly aligned with sustainability goal: A Low Waste Community. Recommend the performance pathway for developments above a certain threshold size.
15 Greenhouse Gas Emissions	Directly aligned with sustainability goal: 'Low Carbon Community'. Recommend at least 4 points (minimum met by National Construction Code requirement in planning controls), or the number specified for development types in the Appendix A.
17 Sustainable Transport	Recommend 2 points under this credit, specifically for 17B.2 and 17B.4 for Active Transport and Reduced Car Parking Provision – these are specifically met by planning controls.
18 Potable Water	Recommend water efficiency measures as discussed in Table 2. Recommend 3 points under this category.
23 Ecological Value	Recommend 1 point under this category, due to urban renewal nature of precinct.
25 Urban Heat Island Effect	Directly aligned with planning controls and sustainability goals.
26 Stormwater	Recommend both 26.1 and 26.2 as aligned with planning controls, wider Melbourne targets, and sustainability goals.

4.6 How does the recommended pathway vary between building types?

We assessed the sensitivity of these pathways was assessed for three different building types:

- Commercial (Premium A grade) buildings
- Medium/high density apartments
- Mixed use developments.

Appendix A shows the 4 and 5 Star pathways for these developments.

We found that sensitivities between buildings types were not significant. Our key conclusions are:

- Indoor Environment Quality credits are likely to be comparatively important for residential applications, particularly in terms of acoustic comfort, whereas these might be less of a priority for commercial buildings.

- Apartment buildings may have the option of being naturally ventilated, and thus use ceiling fans or similar for cooling. Therefore it is possible that no water is required for heat rejection. This earns an additional 2 points under the prescriptive pathway for the Potable Water credit. However, to earn extra water points, the proposed precinct scale recycled water would potentially be a more efficient solution.
- Energy efficiency may be easier to implement for a commercial building with a centralised air conditioning system, and potentially more money to spend on renewables, high performance building fabric, and offsite Green Power.

We did not develop a Green Star pathway for an individual house because we do not expect a small development would pursue a Green Star rating. This is further discussed in Section 4.7.

4.7 At what building scale should independent sustainability certification apply?

Seven Victorian local councils (Banyule, Moreland, Port Phillip, Stonnington, Whitehorse, Yarra and Melbourne) currently have Environmentally Sustainable Design (ESD) requirements within their planning policies. These councils have established a precedent for different sustainability certification processes at different development scales.

In these municipalities, all new buildings are expected to meet sustainability policy objectives. However, the policies recognise that the costs and complexity of documentation should reflect the scale and thus impact of the development.

Typically, councils set a minimum threshold for applying the most complex sustainability requirements (e.g. Green Star). The City of Melbourne Local Policy Clause 22.19 uses 2,000 sqm and 5,000 sqm gross floor area as thresholds to assign different sustainability performance requirements to buildings.

- The 2,000 sqm threshold is used to increase the energy performance requirements for offices and education buildings.
- For offices, education buildings, retail buildings, and accommodation developments above 5,000 sqm, there is an additional requirement to demonstrate that the development has the preliminary design potential to achieve a 5 Star Green Star rating using a current tool. This applies to mixed use buildings as well.

The City of Port Phillip Local Policy Clause 22.13 requires a Sustainability Management Plan, and recommends Green Star as an example tool for:

- Residential developments of 10 or more dwellings, or a residential building for accommodation other than dwellings greater than 1000 sqm gross floor area
- Non-residential buildings greater than 1000 sqm gross floor area

Banyule, Moreland, Yarra, Stonnington and Whitehorse Planning Schemes have the similar requirements as the City of Port Phillip Planning Scheme, although the

exact thresholds vary with the profile of development scales within those municipalities.

The Green Building Council of Australia has communicated that it has certified 13 residential buildings 5,000 sqm or less, the smallest being 913 sqm.[10] These represent 25% of multi-unit residential certifications. Five of these 13 smallest buildings were in Bowden Village, an ambitious government-led urban infill project.

The average certified multi-unit residential building is around 23,000 sqm.

We believe that setting a 5,000 sqm minimum threshold for independent sustainability certification will capture most of the development at Fishermans Bend, as 5,000 sqm would be around two to three storeys of a typical block. Given the height limits set out in the Framework Plan, we expect that most new development at Fishermans Bend will be at least four storeys high.

We suggest that it would be appropriate to set the 5,000 sqm gross floor area threshold in the first iteration of the planning controls, monitor the residential sector, then review the threshold in future revisions to sustainability standards.

Arup recommendation

Amend the planning control to apply the 4 Star Green Star standard or equivalent for buildings greater than 5,000 sqm gross floor area.

For developments smaller than 5,000 sqm, we recommend that applicants be required to provide a Sustainability Management Plan that:

- Describes how the building could achieve the equivalent of 4 Star Green Star certification
- Describes how the sustainability measures will be managed and implemented as the building is designed, constructed and commissioned
- Is prepared by a suitably qualified person.

Arup recommendation

In planning controls, require the development of a Sustainability Management Plan to be developed for buildings up to 5,000 sqm.

Prepare a template for a Fishermans Bend Sustainability Management Plan, with supporting guidance on demonstrating equivalent performance to 4 Star Green Star.

[10] Green Building Council of Australia, personal communication by email, 9 Jan 2018

4.8 What Green Star evidence is available at the time of planning submission?

In order for the independent certification process to support the planning process, there must be:

- Sufficient evidence from planning permit applicants to indicate progress towards achievement of a Green Star Design & As-Built rating or equivalent third party scheme, and
- Reviewing this evidence must not pose an undue burden on the planning authority. The requirement for third party certification should ease the burden on the planning authority, not increase it.

Green Star Design & As-Built is currently assessed in two stages. The first stage is optional, for which developers submit documentation demonstrating compliance for a Design Review. This usually occurs towards the end of the Detailed Design stage of the project. This is an opportunity for the design team to ensure that their design meets the requirements of the Green Building Council, and to obtain feedback.

The second stage is required for certification, and is referred to as an As-Built submission. This must occur after construction, and demonstrates that the building has been constructed as per the compliant design.

This timeline must be reconciled with the planning approval timeline.

The draft planning controls outline the evidence that the applicant would provide to the responsible authority to demonstrate progress towards achieving Green Star Design & As-Built certification (Table 7).

Table 7 Green Star evidence to be provided to the responsible authority

Project stage	**Evidence required**
Prior to commencement of works	Registration of the project with Green Star
Prior to occupation	Design Review achieving 4 Star Green Star Design & As-Built or equivalent
Within 12 months of occupation	4 Star Green Star Design & As-Built rating achieved (or equivalent).

We recommend that DELWP develops a template to be completed by the applicant. The applicant would update the template for review by the responsible authority at each of the stages outlined in Table 7. The template should set out how a project would demonstrate progress towards 4 Star Green Star certification, in the form of a Green Star pathway or similar. Where a project seeks alternative certification, the template should set out how the applicant can demonstrate that the alternative scheme responds to the criteria for equivalency in Section 5.

Arup recommendation

Prepare a template to be completed by the applicant at each project review stage. The template should demonstrate the means by which the project will achieve the 4 Star Green Star certification, or equivalent.

In addition, we recommend that the timeline in the draft planning controls be amended to require the Green Star Design Review prior to commencement of works. A Green Star Design Review submission is usually achievable towards the end of the detailed design stage.

Once design is complete and construction begins, there is little opportunity to change the design, and thus feedback from the Green Building Council of Australia may be difficult to incorporate.

Arup recommendation

Amend the planning controls to require the applicant to complete the Green Star Design Review prior to commencement of works.

4.9 What are the opportunities to streamline the Green Star submission process?

Some of the burden associated with Green Star certification is due to the documentation required to demonstrate compliance. We identified the credits in Table 8 as having the potential to be achieved using the same set of standardised documentation across all relevant projects in Fishermans Bend.

Arup recommendation

Discuss with the GBCA an agreed approach for precinct-wide documentation to be included in development-specific Green Star applications.

Table 8 Green Star credits that could make use of standardised documentation across Fishermans Bend

Green Star credit	Documentation or requirement
Credit 3: Adaptation and Resilience	Climate Change Adaptation Plan – Part of this could be precinct-wide, with additional sections to be building specific. Buildings would still need to demonstrate how this has influenced building design.

Green Star credit	Documentation or requirement
Credit 5.1: Environmental Building Performance	Environmental Building Performance – Opportunity for precinct-wide documentation of building performance targets.
Credit 5.2: End of Life Waste Performance	Lease 'make-good' clauses – Opportunity for streamlined clauses for all developments.
Credit 8: Operational Waste	Waste management plan – Opportunity for sections of the waste management plan to apply precinct wide, with additional sections to be building specific. Buildings would still need to demonstrate how this has influenced building design.
Credits 15, 16, Innovation	Any district energy infrastructure, or precinct renewable infrastructure could have streamlined documentation for relevant credits, should this be implemented in future. Streamlined documentation/alternative approach for residential developments following the NatHERS pathway for Credit 15, for demonstration of compliance with Credit 16.
Credit 23.0: Endangered, Threatened or Vulnerable Species and Communities	Precinct-wide assessment of endangered, threatened or vulnerable species.
Credit 23.0: Ecological Value	Precinct-wide assessment of improved ecological value, given that this is an urban renewal site.
Credit 26: Stormwater	Opportunity for precinct wide stormwater discharge and pollutant reduction documentation to partially fulfil documentation requirements, with building specific additional information.
Innovation Credit: Integrating Healthy Environments	Precinct-wide collaboration with public health professionals to characterise project impacts on end users – Optional innovation credit.
Innovation Credit: Reconciliation Action Plan	Reconciliation Action Plan – Could potentially be partially precinct wide, or tie into the precinct wide plan. Optional innovation credit.
Innovation Credit: Social Enterprise for Affordable Housing	Social Enterprise for Affordable Housing – either an alternative means of meeting the intent of this credit as per policy allowance for increased Floor Area Ration for affordable housing provision, or a precinct wide move to become involved with the Homes for Homes program – Optional innovation credit.
Innovation Credit: Social Return on Investment	Social Return on Investment study – At least sections of this would be applicable precinct-wide – Optional innovation credit.
Innovation Credit: Community Benefits	Community benefits – Incorporation of spaces that are publically accessible for use by the wider community as per policy allowance for increased Floor Area Ration for developments incorporating areas of community benefit – Optional innovation credit
Innovation Credit: Market Benefits	Possible precinct wide research on market benefits of sustainable building practices and Green Star – Optional innovation credit.

4.10 How will changes in Green Star and the National Construction Code affect the standards?

The long process of urban renewal means that it is necessary to consider how likely changes to Green Star will affect its use at Fishermans Bend.

4.10.1 Updates to the Green Star scheme

The Green Star rating tool is regularly updated. There are two types of updates:

- Minor updates, every 1-2 years, indicated by increases to the sub-version of the rating tool (v1.2, 1.3 etc). These changes respond to feedback and technical questions to the Green Building Council of Australia, and incorporate changes to areas such as readability, documentation requirements, innovation credits and benchmark updates.
- Major updates, every 3-5 years, indicated by increases to the version of the rating tool (v2, v3 etc.). These updates aim to keep the Green Star tool as a relevant means of measuring best practice and leadership in building sustainability. These changes respond to industry engagement, certified projects, innovation, and market progress.

Developments in Fishermans Bend are expected to achieve a formal Green Star rating under the version current at the time of registration. As a result, our recommended pathway to attaining 4 Stars will need to be adapted to future changes to the rating tool.

In particular, updates to the Green Star rating tool are anticipated to reflect the aspirations of the Green Building Council of Australia to encourage net zero (or even net positive) buildings, with relation to water use, greenhouse gas emissions and waste.[11] Target timelines for Green Star Design & As-Built are:

- 6 Star Green Star new buildings to achieve carbon neutrality by 2021
- 5 Star Green Star new buildings to achieve carbon neutrality by 2024
- 4 Star Green Star new buildings to achieve carbon neutrality by 2027

It is likely that the Green Building Council of Australia will also change Green Star's distinction between tenant and base building energy consumption. This would move towards measuring whole building energy consumption, and potentially towards increasing the focus on performance beyond practical completion.

4.10.2 Updates to National Construction Code

The National Construction Code outlines technical provisions for design and construction of buildings, structures, plumbing and drainage systems in Australia. It represents the minimum level of compliance for buildings in Australia.

[11] Green Building Council of Australia (2017), 'A carbon positive roadmap for the built environment', available at http://new.gbca.org.au/news/gbca-media-releases/carbon-positive-roadmap-will-pave-way-climate-action/, accessed on 12 Feb 2018

Sustainability-related requirements are largely covered under Building Code of Australia Volume 1, Section J, Energy Efficiency.

The current version was released in 2016. The next version will be released in 2019, and any changes may affect the Green Star pathways adopted by developments in Fishermans Bend in order to achieve the 4 Star target.

Anticipated changes to Section J in 2019 include the following:

- Quantification of performance targets for building efficiency
- Introduction of NABERS energy commitment agreement as a means of verification
- Introduction of a Green Star verification method
- Introduction of commissioning requirements
- Further consideration of renewables

These changes could impact the number of Green Star credits that are 'automatically' achieved by compliance with the National Construction Code, depending on the relative changes in Green Star requirements.

The current draft National Construction Code indicates that a building can seek compliance with Section J through being registered for a Green Star Design & As-Built rating, and showing modelling results where the proposed building has less than 90% of the annual greenhouse gas emissions of the reference building, and has thermal comfort modelling results within a certain band.

If the National Construction Code recognises Green Star as a verification method, as indicated in the current draft version, the recommended pathway may need to be adjusted to increase the number of points to be achieved for Green Star credit 15 Greenhouse Gas Emissions. The draft planning control currently sets the standard for buildings to perform 20% better than National Construction Code minimum requirements.

The introduction of a Green Star energy verification method will be of benefit to developments in Fishermans Bend as it will streamline documentation required for building code compliance and Green Star certification.

Arup recommendation

Update supporting guidance with recommended pathway, once National Construction Code confirms the inclusion of Green Star Design and As-Built as an alternative verification method.

5 Alternative third party schemes

There will be certain developments for which Green Star is not an appropriate rating tool, is not feasible, or for which the applicant prefers an alternative standard.

Our recommendation for developments up to 5,000 sqm is outlined in Section 4.7. For developments greater than 5,000 sqm, this section sets out criteria for a rating scheme to demonstrate its suitability for use in the Fishermans Bend planning process.

The criteria in Table 9 focus broadly on the standard's objectives, governance processes and procedures, and the documented evidence required for certification. Aside from responding to the criteria outlined here, the applicant would also demonstrate that the performance as measured by the alternative scheme is equivalent to the 5 Star Green Star standard.

To illustrate how this criteria should be used, we have assessed:

- Green Star Design & As-Built (Table 10)
- EnviroDevelopment (Table 11)
- PassivHaus (Table 12)

Our findings are:

- Green Star is an appropriate rating tool for applicants to use in response to planning requirements.
- EnviroDevelopment is potentially relevant, if the applicants are targeting the highest levels of the available criteria, and if supplemented by studies such as a climate change risk assessment.
- PassivHaus is not an appropriate holistic tool for applicants to use in isolation, but would be one of a number of tools an applicant might use to demonstrate achievement of sustainability objectives.

Table 9 Criteria for assessing the suitability of a third party rating scheme for use as part of Fishermans Bend planning processes

	Criteria	High	Medium	Low
	Objective and standards			
1	Does the scheme have the same or wider scope than the Framework sustainability goals, targets and objectives, and the vision to achieve world leading sustainability outcomes?	The scheme requires users to address goals in at least all of these categories: • connected and liveable community • prosperous community • inclusivity and healthy community • climate resilient • water sensitive • biodiversity • low carbon, including energy efficiency • low waste The vision of the scheme is to achieve world leading sustainability outcomes.	The scheme addresses up to 75% of these goals. The vision of the scheme is to achieve sustainability outcomes.	The scheme addresses up to 50% of these goals.
2	Does the scheme align with accepted holistic best practice sustainability built environment outcomes in Australia, and informed by global best practice schemes?	The scheme fully aligns with Australian and international industry best practice by ensuring stringency in standards to achieve sustainable outcomes.	The scheme aligns with international industry best practice to achieve sustainable outcomes. Some standards may not be mandatory.	The scheme does not demonstrate industry best practice. Most or all standards are optional.
3	Does the scheme have carbon performance targets that align with internationally accepted science based targets, and facilitate the delivery of Victorian Government's carbon targets as defined in the Victorian Climate Change Act 2017?	The scheme demonstrates it is facilitating the delivery of the Victorian Government target of net zero greenhouse gas emissions by 2050, or sooner and aligns with internationally accepted targets.	The scheme has carbon reduction targets in place but these are not as stringent as Victorian standards.	There are no or low carbon targets mentioned in the scheme.

	Criteria	High	Medium	Low
	Process and governance			
4	Does the certification scheme include independent third party assessment of design stage and as built documentation?	The scheme requires assessment of both design stage and as built for certification which must be completed by an independent third party panel of experts.	The scheme involves self-assessment by the user of either design stage and as built, or both, which is verified by the accrediting organisation.	The scheme involves a self-assessment of the design stage, which may or may not be verified by the accrediting organisation.
5	Does the scheme have a robust set of industry-accepted governance processes and procedures, ensuring high levels of probity are maintained through independent third party processes?	The scheme has industry accepted governance processes and procedures. There are mechanisms in place to address any conflict of interest that may arise in independent assessment processes.	Three are some governance processes in place to maintain probity levels. In assessment processes, the scheme has voluntary conflict of interest declaration.	There are minimal governance processes in place. The scheme does not have a conflict of interest process.
6	Does the scheme provide feedback and assessment during the design stage of the development, as well as certification of the building at ‘as built’ stage?	The scheme provides multiple rounds of feedback by a third party assessor to the user throughout the project's development, with opportunity and support provided to the user to address any recommendations. The scheme certifies the building at the as built stage if it meets the certified design.	The administering organisation provides few opportunities for feedback at the design stage of development and as built stages certification stage.	No feedback is provided throughout the development of the project. Certification is only provided at design stage.
7	Has the certification process been formally assured by internationally recognised quality standards such as ISO 9001?	The scheme has been formally assured by internationally recognised quality standards, such as ISO 9001.	The scheme has only been formally assured by domestically recognised quality standards.	The scheme has not been formally assured by any quality standards.
	Evidence			
8	Does the evidence required to support a claim for certification allow for adequate third party technical assessment to validate performance outcomes, and ensure claims made are followed through at an as-built stage, OR does it require performance verification?	The scheme requires ongoing submission/monitoring of evidence to support standards which must be verified by third party technical assessors. Certification requires follow through from design to as built. Annual or ongoing reviews may be required to validate performance outcomes.	Technical assessment is undertaken by the administering organisation. Evidence must be submitted at each milestone to the administering organisation. Certification may require follow through from design to as built.	Only performance verification is required. There is no requirement to follow through from design to as built stage.

Table 10 Assessment of Green Star Design & As-Built against rating scheme suitability criteria

	Criteria	Rating	Rationale
1	Does the scheme have the same or wider scope than the Framework sustainability goals, targets and objectives, and the vision to achieve world leading sustainability outcomes?	High	Section 4.2 of this report discusses in detail the extent to which Green Star's requirements are aligned with the Framework's Sustainability Goals.
2	Does the scheme align with accepted holistic best practice sustainability built environment outcomes in Australia, and informed by global best practice schemes?	High	Green Star is consistent with sustainability rating schemes that are widely understood and accepted by industry. The highest rating level, 6 Stars, is consistent with global best practice. While the design review stage is an optional part of the process, certification at as-built is dependent on developers meeting a range of compulsory credits to achieve a particular rating. There are some optional credits as part of the scheme, including innovation credits.
3	Does the scheme have carbon performance targets that align with internationally accepted science based targets, and facilitate the delivery of Victorian Government's carbon targets as defined in the Victorian Climate Change Act 2017?	High	As outlined in Section 4.10.1, Green Building Council of Australia will require that new buildings wishing to attain Green Star certification will be required to have net zero emissions by 2027 at the latest for 4 Star Green Star new buildings.
4	Does the certification scheme include independent third party assessment of design stage and as built documentation?	High	Green Star involves an independent third party assessment of projects by a panel of sustainable development experts from GBCA. Assessment is optional at the design stage of the project and compulsory at the as-built stage.
5	Does the scheme have a robust set of industry-accepted governance processes and procedures, ensuring high levels of probity are maintained through independent third party processes?	High	Green Star has a range of governance processes and procedures in place that meet industry standards, including codes of conduct for all members and feedback processes. The Green Building Council of Australia states that it is committed to continual improvement of governance processes through ongoing advice from the Green Star Steering Committee and supporting advisory groups, as well as regular communication with members and the industry.
6	Does the scheme provide feedback and assessment during the design stage of the development, as well as certification of the building at 'as built' stage?	High	The Green Star scheme provides users with two rounds of optional assessment at the design review stage of development, and two rounds of feedback at the as-built stage. Green Star also provides services including credit interpretation requests, technical clarifications, area definitions and eligibility queries. Buildings are certified at the as-built stage.
7	Has the certification process been formally assured by internationally recognised quality standards such as ISO 9001?	High	In 2017, the Green Building Council of Australia achieved ISO 9001 certification.

	Criteria	Rating	Rationale
8	Does the evidence required to support a claim for certification allow for adequate third party technical assessment to validate performance outcomes, and ensure claims made are followed through at an as-built stage, OR does it require performance verification?	High	The scheme requires detailed documentation in accordance with the Submission Guidelines to submitted to the Green Building Council of Australia for awarding credits. In each credit case, a Submission Template must be presented alongside evidence justifying claims within. Documentation must be prepared by suitably qualified experts. These are assessed by an independent third party. Project teams must indicate that the design is compliant in order to be awarded certification. Performance is not measured after the as-built stage.

Table 11 Assessment of EnviroDevelopment against rating scheme suitability criteria

	Criteria	Rating	Rationale
1	Does the scheme have the same or wider scope than the Framework sustainability goals, targets and objectives, and the vision to achieve world leading sustainability outcomes?	Medium	EnviroDevelopment addresses the majority of sustainability goals under the Fishermans Bend Framework however, not all categories must be targeted in order to achieve a rating. For example, a climate change risk assessment is an optional credit. The vision is to achieve sustainability outcomes, but world leadership does not feature in stated aims.
2	Does the scheme align with accepted holistic best practice sustainability built environment outcomes in Australia, and informed by global best practice schemes?	Medium	A holistic approach is not necessarily required by the scheme as some credits are not mandatory to achieve certification. While the scheme is not classified as world-leading, the standards required for EnviroDevelopment certification have been determined by a panel of government, industry and environmental experts.
3	Does the scheme have carbon performance targets that align with internationally accepted science based targets, and facilitate the delivery of Victorian Government's carbon targets as defined in the Victorian Climate Change Act 2017?	Medium	EnviroDevelopment V2 was released in 2014, before the announcement of Victorian targets. There is an essential requirement to reduce emissions beyond regulatory requirements. A 20% reduction in emissions, or other emissions reduction strategies, can be used to achieve the Energy element. There is no trajectory towards requiring zero carbon development.
4	Does the certification scheme include independent third party assessment of design stage and as built documentation?	Medium	Assessment of projects is verified by the Urban Development Institute of Australia and recertification is undertaken annually. The documentation review is less detailed than that under the Green Star scheme. There is no requirement to follow through rating to as-built, but if the development maintains a current EnviroDevelopment rating, there is assurance that the development has been progressing in line with requirements. It would be possible to require a development to maintain the EnviroDevelopment through to a stage where it has been fully constructed (therefore reducing the risk that a developer achieves a rating, then lets it lapse without following through with commitments).
5	Does the scheme have a robust set of industry-accepted governance processes and procedures, ensuring high levels of probity are maintained through independent third party processes?	Medium	EnviroDevelopment includes a range of compliance mechanisms and procedures to ensure the integrity of the certification process, including random site checks and requests for further information. The Technical Standards are regularly reviewed and updated to ensure they continue to recognise sustainability achievements above government requirements and in light of new technologies and industry standards. However, there is limited scrutiny via technical committees. EnviroDevelopment professionals must undergo comprehensive training and Urban Development Institute of Australia is also advised by multiple committees comprised of industry professionals.
6	Does the scheme provide feedback and assessment during the design stage of the development, as well as certification of the building at 'as built' stage?	High	The certification process involves contact with Urban Development Institute of Australia from the expression of interest stage, through to project registration and submission. Feedback is also provided

	Criteria	Rating	Rationale
			annually as the project must be recertified on an annual basis. Development can be certified at the as-built stage, although it is not required by the scheme and developers may let the rating lapse.
7	Has the certification process been formally assured by internationally recognised quality standards such as ISO 9001?		Unknown – to be confirmed with Urban Development Institute of Australia.
8	Does the evidence required to support a claim for certification allow for adequate third party technical assessment to validate performance outcomes, and ensure claims made are followed through at an as-built stage, OR does it require performance verification?	Medium	Projects must complete the Application Template and supporting documentation to clearly demonstrate achievement and future delivery of initiatives to satisfy EnviroDevelopment standards. However, substantially less evidence is required far less evidence required than for Green Star Design and As-Built, including less analysis and modelling. Annual reviews are required in order to maintain certification.

Table 12 Assessment of PassivHaus against rating scheme suitability criteria

	Criteria	Rating	Rationale
1	Does the scheme have the same or wider scope than the Framework sustainability goals, targets and objectives, and the vision to achieve world leading sustainability outcomes?	Low	The PassivHaus scheme primarily focuses on improving indoor environmental quality and energy, though other facets of ecologically friendly design, such as management and water, may be considered in the standard. There are no requirements for improved connectivity, liveability, inclusivity, prosperity, biodiversity or waste.
2	Does the scheme align with accepted holistic best practice sustainability built environment outcomes in Australia, and informed by global best practice schemes?	Medium	PassivHaus derives from Germany and uptake in Australia has been limited. In terms of energy efficiency, the scheme aligns with industry best practice for buildings and is renowned internationally; however, it has a limited focus on wider sustainable outcomes. To achieve certification as a PassivHaus, all standards must be satisfied.
3	Does the scheme have carbon performance targets that align with internationally accepted science based targets, and facilitate the delivery of Victorian Government's carbon targets as defined in the Victorian Climate Change Act 2017?	High	The ultimate aim of the scheme is to achieve net zero energy or carbon status for a building.
4	Does the certification scheme include independent third party assessment of design stage and as built documentation?	Med-High	Third party assessment is undertaken by certified professionals from the Passive House Institute. There is an initial check of the design before a final assessment is completed by a Passive House certifier. Only as-built certification is required technical data must be submitted prior to construction.
5	Does the scheme have a robust set of industry-accepted governance processes and procedures, ensuring high levels of probity are maintained through independent third party processes?	Medium	The scheme requires particular standards to be met across all Passive Houses seeking certification. Only certifiers registered with the Passive House Institute may undertake assessment processes of buildings. The Passive House Institute ensures transparency in all its operations and does not enter into exclusive contracts.
6	Does the scheme provide feedback and assessment during the design stage of the development, as well as certification of the building at 'as built' stage?	Medium	Certification only occurs at the as built stage, but it is dependent on checks undertaken by third party certifiers throughout the design process. The scheme provides for one round of feedback and revisions before a pass or fail on the assessment is decided.
7	Has the certification process been formally assured by internationally recognised quality standards such as ISO 9001?	Medium	Some of the standards in the scheme are accredited according to ISO standards; however, it does not appear that the scheme as a whole has been formally assured by ISO 9001.
8	Does the evidence required to support a claim for certification allow for adequate third party technical assessment to validate performance outcomes, and ensure claims made are followed through at an as-built stage, OR does it require performance verification?	Medium	An Excel-based tool, the Passive House Planning Package, is required to be completed by the developer. Certifiers must ensure there is no data missing or unsupported evidence. Technical assessment also includes on-site tests for airtightness.

6 Next steps

Table 13 provides a summary of our recommendations and next steps throughout this report.

Table 13 Summary of recommendations

	Recommendation	Prior to finalising planning control	Following finalisation of planning controls	During implementation phase
1	Improve alignment of Transport-related standards in draft planning controls with Green Star Design & As-Built	×		
2	Provide a quantified standard for renewable energy generation in supporting guidance		×	
3	Increase metric to 75% of total site area for reducing urban heat island effect.	×		
4	Provide a quantified standard for low solar absorptance façade materials in supporting guidance		×	
5	Amend reflectivity standard in planning controls to reflect typical Victorian council requirements	×		
6	Provide additional standards in planning controls relating to water efficiency and landscape irrigation systems	×		
7	Build industry capacity to delivery Smart Cities measures by providing further detail in supporting guidance		×	
8	Retain the proposed 4 Star Green Star standard for new buildings in Fishermans Bend.	×		
9	Recommend that applicants adopt the credits nominated in Table 6 as part of the supporting guidance for planning controls.		×	
10	Amend the planning control to apply the 4 Star Green Star standard or equivalent for buildings greater than 5,000 sqm gross floor area.	×		
11	In planning controls, require the development of a Sustainability Management Plan to be developed for buildings up to 5,000 sqm.	×		

	Recommendation	Prior to finalising planning control	Following finalisation of planning controls	During implementation phase
12	Prepare a template for a Fishermans Bend Sustainability Management Plan, with supporting guidance on demonstrating equivalent performance to 4 Star Green Star.		×	
13	Prepare a template to be completed by the applicant at each project review stage. The template should demonstrate the means by which the project will achieve the 4 Star Green Star certification, or equivalent.		×	
14	Amend the planning controls to require the applicant to complete the Green Star Design Review prior to commencement of works.	×		
15	Discuss with the Green Building Council of Australia an agreed approach for precinct-wide documentation to be included in development-specific Green Star applications.		×	
16	Update supporting guidance with recommended pathway, once National Construction Code confirms the inclusion of Green Star Design and As-Built as an alternative verification method.			×

Appendix A

Recommended Green Star Design and As Built pathways

Green Star - Design & As Built v1.2 Scorecard

Project:	Fisherman's Bend Urban Renewal
Targeted Rating:	4-5 Stars

							General - Easiest Path		Commercial		Apartments (Med/High Density)		Mixed Use	
Points Available	Explicitly met	Aligned	Possible	Time-dependent	Location dependent	Feasibility Further work	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star
100	**13.0**	**59.0**	**91.0**	**4.0**	**2.0**	**29.0**	**50.0**	**66.0**	**53.0**	**66.0**	**52.0**	**66.0**	**54.0**	**68.0**

Category	Aim of the Credit	Code	Criteria	Points Available	Explicitly Met	Aligned	Possible	Future plan dependent	Location dependent		General 4 Star	General 5 Star	General 4 Star	General 5 Star	General 4 Star	General 5 Star	General 4 Star	General 5 Star	Communities Alignment	Standardised Documentation?	GBCA Questions?	Comments
Management																						
Green Star Accredited Professional	To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended.	1.0	Accredited Professional	1			1				1	1	1	1	1	1	1	1	Aligned, but would require extra GSAP involvement for each building		Could this high level planning work represent involvement of a GSAP?	Extra cost to hire GSAP
Commissioning and Tuning	To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential.	2.0	Environmental Performance Targets	-	complies	complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				Implicit to the Framework and planning controls.
		2.1	Services and Maintainability Review	1			1					1	1	1		1	1	1				
		2.2	Building Commissioning	1			1					1	1	1		1	1	1				
		2.3	Building Systems Tuning	1			1					1	1	1		1	1	1				
		2.4	Independent Commissioning Agent	1			1															Extra cost to hire ICA
Adaptation and Resilience	To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters.	3.1	Implementation of a Climate Adaptation Plan	2		2	2				2	2	2	2	2	2	2	2	Aligned - but should be building specific	Possibly - partly standardised climate adaptation plan, with a section to be specifically tailored to the individual building	Could this be achieved based on Communities compliance?	Directly aligned with Sustainability Goal: A Climate Adept Community.
Building Information	To recognise the development and provision of building information that facilitates understanding of a building's systems, operation and maintenance requirements, and environmental targets to enable the optimised performance.	4.1	Building Information	1	1	1					1	1	1	1	1	1	1	1		Potential for standardised app		Potential for wider F-bend building information sustainability app or standardised way of communicating building information. Smart Cities section of Planning Controls references this.
Commitment to Performance	To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way.	5.1	Environmental Building Performance	1	1	1					1	1	1	1	1	1	1	1		Possibly	Could this be standardised based on overall F-Bend requirements?	Implicit to the Framework and planning controls.
		5.2	End of Life Waste Performance	1		1	1				1	1	1	1	1	1	1	1	Aligns with Credit 30.1	Yes - if contractual documentation could be set up across all possible F-Bend developments requiring 'make-good' clauses	How can we extend this requirement over whole precinct?	Directly aligned with Sustainability Goal: A Low Waste Community.
Metering and Monitoring	To recognise the implementation of effective energy and water metering and monitoring systems.	6.0	Metering	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				No explicit requirements in Planning Controls - aligned with 'Smart Cities' section of local policy.
		6.1	Monitoring Systems	1		1	1				1	1	1	1	1	1	1	1				
Responsible Construction Practices	To reward responsible construction practices that manage environmental impacts, enhance staff health and wellbeing and improve sustainability knowledge on site.	7.0	Environmental Management Plan	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies	Aligns with 8.2 - medium risk			
		7.1	Formalised Environmental Management System	1			1				1	1	1	1	1	1	1	1	Aligns with 8.1 - identified as uncertain			May require extra cost in hiring appropriate contractor.
		7.2	High Quality Staff Support	1			1					1		1		1		1				
Operational Waste	Performance Pathway	8.0	Prescriptive/Performance	1		1	1				1	1	1	1	1	1	1	1		Yes, if possible to have operational waste management plan for all buildings.	Is it possible to have an Operational Waste Management Plan for the entire precinct?	Directly aligned with Sustainability Goal: A Low Waste Community. Also indicated in planning controls. Note that this will also have both community infrastructure and location implications. Strategies in framework target 70% of household waste diversion from landfill, 50% of food waste to be diverted from landfill. Consider mandating the performance pathway for any buildings above a certain threshold size.
Indoor Environment Quality																						
Indoor Air Quality	To recognise projects that provide high air quality to occupants.	9.1	Ventilation System Attributes	1			1					1	1	1	1	1	1	1				
		9.2	Provision of Outdoor Air	2			2					1		1		1		1				
		9.3	Exhaust or Elimination of Pollutants	1			1					1	1	1	1	1	1	1				
Acoustic Comfort	To reward projects that provide appropriate and comfortable acoustic conditions for occupants.	10.1	Internal Noise Levels	1			1				1	1	1	1	1	1	1	1				
		10.2	Reverberation	1			1					1			1	1	1	1				
		10.3	Acoustic Separation	1			1								1	1	1	1				
Lighting Comfort	To encourage and recognise well-lit spaces that provide a high degree of comfort to users.	11.0	Minimum Lighting Comfort	-			complies				complies	complies	complies	complies	complies	complies	complies	complies				
		11.1	General Illuminance and Glare Reduction	1			1				1	1	1	1	1	1	1	1				
		11.2	Surface Illuminance	1			1															
		11.3	Localised Lighting Control	1			1															
Visual Comfort	To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants.	12.0	Glare Reduction	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				
		12.1	Daylight	2		1	2				1	1	1	1	1	1	1	1				Planning controls reference access to da;ylight and internal amenity, but this is not quantified.
		12.2	Views	1		1	1				1	1	1	1	1	1	1	1				
Indoor Pollutants	To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels.	13.1	Paints, Adhesives, Sealants and Carpets	1			1				1	1	1	1	1	1	1	1				
		13.2	Engineered Wood Products	1			1					1		1		1		1				
Thermal Comfort	To encourage and recognise projects that achieve high levels of thermal comfort.	14.1	Thermal Comfort	1		1	1			1	1	1	1	1	1	1	1	1				Planning controls reference to a high level of internal amenity
		14.2	Advanced Thermal Comfort	1			1															
Energy																						
Greenhouse Gas Emissions	5 possible pathways: Prescriptive (10) NatHERS (16) BASIX (16) NABERS Commitment Agreement (20) Reference Building Pathway (20)	15E.0	Conditional Requirement: Reference Building Pathway	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				
		15E.1	Comparison to a Reference Building Pathway	20	4	20	16			9	6	9	6	9	5	6	5	8	Aligns with Credit 25, but the decentralised and renewable energy credits have been identified as uncertain	Should there be district energy provision, some documentation could be streamlined		Planning Controls NCC requirement would achieve 4 points under prescriptive pathway. Directly aligned with Framework goal for a 'low carbon community'.

Green Star - Design & As Built v1.2 Scorecard

Project:	Fisherman's Bend Urban Renewal
Targeted Rating:	4-5 Stars

							General - Easiest Path		Commercial		Apartments (Med/High Density)		Mixed Use	
Points Available	Explicitly met	Aligned	Possible	Time-dependent	Location dependent	Feasibility Further work	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star
100	**13.0**	**59.0**	**91.0**	**4.0**	**2.0**	**29.0**	**50.0**	**66.0**	**53.0**	**66.0**	**52.0**	**66.0**	**54.0**	**68.0**

Category	Aim of the Credit	Code	Criteria	Points Available	Explicitly Met	Aligned	Possible	Future plan dependent	Location dependent		General 4 Star	General 5 Star	General 4 Star	General 5 Star	General 4 Star	General 5 Star	General 4 Star	General 5 Star	Communities Alignment	Standardised Documentation?	GBCA Questions?	Comments
Peak Electricity Demand Reduction	2 Possible Pathways: Prescriptive Pathway (1) Performance Pathway (2)	16B	Performance Pathway - Reference Building	2			2			1	1	1	1	1	1	2	1	2			How to encourage connection to precinct wide future technology while coming up with current strategies to reduce energy consumption and peak demand?	Design Development Standards: 'include opportunities for on site renewable energy generation - including solar, wind, or other technology as appropriate to the site conditions.' Question for workshop - what is the proposal from the NZE strategy? Given NZE strategy in place, recommended that 1 point is targeted for peak demand for all building types, with 2 for 5 star.
Transport																						
Sustainable Transport	2 Possible Pathways: Performance Pathway (10) Prescriptive Pathway (7)	17A	Prescriptive/Performance	10	2	10	3	3	2		3	3	3	3	3	3	3	3				Currently no points for access by public transport. Car parking provision reduction point would be achieved based on Framework strategy 'Limit private car parking in new developments to…' Aligned with Framework strategy 'Encourage inclusion of car share spaces within new develpments' Active transport provision would likely be met by Framework strategies. Access to amenities determined by future development.
Water																						
Potable Water	2 Possible Pathways: Performance Pathway (12) Prescriptive Pathway (6)	18A.1	Potable Water - Performance Pathway	12	2	6	9	1		6	3	4	3	4	3	4	3	4	Aligned with Water credits, but dependent on precinct implementation	Where there is district water provision, some documentation could be streamlined.		Plans for precinct wide recycled water and rainwater - this will be time dependent.
Materials																						
Life Cycle Assessment/Impacts	2 Possible Pathways: 19A Life Cycle Assessment (7) 19B Life Cycle Impacts (11)	19A.1	Life cycle impacts	7			7			7	2	2	2	3	**2**	**3**	**2**	**3**	Aligned with 26 - need to investigate scope of this Communities credit			
Responsible Building Materials	To reward projects that include materials that are responsibly sourced or have a sustainable supply chain.	20.1	Structural and Reinforcing Steel	1			1				1	1		1		1		1				
		20.2	Timber Products	1			1					1		1		1		1				
		20.3	Permanent Formwork, Pipes, Flooring, Blinds and Cables	1			1				1	1		1		1		1				
Sustainable Products	To encourage sustainability and transparency in product specification.	21.1	Product Transparency and Sustainability	3			3											1				
Construction and Demolition Waste	2 Possible Pathways: Fixed Benchmark Percentage Benchmark	22B	Percentage Benchmark	1			1					1		1		1		1				
Land Use & Ecology																						
Ecological Value	To reward projects that improve the ecological value of their site.	23.0	Endangered, Threatened or Vulnerable Species	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies		Yes - streamlined documentation for entire precinct		Assumes no currently endangered/threatened/vulnerable species on the site
		23.1	Ecological Value	3	1	3	2			2	2	2	2	2	2	2	2	2	Credit 29	Potentially	How can we integrate the communities strategy with the building strategy?	Urban heat island effect strategies in Planning Controls align with this - 'At least 70% of the total site area in plan view should comprise building or landscaping elementst that reduce the impact of the urban heat island effect including'
Sustainable Sites	To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land.	24.0	Conditional Requirement	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				Assumes that at date of site purchase site did not include areas of high national importance or national significance
		24.1	Reuse of Land	1	1	1					1	1	1	1	1	1	1	1				Should meet this requirement as is urban renewal project.
		24.2	Contamination and Hazardous Materials	1		1	1				1	1	1	1	1	1	1	1	Aligned with Credit 28	Should have a consistent policy for best practice remediation of site contamination	Can we streamline the documentation	Evidence of land contamination with heavy metals, and potentially groundwater
Heat Island Effect	To encourage and recognise projects that reduce the contribution of the project site to the heat island effect.	25.0	Heat Island Effect Reduction	1		1	1				1	1	1	1	1	1	1	1				Planning Controls stipulate 70% rather than the required 75%
Emissions																						
Stormwater	To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure.	26.1	Reduced Peak Discharge	1	1	1				1	1	1	1	1	1	1	1	1	Aligned with Credit 24	Possibly - integrate into design standards?		See 'A Water Sensitive Community' - strategies include 'Ensure that stormwater is treated to reduce nutrient discharge and minimise environmental impacts, harvest, treat and reuse stormwater to minimise flooding and other environmental impacts' Aligns with CoM water sensitive urban design targets.
		26.2	Reduced Pollution Targets	1		1	1			1	1	1	1	1	1	1	1	1	Aligned with Credit 25	Possibly		
Light Pollution	To reward projects that minimise light pollution.	27.0	Light Pollution to Neighbouring Bodies	-		complies	complies				complies	complies	complies	complies	complies	complies	complies	complies				Strategy 1.8.2 'Require development to mitigate against negative amenity impacts such as noise, vibration, odours and light pollution associated with adjoining/nearby infrastructure and land uses
		27.1	Light Pollution to Night Sky	1		1	1				1	1	1	1	1	1	1	1				
Microbial Control	To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems.	28.0	Legionella Impacts from Cooling Systems	1			1								1	1						
Refrigerant Impacts	To encourage operational practices that minimise the environmental impacts of refrigeration equipment.	29.0	Refrigerants Impacts	1			1					1		1								Are there future Montreal Protocol targets? - Phasing out of HFCs from 2019 to 2036.
Innovation																						
On-site renewable energy		Innovation	Providing more than 10% of the building's energy from on-site renewable energy (i.e. PV)	2		1	2			1	1	1	1	1	1	1	1	1		Possibly	How to balance timeline of renewables infrastructure with efficiency of renewables placement?	Dependent on any precinct wide renewables strategies that may be implemented.
			Exceeding stormwater pollution targets	2			2					1		1		1		1				
Financial Transparency		Innovation Challenge	Providing anonymous design and construction cost data to the GBCA confidentially.	1			1				1	1	1	1	1	1	1	1				
Occupant engagement		Innovation Challenge	Undertaking pre-occupancy surveys of future tenants and commiting to undertake post occupancy surveys.	1			1				1	1	1	1								
Low VOC paints		Innovation	>50% paints by cost are ultra low VOC (<5g/L)	1			1				1	1	1	1	1	1	1	1				
Beauty in Design		Innovation	1 point for 'meaningful integration of public art. Contains design features intended solely for human delight and the celebration of culture, spirit and place appropriate to the project's function' - from Living Building Challenge	1			1				1	1	1	1	1	1	1	1				

Green Star - Design & As Built v1.2 Scorecard

Project:	Fisherman's Bend Urban Renewal
Targeted Rating:	4-5 Stars

							General - Easiest Path		Commercial		Apartments (Med/High Density)		Mixed Use	
Points Available	Explicitly met	Aligned	Possible	Time-dependent	Location dependent	Feasibility Further work	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star
100	**13.0**	**59.0**	**91.0**	**4.0**	**2.0**	**29.0**	**50.0**	**66.0**	**53.0**	**66.0**	**52.0**	**66.0**	**54.0**	**68.0**

										General		General		General		General					
Category	Aim of the Credit	Code	Criteria	Points Available	Explicitly Met	Aligned	Possible	Future plan dependent	Location dependent		4 Star	5 Star	4 Star	5 Star	4 Star	5 Star	4 Star	5 Star	Communities Alignment	Standardised Documentation?	GBCA Questions?	Comments
Green Cleaning		Innovation	To encourage green cleaning services that prevent the use of contaminants that impact on indoor environment quality, occupant health and the natural environment. - from Performance tool.	1			1				1	1	1	1	1	1	1	1				
Groundskeeping		Innovation	To encourage environmentally sensitive landscape, hard surface and building exterior maintenance practices that reduce environmental impacts and improve ecological value - Green Star Performance credit.	1			1				1	1	1	1	1	1	1	1				
Integrating Healthy Environments		Innovation Challenge	To support high-performance, cost effective and health promoting project outcomes through an early analysis of the interrelationships among systems. Collaboration with public health professionals in order to characterise project impacts.	1			1				1	1	1	1	1	1	1	1		Possibly	How could this credit be tied into the Communities rating innovation credit for this?	
Local Procurement		Innovation Challenge	To encourage the sourcing of products and materials made in Australia and to encourage the use of local services and skilled labour.	1			1															Requires benchmarked proportion of products and materials to be produced/manufactured in Australia, and for local services and skilled labour employed by the project to come from the local area surrounding the site.
Marketing Excellence		Innovation Challenge	To engage, educate and sell the benefits of sustainable building practices and Green Star to building occupants and the wider community through marketing information developed on the basis of comprehensive market research.	1			1														Could this research be done on behalf of the whole precinct?	
Reconciliation Action Plan		Innovation Challenge	To encourage organisations to take formalised steps to provide opportunities for Aboriginal and Torres Strait Islander peoples. The Green Star Project being rated must play a central role in the delivery of the Reconciliation Action Plan.	1		1	1				1	1	1	1	1	1	1	1	Aligns with innovation credit targeted in current Communities pathway	Possibly	How could the precinct as a whole deliver a RAP?	
Social Enterprise for Affordable Housing		Innovation Challenge	To generate new funds to increase the supply of social and affordable housing - through the Homes for Homes program, donating a proportion of the sale/lease price to HfH.	1		1	1													Possibly	Could there be an alternative means of meeting the Affordable Housing objective? Given that this is included in the means of negotiation for developers looking to expand their development?	
Social Return on Investment		Innovation Challenge	To recognise holistic methods to assess return on investment on the productivity, health and other social benefits provided by a project.	1			1				1	1	1	1	1	1	1	1			Could there be a means of doing this for the whole development?	
Community Benefits		Innovation Challenge	To encourage investment by projects in infrastructure for use by the broader community, such as the incorporation of spaces that are publically accessible	1		1	1				1	1	1	1	1	1	1	1		Possibly	Could this be implemented precinct wide? Could this be streamlined for any project that includes community space in return for extra area?	
Mystery Innovation		???	Could there be opportunity for better investigating the relative value incorporated by implementing sustainability initiatives on a precinct vs building level? Scope for providing the GBCA further information on the synergies between Communities and D&AB? Other?																			
Total				**10**		**4**	**10**	**0**	**0**	**1**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**				**0**

	Points Available	Explicitly Met	Aligned	Possible	Time Dependent	Location Dependent	Feasibility Further work							
Core Points	100	13	55	81	4	2	28	40	56	43	56	42	56	44	58
Category Percentage Score		13.0	55.0	81.0	4.0	2.0	28.0	40.0	56.0	43.0	56.0	42.0	56.0	44.0	58.0
Innovation Points	10	0.0	4.0	10.0	0.0	0.0	1.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Score Targeted		13.0	59.0	91.0	4.0	2.0	29.0	50.0	66.0	53.0	66.0	52.0	66.0	54.0	68.0

Appendix B

Technical feasibility analysis of selected credits

B1 Credit 14: Thermal Comfort

2 points are available under this credit for thermal comfort.

For typical mechanically ventilated mixed use and commercial buildings, the requirement for 1 point is for the space to demonstrate that it falls within a Predicted Mean Vote threshold of -1 to 1. This metric corresponds to the equivalent of 80% of people feeling acceptably comfortable in the space, and is calculated based on certain environmental conditions.

From our experience, this is an achievable target for buildings with reasonably high performing facades and mechanical systems, and is targeted and achieved by many commercial buildings.

The second point requires a PMV threshold between -0.5 and 0.5. This point can be much more difficult to achieve, and often requires the installation of internal automated blinds.

For residential buildings, the requirement is for the development to achieve an average NatHERS rating of 7.0 stars. This is a reasonable expectation, but requires consideration early in the design process of insulation and glazing selection, and glazing extents. High performance low-e double glazing is likely to be needed, and some increase on minimum insulation levels.

The second point requires an average NatHERS rating of 8.0 stars. This represents a more onerous requirement, and would require further improvements to the façade performance and would be likely to incur higher design and installation costs.

Summary

Thermal comfort Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
1	1	1	1	1	1

1 point is feasible and recommended for multi-use and commercial buildings.

1 point is feasible for residential buildings, but is likely to be more difficult to achieve than for other building types.

2 points for all building types represents a more onerous requirement, and may incur higher design and implementation costs.

B2 Credit 15: Greenhouse Gas Emissions

There are a number of pathways available in the energy section to claim available points. The sections below list the most suitable pathways for the various development types and the implications in terms of design and verification. Implications of alternative pathways are also provided.

Residential developments

Residential developments would often follow the NatHERS pathway.

The table below provides a summary of the requirements of the NatHERS pathway for residential developments.

Design features	• For **1 point** a development average NatHERS star rating of 7.0 stars to be targeted. Current minimum (policy and Green Star) for developments above 5,000m^2 is 6.5 stars however 7.0 star average required to achieve pursued thermal comfort credit. This may require the following beyond standard practice requirements for a typical development: - High performance low-e double glazing. Total U-value 3.5W/m^{2}K or lower and SHGC within approximately 10% of 0.5 - External blinds/shading to west facing apartments. - Modest widow to wall ratios ~ 30-40% averaged across all facades. - Ceiling fans in all living rooms. • For **1 point** - LED Lighting throughout with daylight/occupancy sensing in common areas (standard) • For **2 points** – dwelling heating and cooling system star rating to be minimum 3 stars and not oversized by more than 20% (good practice) • For **0.5 points** - Gas hot water for all developments (standard if development provided with gas) • For **1 point**, all appliances provided to be within 1 star of the best available. (difficulty dependant on appliances provided. Difficult to achieve if clothes dryers provided, easier if only dishwashers provided)
Green Star verification	• Standard NatHERS assessments for all dwelling as required for National Construction Code compliance. • Standard services and architectural documentation.

The above are likely to be the typical requirements of a residential development. Each development must be assessed on a case by case basis and alternative features may be required depending on the orientation, height, size and type of heating/cooling system installed.

Also note that the draft local policy requirement is also for NatHERS 7 Star rating.

Alternative pathways for residential developments

Of the four remaining pathways in the energy section only one is applicable to Victorian residential developments - 15E the Reference Building pathway. This pathway requires a detailed energy analysis to be conducted on the development in addition to NatHERS modelling to be undertaken for NCC compliance.

The additional energy modelling required represents additional consulting work and fees not normally associated with these types of developments and are unlikely to add significant value particularly if the development is conditioned by decentralised split systems.

It is important to note that the New South Wales Office for Environment and Heritage, the body that administers the NABERS rating tool is currently developing a tool for multi-residential apartment buildings expected for release in 2018. The current Green Star NABERS pathway may be expanded at some point within the next few years to include a NABERS pathway for residential buildings.

Commercial Developments

Commercial developments will often follow the 15E Reference Building Pathway

For the majority of commercial developments to achieve the required 6 points identified in the 4 star pathway, it will be likely required to follow the 15E - Reference Building pathway. In terms of energy efficiency this equates to approximately a **4.5-5 star NABERS** energy base building design potential. The table below provides a summary of the design features required as well as Green Star verification.

Design features	• For **2 points** generally the following building fabric requirements - Double glazing with either tinting or external shading (horizontal fins on east/west glazing and vertical 400-600mm fins on north facades) (standard practice) - Insulation levels consistent with the provisions of Section J of the BCA Deemed to Satisfy criteria (standard practice) - Modest window to wall ratios maximum 50-60% • For the remaining **4 points** - LED Lighting throughout with daylight/occupancy sensing in common areas and perimeter zones (standard) - Efficient Heating, Ventilation and Air Conditioning plant with condensing boilers, efficient chillers (design COPs > 5.5), variable speed drives provided to suitable pumps and fans. Efficient lifts with power off functions and regenerative braking where appropriate (high rise).

Green Star verification	• Detailed energy assessment consistent with the Green Star modelling protocol • Standard services and architectural documentation.

The above design requirements are beyond minimum compliance, however are standard practice requirements for today's new buildings (particularly for Property Council of Australia Premium and A grade new buildings). It is important to note that the above are likely to become part of new minimum energy efficiency standards to be introduced into the 2019 Section J.

The table below provides an indication of the NABERS ratings achieved for various building types in Victoria in the 2015/16 financial year.

Average NABERS ratings achieved for all Victorian buildings rated in 2015/2016 (includes new and mainly existing buildings)	**4.1 Stars** Reference: https://nabers.gov.au/AnnualReport/2015-2016/201516-program-statistics.html
Arup 2015/16 Projects Victoria Average NABERS Star rating (energy model design potential)	**5 Stars** All either PCA premium and A-grade buildings
Arup 2015/16 Sydney Projects average NABERS star rating (energy model design potential)	**5 Stars** All either PCA premium and A-grade buildings

Based on the above, it can be expected that the majority of new buildings in Victoria can currently achieve a 4.5-5 star level of energy efficiency and achieve the required 6 points to demonstrate compliance with the Green Star energy pathway. The changes to the 2019 NCC Section J are likely to push minimum performance requirements in excess of these provisions for all buildings by 2019.

The detailed energy simulation required to verify and determine the number of points achieved is a non-standard exercise that project applicants will have to undertake. This will require additional consultant fees not normally associated with a standard project. The analysis however can be used to demonstrate compliance with other credits such as thermal comfort and peak electricity demand reduction credits, and can inform and improve the energy efficiency of building design.

Alternative pathways for commercial developments

Of the four remaining pathways in the energy section, two are applicable to commercial buildings:

- 15A – Prescriptive Pathway
- 15D – NABERS Energy commitment agreement

15A – Prescriptive Pathway

This pathway may be followed by the project applicant and would help the applicant avoid having to undertake a detailed energy analysis required under the reference building pathway. The following design features would be required:

- Insulation in excess (15% greater) than current DTS requirements
- Glazing performance in excess (15% greater) than current DTS requirements
- LED Lighting throughout with daylight/occupancy sensing in common areas and perimeter zones (standard)
- Efficient selection of HVAC plant and equipment – fans, pumps, boilers and chillers to all exceed minimum provisions by 15%
- Natural gas for domestic hot water
- Commitment to procure at least 50% of the buildings electricity consumption from accredited GreenPower products

The above are similar to the requirements under the Reference Building pathway and may be the more suitable option for some developments. They are however all rigid and to be achieved individually. There is no flexibility as would be provided by the performance pathway.

The prescriptive pathway would not require a detailed energy analysis. The absence of this type of analysis would make it difficult to demonstrate compliance with other credits and targeted points such as thermal comfort and peak electricity demand reduction credits.

15D – NABERS Energy commitment agreement

A NABERS energy commitment agreement is a contractual agreement a project team enters into during the design stages of a project to commit to achieving a certain star rating for their building. By doing this, the project is able to market the star rating of the building from an early phase. This would be an onerous undertaking for the majority of developments. A project would also be expected to achieve a 5 – 5.5 star NABERS energy base building rating to achieve the required 6 points via this pathway.

The pathway and design requirements would therefore not be applicable to the majority of developments apart from those entering into the agreement with the appropriate target.

Mixed use developments

Mixed use developments that are a combination of commercial or residential can follow the pathways above for the respective portions of the development. Similar design features will be required.

For developments other than commercial and residential, either the prescriptive or reference building pathway must be followed. Again, the level of performance and design features expected are not considered onerous for current developments however the reference building pathway is the preferred option for Mixed Use Developments so that compliance with other credits can also be demonstrated via a detailed energy model analysis.

Summary

Greenhouse Gas Emissions Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
6	9	5	6	5	8

The points targeted under Credit 15: Greenhouse Gas Emissions are deemed feasible for all building types.

Residential projects will typically follow the NatHERS pathway, which does not require additional modelling or verification beyond that required for NCC and BAD compliance. Commercial buildings will typically follow the Reference Building pathway.

Energy modelling can represent additional consulting fees beyond minimum practice for buildings below a certain threshold size – approximately 5,000m^2. However, energy modelling can also lead to improved system and façade design, and contribute to additional Green Star points for Thermal Comfort, Renewables and Peak Electricity Demand Reduction.

B3 Credit 16: Peak Electricity Demand Reduction

Two pathways are available for determining the reduction in Peak energy demand for a development. These include the following for a targeted one point:

Option 1 – Prescriptive Pathway on-site energy generation	One (1) point is awarded where it is demonstrated that the use of on-site renewable energy or on-site generation sources reduces the

	peak electricity demand by at least 15% as calculated in accordance with appropriate standards
Option 2 – Performance Pathway – Reference Building	Based on completed energy performance analysis modelling for 15E – the reference building pathway in the `

Option 1 – Prescriptive Pathway

Option 1 is considered suitable only for developments which contain substantial PV or other on site electricity generation (~ 15% peak demand contribution). This is level of generation is not considered to be standard therefore it is expected the majority of developments will need to demonstrate compliance via option 2.

Option 2 – Performance Pathway

Compliance via Option 2 can only be demonstrated if energy modelling is undertaken in accordance with pathway 15E for the Greenhouse Gas Emissions credit. This requires an in depth model, comparing the proposed development's performance with that of a reference building. This would likely be conducted for an office or mixed use building to achieve required energy points. However, this modelling would require a significant amount of additional consulting work for a residential building which is most likely to demonstrate compliance in the energy Section through the NatHERS pathway rather than through the pathway 15E.

In terms of the building features required to achieve compliance, these are not considered to be particularly onerous and are summarised in the table below. Note these requirements assume the buildings will meet the targeted number of points in the energy section. Feasibility and requirements are summarised in the following tables:

	Residential	**Commercial and Mixed Use**	**Mixed Use**
Important building features required to achieve targeted Peak Demand reduction features for the targeted 1 point.	- High performance low-e double glazing. Total U-value 3.5W/m^{2}K or lower and SHGC within approximately 10% of 0.5	- LED lighting with a lighting power density of <5W/m^2 - High performance low-e double glazing. Total U-value 3.0W/m^{2}K or lower and SHGC 0.3 or lower	- LED lighting that exceeds BCA maximum lighting power densities by 20-25% - High performance low-e double glazing. Total U-value 3.0W/m^{2}K or lower and SHGC 0.3 or lower

Option	Residential	Commercial and Mixed Use
Option 1	Achievable only for low-rise developments with significant capacity for PV generation	Achievable only for low-rise developments with significant capacity for PV generation
Option 2	Technically achievable however additional energy performance analysis required to demonstrate compliance assuming the NatHERS pathway is followed in the energy section	Technically achievable and demonstrable provided the 15E reference building pathway is followed in the energy section

Summary

Peak Demand Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
1	1	1	2	1	2

1 point under this category is achievable under the prescriptive pathway for developments with a large ratio of roof to floor area and space for a significant PV array.

1 point under this category under the performance pathway is easily achievable for a commercial or mixed use development provided the 15E Reference Building Pathway is followed in the energy section and an energy model/performance analysis created.

1 point under this category under the performance pathway is feasible for residential developments but will require an additional in-depth energy performance simulation to be undertaken, if the building chose to follow the NatHERS pathway for energy credits under Credit 15. It is recommended an alternative prescriptive pathway is developed with the Green Building Council of Australia for residential developments to avoid additional consultation work in this section.

B4 Credit 18: Potable Water

The table below provides an overview of Green Star features available from the prescriptive pathway in the water category, the number of points available, and current industry practice in relation to compliance with the criteria.

There is an alternative performance pathway available for demonstrating compliance with the credit criteria. Generally, the prescriptive features below translate to a similar number of points in the performance pathway.

The performance pathway may be pursued when additional features such as greywater or blackwater reuse may be incorporated into a project that are not accounted for in the prescriptive pathway.

Please note that it is not recommended that redundant small-scale greywater or blackwater treatment systems are installed in order to gain further Green Star points, where this is already addressed on a precinct scale (ie. by the precinct wide third pipe system). It is recommended that this is addressed in the guidance to developers or elsewhere in the planning controls.

The prescriptive pathway is also capped at 6 points. Scores in excess of 6 points require the performance pathway to be followed and this is recommended for projects targeting 5 and 6 star ratings.

	Points Available	**Residential**	**Commercial**	**Mixed Use**
Sanitary Fixture Efficiency	1	Standard Practice		
Rainwater Reuse	1	To be determined on a case by case basis. Generally smaller low-rise (<7 storeys) developments can achieve this point due to larger roof area for rainwater capture. Difficult for large, high-rise (>7 storeys) developments to achieve with lower roof/capture area to GFA ratio. Rainwater tank will generally be required to meet stormwater treatment objectives therefore will likely also meet rainwater re-use criteria.		
Heat Rejection	2	Standard Practice	Standard Practice for buildings under approximately ~8,000m^2 NLA which are generally served by air based heat rejection. Difficult to achieve for larger developments which are often served by water based heat rejection systems.	
Landscape Irrigation	1	Standard Practice		

Fire System Test Water	1	Considered to be standard practice in new developments. Requires recirculating loops in fire sprinkler system and tank for capture of at least 80% of any other water that may be expelled by the fire system testing. Recommended to be incorporated into all developments.
Fishermans bend third pipe scheme	1 (est)	Standard Practice for Fishermans Bend– final number of points to be confirmed with the GBCA

Summary

Potable Water Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
3	4	3	4	3	4

A minimum of four points is expected to be achieved in any standard commercial or mixed use development. This is the number of points nominated in the proposed 5 star pathway for all development types. This is also contingent on 1 point being available from third pipe scheme which is to be determined in consultation with the Green Building Council of Australia. As shown in the summary table below, the majority of development types is expected to achieve in excess of the minimum 3 points targeted.

Development type	**Minimum score achievable**
Residential	6 points
Commercial and Mixed Use – Small (no water based heat rejection)	6 points
Commercial and Mixed Use - Large (with water based heat rejection)	4 points

B5 Credit 19: Life Cycle Assessment

There are two pathways possible for demonstrating compliance with this credit. The feasibility of meeting the requirements under the prescriptive pathway is examined for this credit.

Prescriptive Pathway	Points can be achieved through the use of lower-environmental impact materials. This includes the use of higher strength steels to

	reduce overall volumes, concrete with reduced energy intensive Portland cement content and the use of structural timber.

Achieving two points under the prescriptive pathway for any development type would generally require at least two of the following requirements to be met.

Initiative	**Difficulty**
Use of recycled/reclaimed water in at least 50% of all concrete mixes used throughout a development and a 25% reduction in the use of natural aggregates or 40% reduction in the use of coarse aggregates.	Low
Portland cement reduction within concrete below industry averages, targeting an average reduction of 30% across the development compared to a business as usual reference case.	Medium
A 5% reduction in the use of steel in a proposed building compared to a standard practice reference case.	Medium
Application of structural timber for at least 30% of the buildings GFA	High
Portland cement reduction within concrete below industry averages, targeting an average reduction of 40% across the development compared to a business as usual reference case. (no other initiative required if this initiative is pursued)	High

Compliance with the first two initiatives above ispursued on the majority of Green Star projects for all development types. A premium for procurement costs of concrete with these properties would not be anticipated for any development type however the use of fly-ash in these concrete types would lead to an increase in setting times and therefore overall construction times and costs.

The use of structural timber is a relatively new practice and would be considered onerous. The use of high strength steel to reduce overall steel used in constructions is generally not pursued

Summary

Life Cycle Impacts

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
2	3	2	3	2	3

Achievement of two points under this credit, using the prescriptive pathway is achievable for all development types. Further points could be more onerous and incur higher costs.

For further points the performance pathway should be considered.

B6 Credit 23: Ecological Value

There are up to 3 points available under this credit: the number of points achieved depends on performance measured using the Ecological Value calculator.

The calculator determines the change in ecological value due to the landscaping at the project site, comparing its condition before and after design/construction. It takes into account the land type (hard surfaces, native, exotic vegetation, water-bodies etc.), assigning each a weighting for the calculation.

Improvement in Ecological Value	Points Achieved
0.01	1
0.10	2
0.20	3

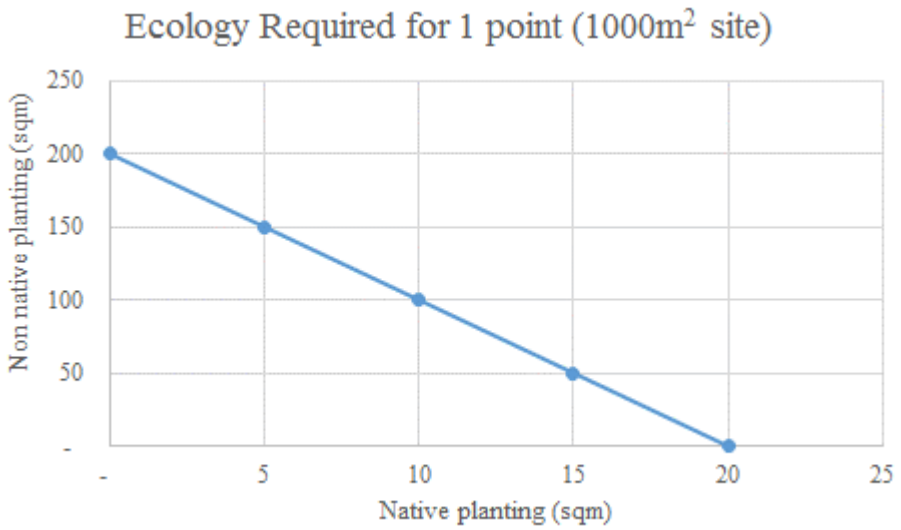
The majority of Fisherman's Bend Sites are assumed to have an ecological value of zero since they consist entirely of hardscape.

Most developments achieve points in the ecological value score through provision of the following vegetation types:

- Exotic vegetation
- Planted native vegetation

Other options to improve ecological value include natural or artificial water bodies and remnant native vegetation. These strategies are less frequently implemented as they are usually required to be inherent to the existing site or require a qualified ecologist for verification of the ecological value of the initiative.

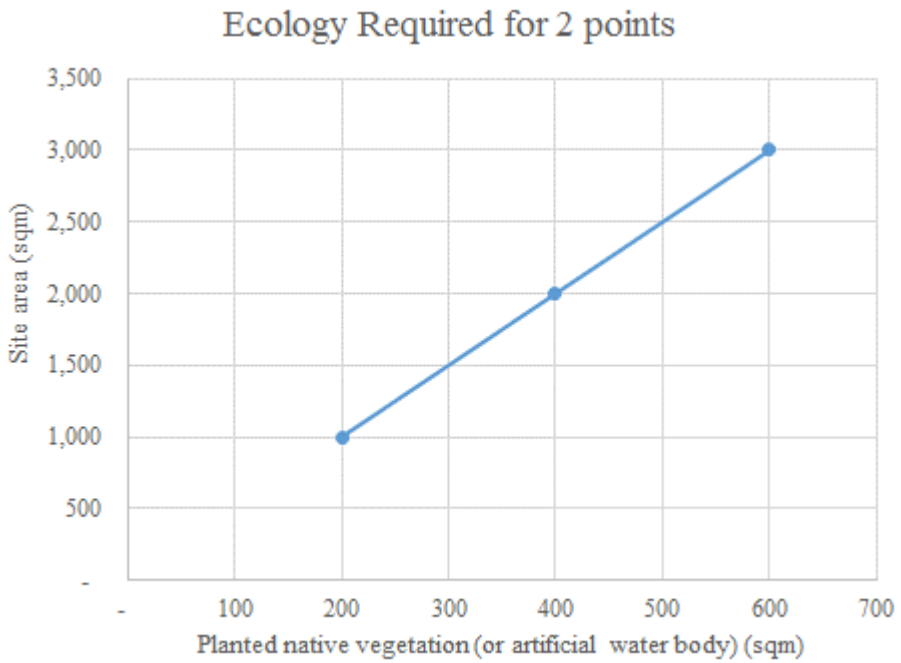
A strategy for achieving 1 point and an ecological value score of 0.01 (as determined by the change of ecology calculator) using exotic and planted native vegetation is shown in the graph below for a hypothetical 1000m^2 development site



Ecological value of the various features is given a range of weightings. Native planting is weighted 10 times higher than non-native planting. For a hypothetical 1,000m^2 site (any development type), 20m^2 of native planting or 200m^2 of non-native planting with the remaining area as hardscape will achieve 1 point and an ecological value score of 0.01. As shown in the graph above, various combinations of the two types of vegetation will also achieve the point.

Achieving two points requires an ecological value of 0.1 – 10 times higher than the ecological value required for 1 point. This cannot be achieved using non-native planting since it would require the entire site to be covered with no allowance for hard scaping.

This means that the ecological value must be entirely achieved using native vegetation or another feature with a similar weighting (artificial water bodies).



As shown above, a site is required to have a 20% allowance for native planting to achieve a 2 point target. This can also be contributed to by features such as artificial water bodies. For example, a 1,000m^2 site can achieve two points with either 200m^2 of native planting or 200m^2 artificial water bodies or a combination of 100m^2 native planting and 100m^2 artificial water bodies. It is important to note that native planting in green walls or roof can also be included in the score as long as the planting is placed externally and the area of the soil or substrate area is counted only.

Summary

Ecological Value Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
2	2	2	2	2	2

Achieving 1 point in the change of ecology calculator requires a minimal amount of landscaping ~ 2% native planting and is considered easily achievable in most developments and not to be particularly onerous.

Achieving 2 points requires a substantial portion of the site ~20% to include landscaping from native planting or item of similar ecological value such as an artificial water body. This may typically require developments to incorporate a green roof. 2 points is considered feasible.

It would be expected that most developments (of any type) would be able to achieve approximately 1.2 points without the requirement for a particularly onerous landscape design strategy.

B7 Credit 26: Stormwater

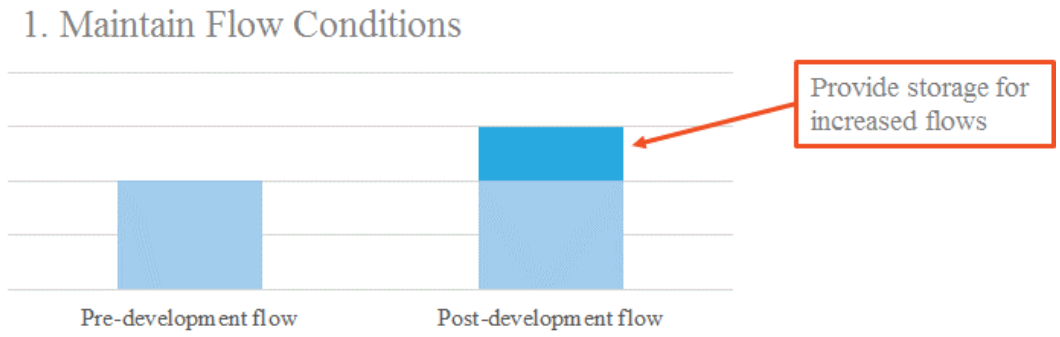
There are 2 points available for stormwater management, and targeted in the appended scorecard:

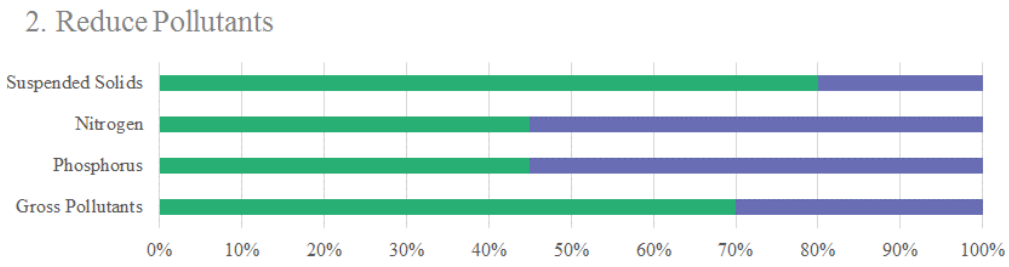
- Credit 26.1 Stormwater Discharge
- Credit 26.2 Stormwater Pollution targets (awarded only when Credit 26.1 has also been awarded)

Stormwater treatment for all development types is required to achieve two outcomes to achieve targeted Green Star objectives:

1. A reduction in the stormwater peak discharge of the post development site compared to the pre-development site for 1 point.
2. Conditional on the above being achieved, stormwater pollution reduction targets.

The above are summarised graphically below.





Reducing Peak Discharge

As discussed in the Ecological Value section, it is anticipated that the majority of existing developments in Fisherman's Bend consist largely of hard scaping elements or have a small portion of permeable surfaces. Achieving Green Star objectives for any site which maintains or increases landscaping/permeable areas compared to the pre-development site will not require any additional detention or storage since the post development site cannot increase post development peak flows.

If a site does increase the amount of hard scape compared to its previous state, the following considerations should be made:

- Incorporate as much vegetation as possible in green roofs and balconies. This will reduce the runoff generated by the site and minimise the need for tanks to provide detention storage.
- Consider 'blue roofs' or permeable pavements with storage cells that will allow rainwater to be stored in roofs, podiums and at ground level. This will allow storage systems to drain by gravity to the stormwater network, rather than requiring pumps which is the case if storage tanks in the basement are used.
- Consider any plaza areas that can be allowed to strategically fill in a major storm event, providing detention storage.

If the above cannot be accommodated, the use of detention storage tanks will be required. It is important to note that these latter requirements are anticipated to be required in a minority of developments. The requirements are not considered particularly onerous or to represent an increase in cost beyond current requirements. It is also noted that the draft planning policy has mandatory requirements for rainwater storage tanks.

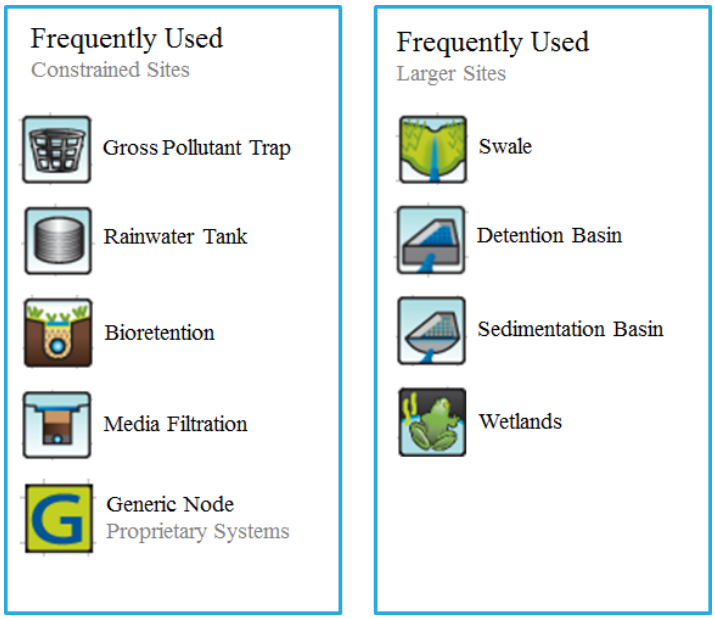
Reduced Pollution Targets

The table below lists a comparison between the current Green Star targets for the development compared to current requirements in the Melbourne and City of Port Phillip Planning Scheme:

	Green Star Targets	**Melbourne Planning Scheme Requirements**	**Green Star Comparison**
Total Suspended Solids	80%	80%	-
Gross Pollutants	85%	70%	Increase
Total Nitrogen	30%	45%	Decrease
Total Phosphorus	30%	45%	Decrease

Green Star requires an improvement in only 1 scenario. All other requirements are either reduced or equivalent. Achieving current council pollutant reduction targets generally results in achievement of the targeted 1 point in Green Star.

Pollution reduction is achieved using the following methods. Depending on the available area from the site, alternative strategies can be incorporated.



Most developments whether commercial, residential or mixed use are able to achieve pollutant reduction targets with the first two items (constrained sites):

- A rainwater tank harvesting runoff from a roof or other non-trafficable surface and supplying water for a portion of toilets within the development and
- A gross pollutant trap at the point of discharge capturing all litter

If a site is not able to re-use significant amounts of rainwater for toilet flushing, i.e. low-rise and low occupancy sites, additional items may be required such as bioretention or media filtration (raingardens).

Summary

Stormwater Green Star point targets

Commercial		Apartments (Med/High density)		Mixed use	
4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
2	2	2	2	2	2

Developments would not need to significantly need to exceed mandatory requirements in order to achieve Green Star objectives. Passive measures rather than active measures i.e. bioretention rather than the use of proprietary systems

are encouraged and could simultaneously help to contribute to the Ecological Value credit. The requirements of these credits are not considered onerous or representative of a significant cost increase compared to current standard practice.

B8 Innovation: Renewables

Renewable energy targets for all building types are listed in the table below:

Innovative Technology or process – onsite renewable energy	One (1) point is awarded where a 5% renewable energy contribution is provided to the development

The majority of developments would be expected to meet this target through the use of Solar Photovoltaic (PV) panels mounted on the roof. The table below provides an indication of the extent required for an indicative 5,000m^2 GFA development.

	Residential	**Commercial**	**Mixed Use (assumed half residential and half commercial)**
PV Capacity	~12kW	~15kW	~13.5kW
Indicative array area	~80m^2	~100m^2	~90m^2

The above figures are based on an office building achieving a 5 star NABERS energy base building level of performance. Apartment buildings are also assumed to meet the efficiency requirements targeted for the energy section.

The above figures are indicative for a 5,000m^2 development. Poorer performance in the energy category will require additional panels to make up the renewable energy portion.

In terms of feasibility, solar arrays are commonly installed on all building types above and represent cost effective environmental initiatives for owners. In terms of meeting the area requirements, this will be highly dependent on the building form and layout. Based on the example above, buildings require roughly 2% of GFA to be available on the rooftop to meet credit requirements. Buildings greater than 7 storeys may find this allowance difficult, particularly commercial and mixed used buildings which may locate plant and equipment on the rooftop. Residential developments generally consume less energy and, if conditioned by decentralised air conditioning units will have the available space to meet the credit criteria.

Summary

Renewables Green Star point targets

Commercial	Apartments (Med/High density)	Mixed use

4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway	4 Star pathway	5 Star pathway
1	1	1	1	1	1

This point is considered feasible for developments that have targeted a reasonable standard of energy efficiency/performance, and have a suitable proportion of rooftop area available (are less than approximately 7 storeys). It is expected that space will not be a problem for residential developments.