The Pearl Rating System for *Estidama*

Building Rating System

Design & Construction

Version 1.0

The Pearl Rating System *for* Estidama
Emirate of Abu Dhabi

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Introduction

ESTIDAMA

Estidama, which means 'sustainability' in Arabic, is the initiative which will transform Abu Dhabi into a model of sustainable urbanization. Its aim is to create more sustainable communities, cities and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural and social.

Figure 1: The Four Pillars of Estidama

The aspirations of Estidama are incorporated into Plan 2030 and other Urban Planning Council (UPC) policies such as the Development Code. Estidama began two years ago and is the first program of its kind that is tailored to the Middle East region. In the immediate term, Estidama is focused on the rapidly changing built environment. It is in this area that the UPC is making significant strides to influence projects under design, development or construction within the Emirate of Abu Dhabi. One of Estidama's key initiatives is the **Pearl Rating System**.

THE PEARL RATING SYSTEM FOR ESTIDAMA

The Pearl Rating System for Estidama aims to address the sustainability of a given development throughout its lifecycle from design through construction to operation. The Pearl Rating System provides design guidance and detailed requirements for rating a project's potential performance in relation to the four pillars of Estidama.

The Pearl Rating System is organized into seven categories that are fundamental to more sustainable development. These form the heart of the Pearl Rating System:

- **Integrated Development Process**: Encouraging cross-disciplinary teamwork to deliver environmental and quality management throughout the life of the project.
- **Natural Systems**: Conserving, preserving and restoring the region's critical natural environments and habitats.
- **Livable Buildings:** Improving the quality and connectivity of outdoor and indoor spaces.
- **Precious Water:** Reducing water demand and encouraging efficient distribution and alternative water sources.
- **Resourceful Energy:** Targeting energy conservation through passive design measures, reduced demand, energy efficiency and renewable sources.
- **Stewarding Materials:** Ensuring consideration of the 'whole-of-life' cycle when selecting and specifying materials.
- **Innovating Practice:** encouraging innovation in building design and construction to facilitate market and industry transformation.

Pearl Rating Levels

Within each section there are both mandatory and optional credits and credit points are awarded for each optional credit achieved. To achieve a 1 Pearl rating, all the mandatory credit requirements must be met. To achieve a higher Pearl rating, all the mandatory credit requirements must be met along with a minimum number of credit points.

Table 1: Pearl Building Rating Levels

Requirement	Pearl Rating Achieved
All mandatory credits	1 Pearl
All mandatory credits + 60 credit points	2 Pearl
All mandatory credits + 85 credit points	3 Pearl
All mandatory credits + 115 credit points	4 Pearl
All mandatory credits + 140 credit points	5 Pearl

Section Weightings

The number of credit points available in a given section determines the weighting of that section. Different building uses may have a different number of credit points for a particular component. This is intended to reinforce the critical issues that should be addressed for a particular building use. For a mixed-use building, the total number of credit points available will vary depending on the different uses that are present.

Table 2: Maximum Credit Points Available for each Section

Credit Section	Maximum Credit Points
IDP – Integrated Development Process	13
NS – Natural Systems	12
LB - Livable Buildings	37*
PW – Precious Water	43*
RE – Resourceful Energy	44
SM – Stewarding Materials	28
IP – Innovating Practice	3
TOTAL	**177***

* LB : Maximum of 36 credit points available for Offices and 30 credit points for Retail.
PW : Maximum of 45 credit points available for Schools.
Total : Excludes Innovating Practice credit points which are offered as bonus credits.

The Pearl Rating System Documents

The Pearl Rating System comprises the following documents:

- Pearl Community Rating System: Design & Construction
- Pearl Building Rating System: Design & Construction
- Pearl Villa Rating System: Design & Construction

This document focuses on the Pearl Building Rating System. The Pearl Rating System documents are available to download from the UPC / Estidama website, which will also contain frequently asked questions, training information and any revisions to the documents. Please visit www.upc.gov.ae .

The Pearl Rating Stages

The Pearl Rating System recognizes the reality of ownership and responsibility transitions as a project evolves from a design team to a construction team to a facility management team. Accordingly, three rating stages have been established: Design, Construction and Operational.

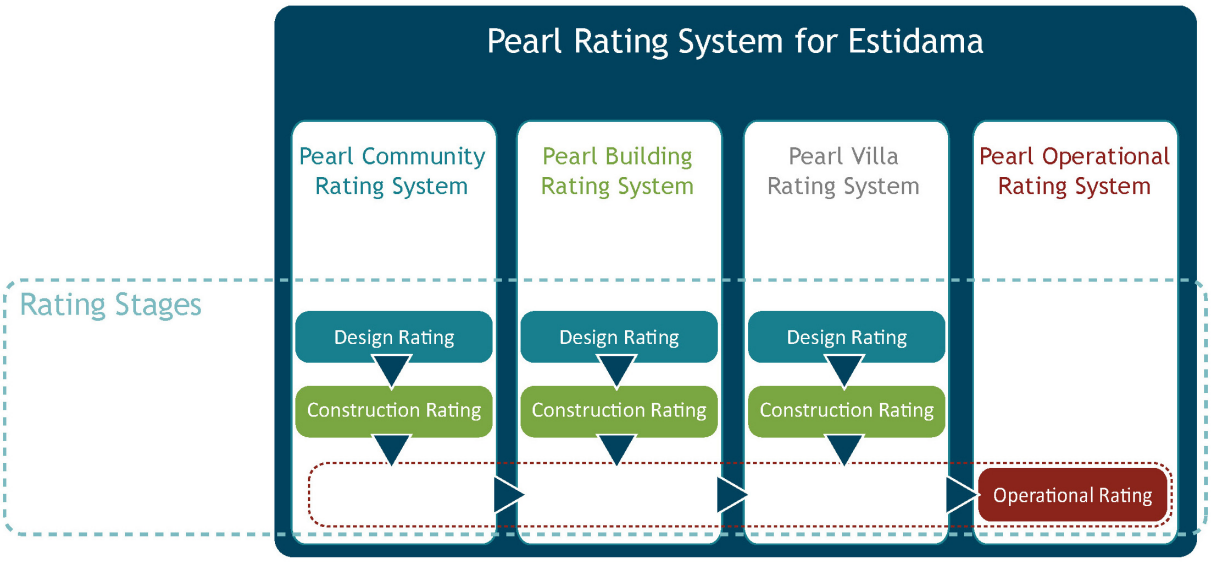
Pearl Design Rating - The Design Rating rewards measures adopted during the design development of the project that meet the intent and requirements of each credit. The Design Rating recognizes the additional marketing value and branding a Pearl Rating will afford a development in its early sale or lease phase. A Pearl Design Rating is valid only until construction is complete, and requires that all collateral, branding and communication materials identify the project as a Pearl *Design* Rated project.

Pearl Construction Rating - The Construction Rating ensures that the commitments made for the Design Rating have been achieved. The Construction Rating requires that all collateral, branding and communication materials identify the project as a Pearl *Construction* Rated project.

This document, the Pearl Building Rating System, addresses both the Pearl Design Rating and the Pearl Construction Rating. The Pearl Operational Rating is currently under development.

Pearl Operational Rating - The operational rating assesses the built-in features and operational performance of an existing building and ensures the building is operating sustainably. The operational rating can only be achieved a minimum of two years after construction completion and when the building has reached a minimum occupancy of 80%.

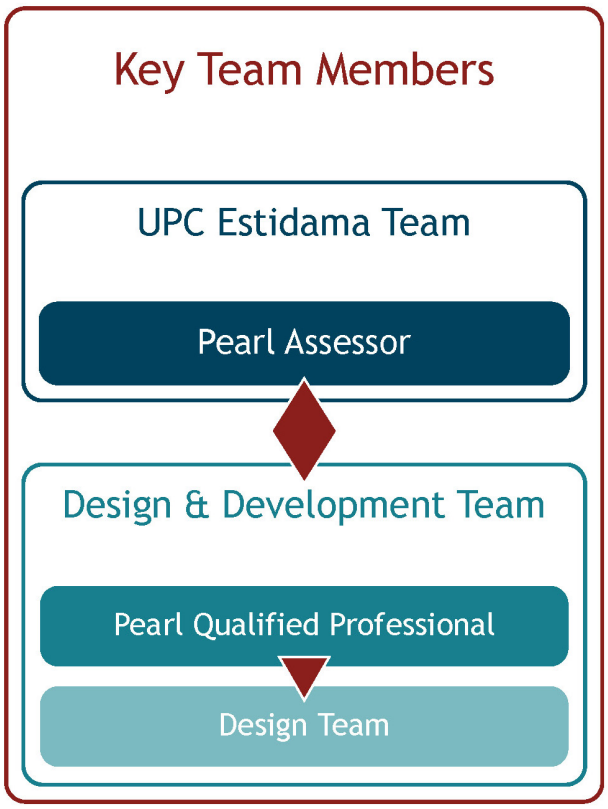
Figure 2: Links between the Pearl Rating Systems



Key Team Members

The assessment process requires the following key team members:

Figure 3: Key Team Members



Pearl Assessor

The Pearl Assessor is an Estidama representative who assesses the Pearl submission documents.

Pearl Qualified Professional

The Pearl Qualified Professional (PQP) is a member of the design team who facilitates the Pearl Rating System for both Design and Construction stages. To become a PQP, the individual must pass an exam which will test their administrative and technical knowledge of the Pearl Rating Systems.

The PQP's role will be as follows:

- understand the requirements of the Pearl Building and Community Rating Systems and associated Guides;
- facilitate the rating process; and
- provide quality assurance to documents prior to submission to Estidama.

Communication with Estidama and the Pearl Assessor will generally be via email, with frequently asked questions available on the Estidama website. The website will also provide information to help guide design teams through the Pearl Rating Systems and will contain schedules of training sessions, seminars and events.

The Pearl Rating Process

The Pearl Rating System is designed to facilitate an effective and educational way to assess the sustainability of a specific development. The general steps required to be undertaken by developers and their consultants in the process are summarised as follows:

Figure 4: The Pearl Rating Process

All Pearl Ratings

Step 1: Register the development with Estidama for the relevant Pearl Rating System. Each project will be provided with a unique identification number.

Step 2: Appoint a PQP to facilitate the rating process and co-ordinate the submission.

Step 3: Conduct workshops in compliance with the Estidama Integrated Development Process (EIDP) with facilitation by the PQP (compliant with IDP-R1).

Pearl Design Rating

Step DR4: Review and update credit submissions on a regular basis throughout the design process.

Step DR5: Issue the final design credit submissions to Estidama at the end of the construction documentation stage.

Step DR6: The submission will be reviewed by a Pearl Assessor, who may request clarifications or additional information from the PQP as necessary.

Step DR7: The Pearl Assessor will award a Pearl Design Rating based on the credits achieved by the development.

Pearl Construction Rating

Step CR4: Review and update credit submissions on a regular basis throughout the construction process.

Step CR5: Issue the final construction credit submissions to Estidama after construction is complete.

Step CR6: The submission will be reviewed by a Pearl Assessor, who may request clarifications or additional information from the PQP. Estidama reserves the right to undertake on-site verification if deemed necessary.

Step CR7: The Pearl Assessor will award a Pearl Construction Rating based on the credits achieved by the development.

Pearl Operational Rating

Two years following construction completion, once a building has reached a minimum occupancy of 80%, submissions can be made for the Pearl Operational Rating. The process for achieving a Pearl Operational Rating is set out in the separate Pearl Operational Rating System (currently under development).

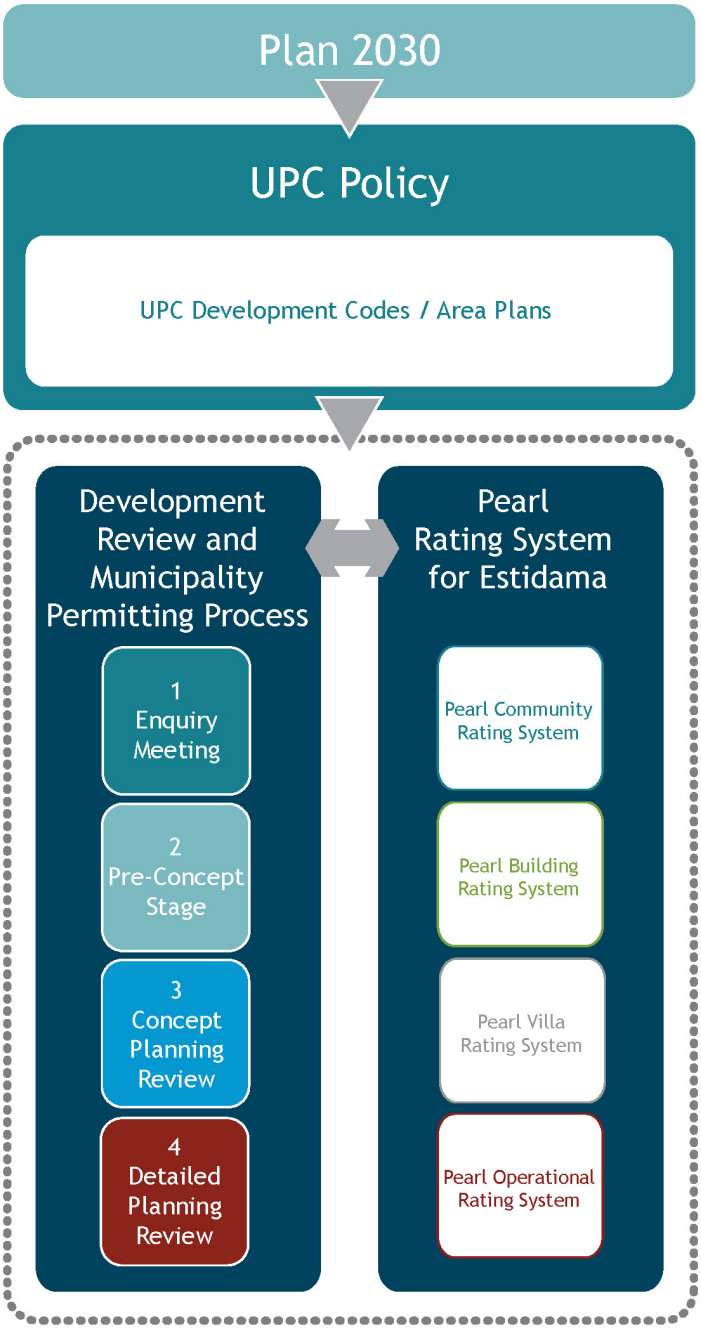
The Development Review Process and The Pearl Rating System

The Development Review Process has been introduced by the UPC to provide a streamlined process for reviewing development proposals. The process comprises four steps: Enquiry, Pre-Concept Stage, Concept Planning Review and Detailed Planning Review. The UPC uses this review process for two main purposes:

- To ensure development proposals comply with the Emirate's urban planning policies (e.g. land uses, densities, Estidama); and
- To coordinate the review and approval of development applications by external government agencies.

There are mandatory Estidama elements within the Development Review Process, which ensure sustainability is considered throughout the planning process and that a minimum level of sustainability is achieved. The Pearl Rating System extends upon the minimum sustainability requirements embedded within the Urban Planning Council's Development Review Process.

Figure 5: Relationship between the UPC Development Review Process, Estidama and the Pearl Rating System



APPLICATION OF THE PEARL BUILDING RATING SYSTEM

The Pearl Building Rating System is designed to address the following uses of buildings, their sites and associated facilities:

- **General:** this applies to all building uses and covers the common requirements. Within individual credits, exemptions or differing requirements may be specified for the following building uses:
- **Office:** this applies to offices and associated spaces (meeting rooms, reception/waiting areas, staff facilities, server rooms etc).
- **Retail:** this applies to display and sale of goods, food retail (supermarkets, convenience stores), food preparation (restaurants, cafés, takeaways) and service providers (banks, post offices, travel agencies). This category also includes shopping centres, department stores and retail parks. It does not include isolated single use warehouse-type retail developments.
- **Multi-Residential:** this applies to multi-family residential developments. All villas must be assessed using the Pearl Villa Rating System.
- **School:** this applies to primary schools, secondary schools, sixth form colleges and further and higher education/vocational colleges and institutions.
- **Mixed Use:** this applies to combinations of two or more of the above usage categories. Where relevant, individual credit calculations should be based on an area-weighted average.

For campus style projects, each building seeking to achieve a Pearl Rating will be assessed separately. It is envisaged that the communal external areas will be assessed using the Pearl Community Rating System, with these areas being allocated to individual buildings as appropriate for the building assessments.

Submission Requirements

The submission requirements for each of the stages of the Pearl Rating System are outlined in each credit. The Design Rating submission should be made at the end of the construction documentation stage and the Construction Rating submission should be made on completion of construction (this includes completion of commissioning and IAQ management where relevant). Both the design and construction submissions should be made electronically from the PQP to the Pearl Assessor at Estidama.

Confidentiality

There will be no public disclosure of information provided or derived as part of the Submission Requirements. Information provided will remain confidential, except as required for identification of the project and its key participants for the purposes of Certification.

UNDERSTANDING THE CREDITS

The Pearl Building Rating System comprises the following two types of credits:

Required Credits - these must be met by every project submitting for a Pearl Rating. These occur at the front of each section and are designated with an 'R', for example SM-R1. While limited in number, they are essential to achieving a Pearl Rating and reflect existing or emerging UPC and other Abu Dhabi Government Agency policies. No credit points are awarded for achieving these required credits.

Optional Credits – these are the voluntary performance credits from which points may be accrued. Some credits, such as SM-4 shown below, award 1 point whereas other credits allow more than 1 point to be attained. Depending on the Pearl Rating level being pursued by a design and development team, the number of credits and the level of achievement will vary from project to project.

Credit reference and title

SM-4: Design for Disassembly

Primary purpose of the credit

Intent

To facilitate the future deconstruction and reuse of buildings and their structural and envelope components.

Description of what must be achieved to meet the intent of the credit

Credit Requirements

GENERAL

Develop a Building Disassembly Plan highlighting the following:

- materials intended for recovery;
- materials connection requirements;
- system for marking and identifying recoverable elements prior to installation;
- best management practices for disassembly; and
- the disassembly sequence.

Details of the requirements for different building uses (if any)

Demonstrate that 50% of the building structural skeleton, 75% of façade, or 90% of the roof is designed for disassembly (by surface area).

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Description of how the credit points will be awarded

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Building is designed to meet Credit Requirements for design for disassembly.
1 (maximum)	**Construction Rating**
1	Building is constructed to meet Credit Requirements for design for disassembly.

Description of the submission requirements to achieve the Design and Construction Ratings

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project intends to meet the Credit Requirements, including any calculations; and
- ☐ Building Disassembly Plan conforming to Project and the Credit Requirements.

Credit Submission: Construction Rating

- ☐ Updated brief narrative describing how the project meets the Credit Requirements, including any calculations; and
- ☐ Photographs illustrating building elements designed for disassembly.

Clarification of any calculations or methodology

Calculations and Methodology

Calculations must indicate the total surface area of the building skeleton, façade and roofing systems, and the amount of this surface area that can be disassembled, both in square meters and as a percentage of the total surface area.

Any referenced standards that should be consulted

References

None

SUMMARY OF CREDIT POINTS FOR THE PEARL BUILDING RATING SYSTEM

IDP	Integrated Development Process	Maximum Credit Points
IDP-R1	Integrated Development Strategy	R
IDP-R2	Tenant Fit-Out Design & Construction Guide	R
IDP-R3	Basic Commissioning	R
IDP-1	Life Cycle Costing	4
IDP-2	Guest Worker Accommodation	2
IDP-3	Construction Environmental Management	2
IDP-4	Building Envelope Verification	1
IDP-5	Re-Commissioning	2
IDP-6	Sustainability Communication	2
	TOTAL	**13**

NS	Natural Systems	Maximum Credit Points
NS-R1	Natural Systems Assessment	R
NS-R2	Natural Systems Protection	R
NS-R3	Natural Systems Design & Management Strategy	R
NS-1	Reuse of Land	2
NS-2	Remediation of Contaminated Land	2
NS-3	Ecological Enhancement	2
NS-4	Habitat Creation & Restoration	6
	TOTAL	**12**

LBo	Livable Buildings : Outdoors	Maximum Credit Points
LBo-R1	Plan 2030	R
LBo-R2	Urban Systems Assessment	R
LBo-R3	Outdoor Thermal Comfort Strategy	R
LBo-1	Improved Outdoor Thermal Comfort	2
LBo-2	Pearl Rated Communities	1
LBo-3	Accessible Community Facilities	1
LBo-4	Active Urban Environments	1
LBo-5	Private Outdoor Space	1*
LBo-6	Public Transport	3
LBo-7	Bicycle Facilities	2
LBo-8	Preferred Car Parking Spaces	1
LBo-9	Travel Plan	1
LBo-10	Light Pollution Reduction	1
	TOTAL	**14**

*LBo-5 – this credit is only applicable to Multi-Residential

LBi	Livable Buildings : Indoors	Maximum Credit Points
LBi-R1	Healthy Ventilation Delivery	R
LBi-R2	Smoking Control	R
LBi-R3	Legionella Prevention	R
LBi-1	Ventilation Quality	3*
LBi-2.1	Material Emissions : Adhesives & Sealants	1
LBi-2.2	Material Emissions : Paints & Coatings	1
LBi-2.3	Material Emissions: Carpet & Hard Flooring	1
LBi-2.4	Material Emissions : Ceiling Systems	1
LBi-2.5	Material Emissions : Formaldehyde Reduction	2
LBi-3	Construction Indoor Air Quality Management	2
LBi-4	Car Park Air Quality Management	1
LBi-5.1	Thermal Comfort & Controls : Thermal Zoning	1
LBi-5.2	Thermal Comfort & Controls : Occupant Control	2*
LBi-5.3	Thermal Comfort & Controls : Thermal Comfort Modeling	2
LBi-6	High Frequency Lighting	1
LBi-7	Daylight & Glare	2*
LBi-8	Views	1*
LBi-9	Indoor Noise Pollution	1
LBi-10	Safe & Secure Environment	1*
	TOTAL	**23**

*LBi-1 – a maximum of 2 credit points are available to Retail
LBi-5.2 – this credit is not applicable to Retail
LBi-7 - this credit is not applicable to Retail
LBi-8 - this credit is not applicable to Retail
LBi-10 – a maximum of 2 credit points are available to Schools

PW	Precious Water	Maximum Credit Points
PW-R1	Minimum Interior Water Use Reduction	R
PW-R2	Exterior Water Monitoring	R
PW-1	Improved Interior Water Use Reduction	15
PW-2.1	Exterior Water Use Reduction: Landscaping	8*
PW-2.2	Exterior Water Use Reduction: Heat Rejection	8
PW-2.3	Exterior Water Use Reduction: Water Features	4
PW-3	Water Monitoring & Leak Detection	4
PW-4	Stormwater	4
	TOTAL	**43**

*PW-2.1 - a maximum of 10 credit points is available to Schools

RE	Resourceful Energy	Maximum Credit Points
RE-R1	Minimum Energy Performance	R
RE-R2	Energy Monitoring & Reporting	R
RE-R3	Ozone Impacts of Refrigerants & Fire Suppression Systems	R
RE-1	Improved Energy Performance	15
RE-2	Cool Building Strategies	6
RE-3	Energy Efficient Appliances	3
RE-4	Vertical Transportation	3
RE-5	Peak Load Reduction	4
RE-6	Renewable Energy	9
RE-7	Global Warming Impacts of Refrigerants & Fire Suppression Systems	4
	TOTAL	**44**

SM	Stewarding Materials	Maximum Credit Points
SM-R1	Hazardous Materials Elimination	R
SM-R2	Basic Construction Waste Management	R
SM-R3	Basic Operational Waste Management	R
SM-1	Non-Polluting Materials	3
SM-2	Design for Materials Reduction	1
SM-3	Design for Flexibility & Adaptability	1
SM-4	Design for Disassembly	1
SM-5	Modular Flooring Systems	1
SM-6	Design for Durability	1
SM-7	Building Reuse	2
SM-8	Material Reuse	1
SM-9	Regional Materials	2
SM-10	Recycled Materials	6
SM-11	Rapidly Renewable Materials	1
SM-12	Reused or Certified Timber	2
SM-13	Improved Construction Waste Management	2
SM-14	Improved Operational Waste Management	2
SM-15	Organic Waste Management	2
	TOTAL	**28**

IP	Innovating Practice	Maximum Credit Points
IP-1	Innovative Cultural & Regional Practices	1
IP-2	Innovating Practice	2
	TOTAL	**3**

Credit Section	Maximum Credit Points
IDP – Integrated Development Process	13
NS – Natural Systems	12
LB - Livable Buildings	37*
PW – Precious Water	43*
RE – Resourceful Energy	44
SM – Stewarding Materials	28
IP – Innovating Practice	3
TOTAL Credit Points	**177***

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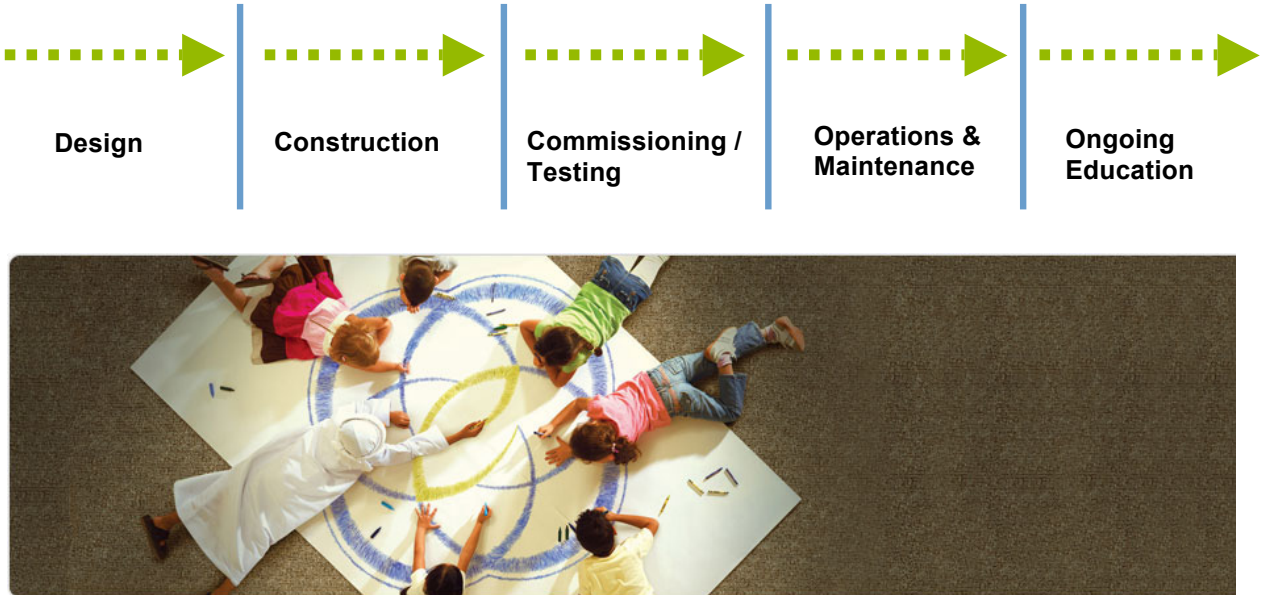
PW : Maximum of 45 credit points available for Schools.
Total : Excludes Innovating Practice credit points which are offered as bonus credits.

Credit Section
IDP: Integrated Development Process

An essential part of the strategy for achieving Estidama is to fundamentally change the way we approach design, construction and real estate development. The Pearl Building Rating System is meant to provide design and development teams with more than a checklist for green buildings and land development. It is part of the overarching Pearl Rating System, a transformative tool aiming to improve the design and development process and provide more cost-effective, higher performing developments.

IDP calls for cross-disciplinary teamwork and builds upon sound thinking, delivering quality and environmental management throughout the life of the project in order to achieve the successful integration of building, community, natural and economic systems. The process requires an integrated design approach from very early on in the design, a clear vision and sustainability targets and implementation strategy. The main objective is to achieve significant environmental, social, economic and cultural benefits while ensuring that the costs of the development are minimized.

Integrated Development Process



Implementing the IDP Credits will:

- establish a more collaborative and iterative design process;
- encourage construction activities that value workers welfare, quality and sound environmental management; and
- prepare the ground for good operation and maintenance where the user plays an informed active role.

CREDITS COVERED IN THIS SECTION

IDP	Integrated Development Process					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
IDP-R1	Integrated Development Strategy	R	R	R	R	R
IDP-R2	Tenant Fit-Out Design & Construction Guide	R	R	R	R	R
IDP-R3	Basic Commissioning	R	R	R	R	R
IDP-1	Life Cycle Costing	4	4	4	4	4
IDP-2	Guest Worker Accommodation	2	2	2	2	2
IDP-3	Construction Environmental Management	2	2	2	2	2
IDP-4	Building Envelope Verification	1	1	1	1	1
IDP-5	Re-Commissioning	2	2	2	2	2
IDP-6	Sustainability Communication	2	2	2	2	2
	TOTAL	**13**	**13**	**13**	**13**	**13**

IDP-R1: Integrated Development Strategy

Intent	To ensure new development adopts the Integrated Development Process (IDP) as a way of attaining greater synergy between project systems, resulting in high performance buildings.
Credit Requirements	**GENERAL** Demonstrate that the design and development team, and development process, are organized and programmed to gain full benefit from an integrated development approach, from project inception through to final delivery. Develop an implementation strategy to facilitate an effective transition between project stages (e.g. from design to construction to commissioning) and project packages (e.g. core & shell to tenant fit out) to ensure that the initial vision, objectives and targets are carried through to completion. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Process chart for the IDP developed at project inception, detailing: ▫ Team structure listing team members and their roles; ▫ Design milestones and workshops listing participants, goals, expected outcomes, required actions with tasks assignments; and ▫ Methodology for ensuring appropriate stakeholders are involved, including construction team, commissioning agent, potential tenants, building operators and relevant regulatory authorities and permit agencies. ☐ Narrative summarizing initial vision, objectives and targets set jointly by the project team for the project; ☐ Implementation strategy for achieving transition between project stages and project packages; ☐ Meeting minutes, action items and team member responsibilities from key workshops held as part of the IDP; and ☐ Narrative highlighting the reasons for any changes from the initial IDP process chart.
Credit Submission: Construction Rating	☐ Narrative showing an updated process chart of the IDP highlighting changes from the design stage and listing successes and challenges during construction stage. ☐ Updated implementation strategy.
Calculations and Methodology	The IDP is a mandatory process as part of the UPC Development Review Process.
References	▪ Estidama Website: www.upc.gov.ae ▪ Abu Dhabi Urban Planning Council Website, www.upc.gov.ae

IDP-R2: Tenant Fit-Out Design & Construction Guide

Intent	To ensure that the design and construction of interior space fit-out will contribute to the overall project's sustainability objectives and targets.
Credit Requirements	**GENERAL** Building on the requirements of the IDP-R1, develop a Tenant Fit-Out Design & Construction Guide in order to formally communicate to future tenants and their design and development teams the requirements for the project in relation to sustainable design and construction. This fit-out guide must accompany lease documents issued to each future tenant, and must cover the following at a minimum: ▪ The IDP planned for the project and tenant's role as part of this process; ▪ Sustainability vision and objectives for the project; ▪ A summary of targets for the project. This can be represented in the form of a scorecard highlighting credits targeted, based on the Pearl Building Rating System; ▪ The certification process for the building and its various milestones; ▪ Technical guidance on how fit-out design and construction measures can contribute to each credit targeted; and ▪ The owner's/developer's quality assurance procedure for verifying the requirements have been implemented. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** This requirement only applies to Core & Shell projects.
Requirement Achievement	This is a requirement for Core & Shell projects. No Credit Points are awarded.
Credit Submission: Design Rating	☐ There is no submission at this stage.
Credit Submission: Construction Rating	☐ Tenant Fit-Out Design and Construction Guide
Calculations and Methodology	None
References	None

IDP-R3: Basic Commissioning

Intent

To ensure that the building performs as designed to protect occupant health and provide comfort and ongoing building efficiency.

Credit Requirements

General

Demonstrate that:

- An independent commissioning agent, reporting to the project owner, is engaged as part of the project design team throughout the design stages;
- Comprehensive commissioning requirements are included in project specifications and construction contracts or provide a Commissioning Plan for the building at construction completion;
- At the building completion stage the building has been commissioned by independent commissioning engineers; and
- The commissioning report has been reviewed and verified prior to building completion.

Additional Requirement/Clarifications

None

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ CV of Commissioning Agent;
- ☐ Contract with the Commissioning Agent;
- ☐ Design Documents reviews; and
- ☐ Commissioning Plan clearly indicating commissioning requirements for the project, including:
  - Owner's Project Requirements and
  - Basis of Design narrative.

Credit Submission: Construction Rating

- ☐ List of all meetings attended by the Commissioning Agent through commissioning period and project handover, including dates; and
- ☐ Final Commissioning Report, including:
  - Owner's Project Requirements;
  - Project commissioning specifications;
  - Verification of installation; and
  - Operation & Maintenance Manual.

Calculations and Methodology

Commissioning is a collaborative effort. Specific roles played by various project team member are as follows:

The **independent commissioning agent** must oversee and lead the commissioning process as follows:

- Review Design Documentations and make recommendations to the design team;
- Review Construction Documentations and make recommendations to the design team;
- Prepare or review the Commissioning Plan; and
- Review and approve the results of commissioned systems.

The **contractor** must perform the following prior to building completion:

- Employ an independent commissioning contractor to commission the installed

systems noted below and commence the development of a Building Log Book (BLB). It is suggested that the format of the BLB should follows CIBSE TM31 or similar guide.

The **design team** must perform the following prior to building completion:

- Review and approve submittals from relevant subcontractors during construction;
- Visually review the results of selected commissioned systems; and
- Review final commissioning documents, including but not limited to the operations and maintenance manual(s) and staff training materials.

The commissioning process must cover, at a minimum, the following systems:

- Heating, ventilation, air conditioning, refrigeration;
- On-site energy generation (including co-generation);
- Building Management System;
- Lighting and lighting controls;
- Domestic hot and cold water systems;
- On-site water treatment systems including swimming pools (if applicable); and
- Automated control features such as blinds.

Additional areas that can be included in the commissioning scope, but which are not required for this credit, are envelope and glazing systems, stormwater management systems, fire suppression systems, and security systems.

The independent commissioning agent should have a minimum of 2 years experience in building commissioning and can be an employee of one of the companies involved in the project as long as this individual is not involved in the project design and/or construction.

References

- CIBSE TM31 CIBSE Building log book tool kit

IDP-1: Life Cycle Costing

Intent

To enable effective long-term decisions about building design and construction in order to maximize efficiency over the whole life of the development.

Credit Requirements

General

Demonstrate that Life Cycle Costing was undertaken as part of the IDP as follows:

- Demonstrate that a life cycle cost (LCC) analysis was started during concept design by a qualified professional to evaluate and compare various design options. The LCC model developed must be maintained and upgraded throughout the design stages in option appraisals.
- Provide evidence from the EIDP that the LCC analysis was used to verify design, technology and process decisions. Meeting minutes and documentation (reports, presentations) submitted as part of IDP-R1 may be used for the purpose of demonstrating compliance.
- At the end of construction, update the LCC report with final construction costs.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
4	Use Life Cycle Cost analysis during design
4 (maximum)	**Construction Rating**
4	Update Life Cycle Cost report with final construction costs

Credit Submission: Design Rating

☐ LCC report produced at the end of design with summary history of the decisions that benefited from LCC.

Credit Submission: Construction Rating

☐ Updated LCC report reflecting final construction costs.

Calculations and Methodology

The LCC qualified professional must be a Chartered Surveyor with previous experience with LCC modeling on at least 2 similar projects. The qualified professional must also be familiar with internationally recognized LCC standards such as the ISO 15686 Building and Constructed Assets - Service Life Planning Part 5: Life Cycle Costing, the Standardized Method of Life Cycle Costing for Construction Procurement supplement to ISO 15686 published by the Building Cost Information Service (BCIS) and the Building Standards Institute (BSI) or similar standards.

References

- ISO 15686 Building and Constructed Assets - Service Life Planning Part 5: Life Cycle Costing
- Standardized Method of Life Cycle Costing for Construction Procurement - supplement to ISO 15686 published by the Building Cost Information Service (BCIS) and the British Standards Institute (BSI)

IDP-2: Guest Worker Accommodation

Intent

To promote fair labor practices in building construction.

Credit Requirements

GENERAL

2 Credit Points : Develop and implement a Construction Guest Worker Accommodation Plan that, at a minimum, addresses the following:

- The provision of accommodation facilities for all construction guest workers on the project. Facilities must be located within suitable walking distances. Appropriate shade must be provided in circulation areas, parks, play fields and waiting/gathering areas such as bus stops. The facilities must provide dedicated and adequate areas for:
  - food preparation,
  - personal hygiene;
  - religious services,
  - healthcare,
  - recreation, and
  - entertainment.
- An ongoing maintenance plan of guest worker housing facilities and total budget allocated to maintenance services;
- Inspection schedules and auditing mechanisms for the guest worker housing facilities with minimum annual inspections required; and
- A formal protocol for engaging with facility residents and other stakeholders to address their requests, concerns and petitions, including the formation of a Workers' Representative Committee and the development of a Workers' Social & Welfare Program to address the following issues at a minimum:
  - Health, safety and security;
  - House rules;
  - Drugs and alcohol awareness;
  - Education programs;
  - Recreation activities; and
  - Transport within, to and from the housing facilities outside working hours.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Develop a Guest Worker Accommodation Plan.
2 (maximum)	**Construction Rating**
2	Implement the Guest Worker Accommodation Plan.

Credit Submission: Design Rating

- ☐ Guest Worker Accommodation Plan;
- ☐ Narrative describing how all requirements of Abu Dhabi Cabinet Decision No. (13) of 2009 are met or exceeded; and
- ☐ For new facilities, a signed copy of tender agreements with housing contractors and subcontractors stipulating the standards and requirements for the provision of guest worker housing, its ongoing maintenance and engagement with residents and stakeholders; or

	☐ For Existing Facilities, photographs and other documentation as listed under 'Credit Submission –Construction Rating'.
Credit Submission: Construction Rating	☐ Photographs illustrating how all requirements of Abu Dhabi Decision No. (13) of 2009 are met or exceeded; ☐ Record of all maintenance visits and inspections, including dates and actions taken, and summary of invoices associated with maintenance expenditures; ☐ Narrative describing how the Contractor applied the stakeholder-engagement protocol; and ☐ Record of the formation of a Workers' Representative Committee and development of a Workers' Social & Welfare Program.
Calculations and Methodology	The provision of accommodation facilities for all construction guest workers on the project must meet or exceed the requirements of Abu Dhabi Cabinet Decision No. (13) of 2009.
References	▪ Abu Dhabi Cabinet Decision No. (13) of 2009: Approving the General Standards Manual for Group Labor Accommodation and Related Services

IDP-3: Construction Environmental Management

Intent

To reduce the environmental impacts associated with construction practices.

Credit Requirements

GENERAL

- 1 Credit Point: Demonstrate that the project's Construction Environmental Management Plan (CEMP) is prepared in accordance with Environment Agency Abu Dhabi's Construction Environmental Management Plan Technical Guidance Document by an EAD-approved and registered consultant and that:
  - the Plan has been approved by EAD, for projects required to produce a CEMP; or
  - the Plan has been peer reviewed by an EAD-approved and registered consultant, for other projects.
- 2 Credit Points: In addition to achieving the above, demonstrate that the project lead contractor is either ISO 14001 or EHSMS certified.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Develop the CEMP in accordance with Abu Dhabi Environment Agency's regulations.
1	Project Lead Contractor is ISO 14001 or EHSMS Certified.
2 (maximum)	**Construction Rating**
1	Provide evidence that the CEMP has been properly applied to the site.
1	Confirm that Project Lead Contractor is ISO 14001 or EHSMS Certified.

Credit Submission: Design Rating

- ☐ CEMP, including:
  - Statement from Environment Agency Abu Dhabi or a suitably qualified peer reviewer that the project's CEMP meets the Abu Dhabi CEMP standard; and
  - CV and EAD-registration of the peer reviewer.
- ☐ Certified Contractor's ISO 14001 or Abu Dhabi EHSMS certification;

Credit Submission: Construction Rating

- ☐ Signed off audit of the CEMP that verifies the project's performance was in compliance with the CEMP including photographs and narrative of construction practices; and
- ☐ Certified Contractor's ISO 14001 or Abu Dhabi EHSMS certification.

Calculations and Methodology

None

References

- Environment Agency Abu Dhabi's EAD's *Construction Environmental Management Plan Technical Guidance Document*
- ISO 14001 Environmental Management Standard: 2004, International Organization for Standardization.
- Abu Dhabi Emirate Environment, Health and Safety Management System (EHSMS) www.ead.ae/en/portal/ad.ehsms.aspx

IDP-4: Building Envelope Verification

Intent

To ensure the building envelope meets the design intent and minimizes building impacts from condensation, water ingress, air infiltration and improper drainage.

Credit Requirements

General

Demonstrate that a member of project team involved in the design of the building envelope has performed the following tasks:

During Design

- A review of the design plans and specifications during Detailed Design phase:

During Construction

- Off-site testing of prototypes for custom-made cladding systems before installation;
- A review of standard product pre-testing certificate for pre-tested systems before installation; and
- On-site water infiltration and air-tightness tests of the building envelope to ensure performance once installed.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	The project team member has performed the above tasks during design.
1 (maximum)	**Construction Rating**
1	The project team member has performed the above tasks during construction.

Credit Submission: Design Rating

☐ Design Plan and Specifications reviewed and approved by the design team member.

Credit Submission: Construction Rating

☐ Narrative describing the results of reviews and tests performed to verify performance of the building envelope.

Calculations and Methodology

None

References

None

IDP-5: Re-Commissioning

Intent

To ensure that the building performs as designed to protect occupant health and comfort, as well as providing for ongoing building efficiency.

Credit Requirements

General

In addition to meeting the requirements of IDP-R4, provide comprehensive commissioning requirements in project specifications for the implementation of re-commissioning after 1 and 2 years to ensure the building continues to perform as intended.

Demonstrate a commitment to the following:

- Final building tuning one year after construction completion;
- Re-commissioning two years after construction completion; and
- Development of the building Operation and Maintenance (O&M) Manual; Building Log Book (BLB) or similar record performance, staff training and maintenance schedules.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Demonstrate that a re-commissioning Plan was developed.
2 (maximum)	**Construction Rating**
2	Demonstrate that a re-commissioning Plan was updated.

Credit Submission: Design Rating

☐ Commissioning Plan clearly indicating commissioning requirements for the project, signed off by the owner / developer, that includes:

- Extracts from contracts or specifications clearly indicating the requirements for ongoing building commissioning as per the Credit Requirements;
- Extracts from contracts or specifications clearly indicating the requirements for a detailed O&M manual including a table of contents and brief description of each section including details on BMS operation, or other means of monitoring building system performance and utilities consumption and maintenance schedules; and
- Written commitment by the building owner to maintain a BLB as per the Credit Requirements.

Credit Submission: Construction Rating

☐ Updated Commissioning Plan that clearly indicates the ongoing commissioning requirements for the project and includes:

- Extracts from contracts or specifications clearly indicating the requirements for ongoing building commissioning as per the Credit Requirements;
- Detailed O&M manual, including details on BMS operation or other means of monitoring building system performance and utilities consumption and maintenance schedules; and
- Copy of the Building Log Book as per the Credit Requirements.

Calculations and Methodology

- The re-commissioning process must be performed by an Independent Commissioning Agent cover, at a minimum, the following systems:

- Heating, ventilation, air conditioning, refrigeration;
- On-site energy generation (including co-generation);
- Lighting and lighting controls;
- Building Management System;
- Domestic hot and cold water systems;
- On-site water treatment systems including swimming pools (if applicable); and
- Automated building features such as blinds.

Additional areas that can be included in the commissioning scope, but which are not required for this credit, are envelope and glazing systems, stormwater management systems, fire suppression systems, and security systems.

- Energy and water loads must be taken from metered data.
- Minimum O&M manual contents to be in accordance with ANSI/ASHRAE 62.2:2007.

References	
	▪ CIBSE TM31 CIBSE Building log book tool kit

IDP-6: Sustainability Communication

Intent

To promote the efficient ongoing operation of the building by enabling occupants to appreciate, understand and therefore contribute to responsible resource use in the building.

Credit Requirements

General

Occupant Handbook

Demonstrate that an occupant handbook was prepared by a suitably qualified person from the design team and updated at the end of construction. The Occupant Handbook must include:

- The maintenance requirements for the building's performance; and
- Actions to be implemented to ensure that the longer term aspects of building management and maintenance are upheld as new techniques come into effect over the lifespan of the building.

Occupant Feedback

Where the above requirements are met, it is possible for projects to earn one additional Credit Point by providing occupants with feedback on how their behavior affects building performance. These systems should include:

- Digital Feedback Systems/Smart Meters with a user interface (e.g. dashboards) inside each tenancy and connected to the centralized building data aggregation centre or BMS.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Develop an Occupant Handbook.
1	Design an occupant feedback mechanism to give information on how they impact building performance.
2 (maximum)	**Construction Rating**
1	Update the Occupant Handbook developed during design.
1	Build the components required as part of the occupant feedback mechanism developed during design.

Credit Submission: Design Rating

☐ Occupant Handbook in either printed or digital format; and

☐ Distribution plan for the Occupant Handbook.

Where the project will provide occupants with feedback on building performance, include the following:

☐ Brief narrative describing how the project meets the Credit Requirements;

☐ Images of the draft digital interface screens representative of a user experience; and

☐ Extracts from specifications indicating the functionality and location of all smart meters /dashboards or other building integrated internal communications.

Credit Submission: Construction Rating

☐ Occupant Handbook (updated as appropriate); and

☐ Updated distribution plan for the Occupant Handbook.

Where the project will provide occupants with feedback on building performance, include the following:

- ☐ Updated narrative describing how the project meets the Credit Requirements;
- ☐ Images of the digital interface screens representative of a user experience; and
- ☐ Typical as-built drawings indicating the functionality and location of all smart meters/dashboard or other building integrated internal communications in each tenancy.

Calculations and Methodology	Topics to be addressed in the Occupant Handbook, at a minimum, include: ▪ The building's energy and water efficiency measures and how occupant behavior affects the building performance; ▪ Information on the building's indoor environmental quality and how it is measured, monitored and managed; ▪ Information on materials used in the building, including environmental and social benefits, as appropriate; ▪ Waste and recycling policies and information such as location, sorting requirements (if any) and the use of green waste (if applicable); ▪ Locations of nearby public transport, shuttle service, carpooling and on-site bicycle facilities; and ▪ Tenant fit-out considerations, such as low-energy lighting installations, to maximize the building performance potential and minimize environmental impacts.
References	None

One of the fundamental building blocks of Plan 2030 is the need to foster careful, sensitive growth that will conserve, preserve, and restore the region's critical natural environments and habitats. The ecosystem services provided by these unique marine and desert systems are invaluable, and their ongoing viability is essential to maintain a high quality of life in the region.

Plan 2030 calls for the creation of a national park system to preserve key areas, but goes beyond that with the concept of a 'green gradient.' This gradient designates levels of conservation, preservation and restoration, and development for five zones, ranging from the most intensely developed urban core to the natural areas that must be preserved. This concept and its policy objectives are more clearly defined in the Coastal Development Guidelines issued by UPC in January of 2009.

Plan 2030 also proposes an open space framework — a system of formal and informal spaces in communities that connect and augment a broader national park system and the resources it protects. This 'green infrastructure' strategy should be reflected not only in plan and form, but also in implementation, leading to healthier ecosystems, habitats and ultimately communities.

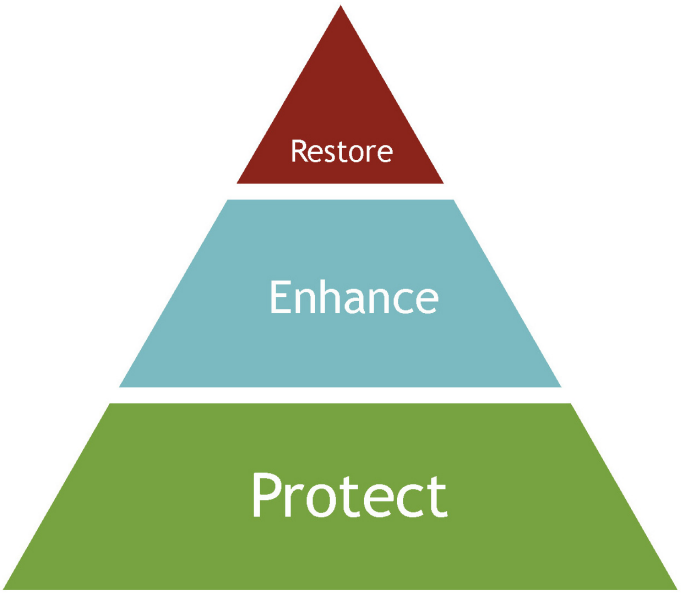
"The islands, sand dunes, sea, coast lines, and native wildlife all blend to create Abu Dhabi's incredibly intricate, sensitive and unique natural environment. This extraordinary mix has coexisted with the people living within it for thousands of years."

— Capital 2030, A Sustainable Foundation

The Natural Systems Credit Section is intended to encourage natural resource management and sustainable land use through:

- thorough analysis and assessment of all Natural Systems on the site;
- conservation of existing significant or valuable assets through protection or mitigation;
- the provision of a natural system design and management strategy;
- encouraging reuse of land;
- remediation of contaminated land;
- enhancement in ecological value; and
- habitat creation, restoration and provision of habitat connections.

The overarching hierarchy followed is illustrated below:



CREDITS COVERED IN THIS SECTION

NS	Natural Systems					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
NS-R1	Natural Systems Assessment	R	R	R	R	R
NS-R2	Natural Systems Protection	R	R	R	R	R
NS-R3	Natural Systems Design & Management Strategy	R	R	R	R	R
NS-1	Reuse of Land	2	2	2	2	2
NS-2	Remediation of Contaminated Land	2	2	2	2	2
NS-3	Ecological Enhancement	2	2	2	2	2
NS-4	Habitat Creation & Restoration	6	6	6	6	6
	TOTAL	12	12	12	12	12

NS-R1: Natural Systems Assessment

Intent	To ensure that at the commencement of the design process, the environmental baseline conditions surrounding, connected to and on the site are considered and assessed.
Credit Requirements	**GENERAL** Demonstrate that, before the start of the design process and site clearance, an assessment of the Natural Systems has been carried out at the: ▪ *project site*; ▪ *area of probable impact* surrounding the project site; ▪ sub-regional; and ▪ regional scale. Identify opportunities, constraints and carrying capacity associated with the development, and present in a Natural Systems Assessment Report. Key performance indicators (KPIs) must be prepared to guide the design of the development, based on the results of the opportunities and constraints analysis. KPIs must be measurable targets against which future design or construction works can be assessed. The assessment must be carried out by a *suitably qualified* environmental professional trained to complete such analysis and assessment. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Natural Systems Assessment Report including: ▫ Narrative; ▫ Maps; and ▫ Site photographs. Maps and site photographs must clearly identify the extent of different habitats and/or other significant natural system features. ☐ Review of the site against Environmental Policy Statements included in Plan 2030; and ☐ CV of appointed suitably qualified environmental professional.
Credit Submission: Construction Rating	There is no required submission at this stage.
Calculations and Methodology	Information contained in the following documents may provide the foundation for this credit: ▪ Preliminary Environmental Review (PER) or Environmental Impact Assessment (EIA) as may be required by the EAD; ▪ The contextual natural systems analysis as a part of the Abu Dhabi Urban Planning Council's (UPC) Development Review Process; and ▪ An Environmental Context Statement as required by the UPC Coastal Development Guidelines. The Natural Systems Assessment Report must cover the following environmental

components, as a minimum:

- Topography;
- Geology/ geomorphology;
- Soils and geotechnical attributes;
- Hydrology and groundwater;
- Waste and contamination;
- Coastal conditions;
- Microclimate (such as prevailing winds, solar orientation and solar shading;
- Priority species, habitats and ecosystems (both onsite and those influenced by the site);
- Flora and fauna (including wildlife corridors, seasonal uses); and
- Archaeological features.

The Natural Systems Assessment must be undertaken in combination with LBo-R2 Urban Systems Assessment.

The assessment must be based on a field survey and a desk top study using historical and/or other data. As a minimum, a field survey must be carried out on the project site and include a Phase I Habitat Survey, or similar. A desk top study is sufficient for the area of probable impact, sub-regional and regional analysis.

The Natural Systems assessment must illustrate the inter-relationship between environmental components and identify the carrying capacity of the site based on the following:

- *Significant Assets* - Assets which are of significant importance (internationally, nationally, regionally and/or locally), including:
    - *Priority Habitats* - Habitats identified in Abu Dhabi Emirate which are of exceptional value and are highly threatened, including Intertidal Mudflats, Mangrove, Vegetated Sandy Beaches, Marine (seagrass, coral), Wadis, Sand Sheets and Low Dunes, Interdunal Plains and High Dunes, Alluvial Plains and Jebels (Reference is to be made to Brown and Boer, 2004 for detailed habitat types);
    - Any other habitat identified as significant through the Development Review Process, the Coastal Development Guidelines, an Environmental Impact Assessment, a Preliminary Environmental Review or a Strategic Environmental Assessment; and
    - *Priority Species* – A protected species (flora or fauna) or species determined to be critically endangered, vulnerable, threatened, near threatened or sensitive (as defined by the Union for Conservation of Nature, IUCN, UAE Red Data List and / or EHSMS.)

- *Valuable Assets* - Any valuable assets, such as features of ecological value, including healthy native trees or shrubs.

The assessment must identify and map areas to be:

- protected;
- used as mitigation areas;
- enhanced;
- remediated; and/or
- allocated for habitat creation or restoration beyond mitigation; and / or compensation requirements.

The assessment must then clearly identify and justify the following, as applicable, in addition to the above:

- developable land;
- buffer areas;
- reclaimed land;

- connections; and
- areas subject to environmental constraints, including high groundwater, flooding, steep slopes, etc.

KPIs must be prepared to guide the design of the development, based on the results of the opportunities and constraints analysis. They must include indicators and targets relating to the following, as a minimum:

- Soil;
- Flora;
- Fauna;
- Microclimate;
- Topography and views;
- Drainage;
- Other targets relating to mitigation of identified environmental constraints; and
- Area of site to be protected, maintained, created or restored.

KPIs must be simple, clear, measurable targets against which future design or construction works can be assessed. They also need to be site specific and reflect the particular attributes of a site.

Project site area - The physical area within which activities of the proposed project will take place (boundary of project area is defined by titled property boundary).

Area of Probable Impact – The extent of a physical area occupied by an environmental component that is likely to be impacted by at least one of the phases of the proposed project. The boundary of the area of probable impact is determined by measurements, previous studies, models or best professional judgment and may vary by *environmental component*. In simple terms the extent of the area outside of the project area that is likely to be directly or indirectly impacted by the proposed project

A *suitably qualified* environmental professional is an individual with:

- a degree in a relevant subject,
- a minimum of five years relevant work experience (For the ecological component of the assessment, where significant and valuable assets are present, this is to include experience of carrying out habitat surveys as well as providing advice on ecological protection, enhancement and mitigation measures),
- a proven track record on working on similar projects in the region.

The Environment Agency Abu Dhabi (www.ead.ae) holds a list of consultants carrying out a range of environmental services within the Emirate of Abu Dhabi.

References

- Abu Dhabi Urban Planning Council (for Development Review and Design Process, and Coastal Development Guidelines), www.upc.gov.ae
- Environment Agency Abu Dhabi (for Environmental Impact Assessment (EIA) and Preliminary Environmental Review (PER) guidelines), www.ead.ae
- Union for Conservation of Nature, IUCN, www.iucn.org

Habitat and ecology references:

- Wild Flowering Plants of the UAE, Environmental Research and Wildlife Development Agency, 2002
- Birds of Abu Dhabi – Checklist, Environmental Research and Wildlife Development Agency, July 2001
- Interpretation Manual of Major Terrestrial Natural and Semi-natural habitat types of Abu Dhabi Emirate, Gary Brown and Benno Boer, Environmental Research and Wildlife Development Agency, September 2004
- Red List of Terrestrial Mammalian Species of the Abu Dhabi Emirate, Environmental Research and Wildlife Development Agency, May 2005
- The terrestrial mammals, reptiles and amphibians of the UAE – Species list and status report, Environmental Research and Wildlife Development Agency, January

2005

- Terrestrial Environment of Abu Dhabi Emirate, Environment Agency Abu Dhabi, 2008, www.ead.ae
- Handbook for Phase 1 Habitat Survey – a technique for environmental audit, JNCC, 2007, www.jncc.gov.uk
- Vascular Plants of Abu Dhabi Emirate, Gary Brown and Sabitha Sakkir, August 2004

NS-R2: Natural Systems Protection

Intent

To protect significant and valuable Natural Systems assets identified in NS-R1 Natural Systems Assessment.

Credit Requirements

General

Demonstrate that significant or valuable Natural Systems assets, as identified in NS-R1 Natural Systems Assessment, are adequately protected or that the impacts are either mitigated or compensated.

This credit contains three types of strategies. Proponents shall demonstrate one of the three:

- Strategy 1 - Protection
- Strategy 2 - Onsite Mitigation
- Strategy 3 - Offsite Compensation

Where significant and valuable assets are present, the Natural Systems Protection, Mitigation or Compensation plan and supporting studies must be prepared by a suitably qualified ecological professional.

Additional Requirement/Clarifications

Strategy 1 – Protection:

- Demonstrate that 100% of a significant asset identified in NS-R1 is retained and protected from damage and destruction sufficient to maintain its existing structure and function (including any reclamation and dredging works at the project site or sources location of dredged materials);
- Demonstrate that 80% of a valuable asset identified in NS-R1 is retained and protected from damage and destruction sufficient to maintain its existing structure and function; and
- Demonstrate that a maximum of 25% of the projects total land area consist of reclaimed land.

or

- Demonstrate that no significant or valuable assets for protection were identified in NS-R1.

Strategy 2 - Onsite Mitigation:

Applies to sites where on-site mitigation is required, due to the impracticality of protection (as determined through consultation with the UPC).

This strategy cannot be applied if the Natural Systems asset to be impacted is located within a protected or proposed protected area or national park, a coastal park or ecological hotspot, or a coastal conservation zone, as defined by the UPC Coastal Development Guidelines.

- Demonstrate that 70% of a significant asset identified in NS-R1 is retained on-site and protected from damage and destruction sufficiently to maintain its existing structure and function (including any reclamation and dredging works at the project site or sources location of dredged materials);
- Demonstrate that 50% of a valuable asset identified in NS-R1 is retained on-site and protected from damage and destruction sufficiently to maintain its existing structure and function;
- Demonstrate that a maximum of 25% of the projects total land area consist of reclaimed land;
- For projects that develop land adjacent to the coast, demonstrate that impacts

affect no more than 20% of the coastal edge;

- Mitigate for impacts (for the loss of up to 30% of significant assets and 50% of valuable assets) through on-site re-establishment of habitat, using similar species diversity as the lost habitat at an area replacement ratio of 2:1;
- Provide for an ecological corridor between the protected habitat area (significant assets) and the mitigation area; and
- Provide confirmation of the appointment of a management and maintenance organization (with a contract running for at least 5 years)

Strategy 3 – Offsite Compensation:
Applies to site where offsite compensation is required, due to the impracticality of protection or mitigation (as determined through consultation with the UPC). UPC's Estidama Assessor must provide approval before the compensation strategy can be pursued.

As for Strategy 2, but instead of onsite mitigation, compensate offsite:

- Compensate for the loss of up to 30% of significant assets and 50% of valuable assets through off-site re-establishment of habitat, using similar species diversity as the lost habitat at an area replacement ratio of 2:1;
- Provide confirmation of the appointment of a management and maintenance organization (with a contract running for at least 5 years) for the compensation site, if management not to be undertaken by the local municipality.
- The compensation site must be:
  - located within the Emirate of Abu Dhabi;
  - a degraded habitat; and
  - located outside an area allocated for development within Plan 2030.
- The habitat to be created in the compensation site must be:
  - of a similar type to the habitat lost at the development site;
  - of a type appropriate to the compensation site location; and
  - ideally located in an area surrounded and connected to a similar habitat.

Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Supporting calculations, summarizing total site area, protection area and/or mitigation area / compensation area in hectares; ☐ Construction strategy to protect sensitive habitats and protected species from construction impacts; ☐ Details of the appointed suitably qualified ecological consultant's professional status, if different to the consultant details provided in NS-R1; and Strategy 1: ☐ Protection Strategy Report which identifies the potential risks to the Natural Systems assets from development and inform setback requirements, including: ▫ narrative and maps which detail the boundaries of the assets; ▫ extent of habitats and species to be protected; ▫ limits of development, buffer areas and setbacks (Works areas must be clearly identified on an aerial photograph of existing conditions); and ▫ any features of ecological value to be lost. Strategy 2: ☐ Mitigation Strategy Report which details the reasons for requiring mitigation for loss of habitat and includes: ▫ narrative and maps of the area of natural system assets to remain protected; ▫ the area and value of habitat to be lost to development; ▫ the area allocated for re-establishment; ▫ limits of development, buffer areas and setbacks (Works areas must be clearly

identified on an aerial photograph of existing conditions);

- a strategy for habitat re-establishment, including source of plant stock and establishment of soil base; and
- five year strategy for on-going management and monitoring following completion of construction, including confirmation of management organization.

Strategy 3:

☐ Compensation Strategy Report which details the reasons for requiring compensation for loss of habitat and includes:

- narrative and maps of the area of natural system asset to remain protected;
- the area and value of habitat to be lost to development;
- limits of development, buffer areas and setbacks (Works areas must be clearly identified on an aerial photograph of existing conditions);
- details on the compensation area allocated for re-establishment, including site location and confirmation of approval to establish habitat;
- strategy for habitat re-establishment, including source of plant stock and establishment of soil base; and
- five year strategy for on-going management and monitoring following completion of construction, including confirmation of management organization.

Credit Submission: Construction Rating

☐ Evidence that features of ecological value have been protected during construction; for example, a construction management plan and dated photographs of successfully protected areas/features;

☐ Updated development map delineating the built limits of all proposed development and disturbance, setback zones, and buffer areas;

☐ Supporting calculations summarizing final total land area and protected areas; and

☐ Confirmation of the appointment of a management and maintenance organization (with a contract running for at least 5 years), if management not to be undertaken by the local municipality. The confirmation must contain details of individuals responsible and their duties in line with the strategy.

Calculations and Methodology

Only species within the *project site* boundary need to be protected, not those within the *Area of Probable Impact* (as defined in NS-1 Natural Systems Assessment).

For mitigation or compensation, calculate the original area of the ecological habitat to be re-established. Re-establish the habitat on two times the surface area of the original habitat area. The mitigation or compensation area must have a similar hydrological function and soil type as the original area.

Setback requirements must be determined by a suitably qualified ecologist depending on the nature of the asset (in consultation with UPC). In the absence of any policy for a specific habitat type, or clear justification for setback, the proposed development must be:

- Setback at least 100 meters from identified coastal and marine priority habitats (intertidal, coral, seagrass);
- Setback at least 50 meters from mangrove and vegetated sandy beaches;
- Setback at least 10 meters from wadis, sand-sheets and low dunes, interdunal plains and high dunes, alluvial plain and jebels;
- Setback from protected trees through use of barriers located either at the outer edge of branch spread or half the height of the tree, whichever is the greater; or
- Setback from other habitat areas through use of barriers located minimum 1 meters from the outer edge.

References

See NS-R1 Natural Systems Assessment

NS-R3: Natural Systems Design & Management Strategy

Intent

To minimize demand for resources, promote soil protection and enhancement and ensure the long term survival and management of landscaped/habitat areas.

Credit Requirements

GENERAL

Demonstrate that a Natural Systems Design and Management Strategy has been prepared that ensure the long term survival and management of the landscape and habitat areas within the site and promotes:

- soil protection and enhancement;
- low maintenance requirements; and
- low demand for resources.

The Natural Systems Design and Management Strategy must cover all landscape areas including the management of:

- protected, mitigated or compensated assets (as identified under NS-R2);
- areas of ecological enhancement (as identified under NS-3); and
- habitat creation and restoration areas (as identified under NS-4).

The Natural System Design and Management Strategy must be prepared by a *suitably qualified* professional.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

Sites that demonstrate no existing or proposed landscaping comply with the requirements.

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

☐ Natural Systems Design and Management Strategy that includes:

- Plans and drawings illustrating layout and design of landscaped and habitat areas;
- Details of soft and hard landscaped areas;
- Details and justification of plant selection (ensuring that only native and adaptive drought and saline tolerant species are specified for habitat areas);
- Details of soil strategy for testing, protection, enhancement and maintenance;
- Irrigation strategy;
- Details of landscape maintenance procedures including fertilizer, herbicide and pesticide application;
- Details of specific establishment, maintenance and protection requirements for sensitive areas; and
- Details of monitoring requirements.

☐ Details of the appointed suitably qualified environmental consultant's professional status, if different to the consultant details provided in NS-R1.

Credit Submission: Construction Rating

☐ Updated Natural Systems Design and Management Strategy including:

- Reporting of any landscape/ habitat design alterations or procedures;
- Report on any failures and rectification work undertaken; and
- Confirmation of the appointment of a management and maintenance

organization (with a contract running for at least 5 years), if management not to be undertaken by the local municipality. The confirmation must contain details of individuals responsible and their duties in line with the strategy.

Calculations and Methodology

The Natural Systems Design and Management Strategy must include the following, as a minimum:

- A landscape design influenced by the assessment undertaken at NS-R1;
- A strategy for protection of site soils from compaction, erosion, pollution and increases in salinity;
- A strategy for soil testing to determine nutrient level, salinity and a strategy for soil enhancement including increasing water retention capacity, salinity management and nutrient management including promotion of low fertilizer requirements;
- Details of plant palette for landscape and/or habitat areas and sources of plant stock or seeds;
- Planting design which groups together species with similar soil and microclimatic requirements and water demands;
- An irrigation strategy which promotes low water demand through species selection and efficient irrigation networks;
- Avoidance of pesticide and herbicide application; if required, identify potential impacts and outline strategy to be adopted to minimize environmental impact;
- Identification of the landscape and/or habitat areas that require specific monitoring and maintenance (as identified by NS-R1 and NS-R2) and outline a strategy for their establishment, survival, generation and protection, identifying the establishment and maintenance periods and a performance criteria for establishment;
- Identify maintenance duties required to be carried out in the various landscaped areas considering species type, soil type, irrigation requirements and season;
- Identify monitoring requirements for the landscape / habitat areas and species for annual monitoring of health, species diversity and abundance and soil condition; and
- Identify monitoring and maintenance organization.

References

See NS-R1 Natural Systems Assessment

NS-1: Reuse of Land

Intent

To encourage new developments to reuse land that has already been built on and infill existing urban areas rather than using undisturbed land.

Credit Requirements

General

Demonstrate that at least 75% of the site area has been previously developed.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Demonstrate that at least 75% of the site area has been previously developed.
2 (maximum)	**Construction Rating**
2	Demonstrate and confirm that at least 75% of the site area has been previously developed.

Credit Submission: Design Rating

- ☐ Brief narrative of the previous uses on the site, outlining existing structures and hard landscaped areas;
- ☐ Plan drawing of the existing, or previous development, on the site (or an aerial photograph, including graphic scale) illustrating the proposed development boundary; and
- ☐ Calculations demonstrating that the previously developed area is at least 75% of the new site area.

Credit Submission: Construction Rating

- ☐ Plan drawing of the existing, or previous, development on the site (or an aerial photograph, including graphic scale) with the property boundary and final building outlined; and
- ☐ Documentation confirming that the previously developed area remains at least 75% of the site area.

Calculations and Methodology

Previously developed land is classified as any land that is, or was occupied by a permanent structure including the land up to the plot boundary of the permanent structure and any associated fixed surface infrastructure. It excludes any land occupied by agriculture or forestry and any parks or recreational grounds.

References

None

NS-2: Remediation of Contaminated Land

Intent

To encourage and promote the remediation of land for building development.

Credit Requirements

GENERAL

Demonstrate the site is contaminated by undertaking an investigative analysis through completion of a Phase I and Phase II American Society for Testing and Materials (ASTM) analysis, or similar. A Site Contamination Assessment Report must be provided identifying, estimating and evaluating the hazard risks on site. Demonstrate that the results of the Contamination Assessment Report have informed the overall design and layout of the development.

Demonstrate that adequate remedial steps will be taken to decontaminate, or safely encapsulate, the site prior to construction through a Phase III ASTM report, or similar. The remediation strategy must be suitable for the proposed land use. The report must state the scope of engagement, the person or organization responsible for overseeing the decontamination operation (from commencement to completion) and confirm that the site will be appropriately remediated for the proposed land uses.

All assessments, analysis and reporting must be carried out by a *suitably qualified* professional trained to complete such analysis and assessment.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Demonstrate the site is contaminated and an assessment report and remediation strategy has been prepared.
2 (maximum)	**Construction Rating**
2	Demonstrate that the land, prior to development, was identified as contaminated through the site contamination assessment report and that adequate remedial steps were taken to decontaminate or safely encapsulate the site prior to construction.

Credit Submission: Design Rating

- ☐ Site contamination assessment report that clearly documents the pre-existing contamination on site; and
- ☐ Certificate of engagement and Phase III remediation strategy from a suitably qualified professional.

Credit Submission: Construction Rating

- ☐ Site contamination assessment report that clearly documents the pre-existing contamination on site; and
- ☐ Validation report of remediation from a suitably qualified professional. The report must state who was responsible for overseeing the remediation operations (from commencement to completion) and confirm that the site has been correctly and appropriately remediated for the proposed land use.

Calculations and Methodology

A site contamination assessment protocol must be followed to evaluate hazardous material pollution.

An example of such a protocol is the *ASTM Environmental Site Analysis Process*, which includes E 1903 – 97 Phase II Environmental Site Assessment.

A Phase I analysis includes the identification of the potential for contamination through former land uses and / or through preliminary site analysis
A Phase II analysis includes the completion of site surveys to determine the presence and extent of contamination on a site.
A Phase III assessment demonstrates the remedial steps to be taken to decontaminate, or safely encapsulate, the site prior to construction.

Asbestos qualifies as contamination where it occurs in the ground.

A remediation strategy must be developed specific to the contaminated site; guidance can be found in the *Model Procedures for the Management of Land Contamination (CRL 11)*.

A *suitably qualified* professional in the context of this credit must be an individual with a degree covering contaminated land remediation, a minimum of five years work experience and regular practice in the field.

References

- Environment Agency Abu Dhabi www.ead.ae
- Standard Guide for Environmental Site Assessments: Phase I, II and III Environmental Site Assessment Process, American Society for Testing and Materials, ASTM E1903-73, ASTM E1527-05, www.astm.org
- Model Procedures for the Management of Land Contamination (CRL 11), www.environment-agency.co.uk

NS-3: Ecological Enhancement

Intent

To enhance the ecological value of the site.

Credit Requirements

General

Enhance the ecological value of the site by planting native or adaptive species:

- 1 Credit Points: 50% plants specified for planting on the site to comprise native and adaptive drought and/or saline tolerant species including a minimum of 5 different types of species.
- 2 Credit Points: 70% plants specified for planting on the site to comprise native and adaptive drought and/or saline tolerant species including a minimum of 10 different types of species.

Integrate management requirements for ecological enhancement areas identified in NS-R3.

The ecological enhancement recommendations must be prepared by a *suitably qualified* ecologist and/ or landscape architect.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	50% of plants to comprise of native and adaptive drought and / or saline tolerant species including a minimum of 5 different types of species.
2	70% of plants to comprise native and adaptive drought and / or saline tolerant species including a minimum of 10 different types of species.
2 (maximum)	**Construction Rating**
1	50% of plants to comprise native and adaptive drought and / or saline tolerant species including a minimum of 5 different types of species.
2	70% of plants to comprise native and adaptive drought and / or saline tolerant species including a minimum of 10 different types of species.

Credit Submission: Design Rating

- ☐ Ecological/ landscape report and plant palette highlighting the proposed species;
- ☐ Drawings highlighting the location and area coverage of the proposed species; and
- ☐ Confirmation of integration of monitoring and management requirements in NS-R3.

Credit Submission: Construction Rating

- ☐ Photographs and as built landscape drawings clearly indicating the planted species.

Calculations and Methodology

The species qualifying for this credit must be native or adaptive plant species which are drought and/or saline tolerant with a proven track record to survive and thrive in an environment similar to the proposed site.

No species known to be of an invasive nature may be included in the plant palette.

References	See NS-R1 Natural Systems Assessment

NS-4: Habitat Creation & Restoration

Intent

To restore or re-create a habitat that is self sustaining.

Credit Requirements

GENERAL

4 Credit Points:
Demonstrates measurable strategies to increase the ecological value of the site by creating, or restoring, pre-existing, or degraded, remnant natural areas. The creation of habitat must use native or adaptive drought and/ or saline tolerant species.

The habitat type to be created or restored must be a *Priority Habitat* of a type appropriate to the site location. Where there is no suitable area onsite for restoration or habitat creation, suitable offsite areas may be used to meet this credit.

Credit points are awarded based on the provision/ implementation of a Habitat Creation or Restoration Strategy with habitat creation/ restoration areas of a minimum size/types according to below:

Onsite habitat creation or restoration
Demonstrate habitat creation/ restoration equivalent to the minimum habitat size area for effective habitat function or two (2) times the minimum landscape area, whichever is the greater. Habitat creation or restoration area must be within areas as identified in NS-R1.

Offsite habitat creation or restoration
Demonstrate habitat creation/ restoration equivalent to four (4) times the area of the minimum landscape area,
and
Demonstrate the off-site habitat creation or restoration area is:

- Located within the Emirate of Abu Dhabi;
- A degraded habitat;
- Located in an area surrounded and connected to a similar habitat to that being created; and
- Located outside an area allocated for development within Plan 2030.

2 Credit Points:
Demonstrate that through collaboration with neighbouring land owner(s), ecological corridors will be created linking habitat creation / restoration site(s) to similar habitat types located near but beyond the site. Ecological corridors must be a minimum 40m width and landscaped with native and adaptive species.

The ecological restoration or rehabilitation recommendations must be prepared by a *suitably qualified* professional.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
6 (maximum)	**Design Rating**
4	Prepare a Habitat Creation or Restoration Strategy; and Allocate an on-site or off-site habitat creation or restoration site of minimum areas as defined above.
2	Demonstrate that through collaboration, off-site ecological corridors have been designed to link similar habitat types.
6 (maximum)	**Construction Rating**
4	Demonstrate on-site or off-site habitat creation or restoration equivalent the Credit Requirements.
2	Demonstrate that through collaboration, off-site ecological corridors have been created to link similar habitat types.

Credit Submission: Design Rating

For Habitat Creation and/ or Restoration Credits:

☐ Habitat Creation or Restoration Strategy, including:

- calculations;
- photographs and maps illustrating habitat creation areas or pre-existing natural resource areas requiring restoration;
- plant palette highlighting the proposed species;
- methodology for habitat creation or restoration of functional habitat;
- KPIs for assuring performance through monitoring and management; and
- maps illustrating any connections between habitats.

For Ecological Corridors Credits:

☐ Ecological/ landscape report and plant palette describing the design of the ecological corridors and proposed species off-site, with details of native and adaptive plant species;

☐ Drawings highlighting the location and area coverage of the off-site ecological corridors and habitat areas connected by the corridors, as appropriate;

☐ Confirmation of the agreement with neighboring land owner to reserve and permanently protect land and create ecological corridors; and

☐ Details of monitoring and management requirements for minimum 10 years for ecological corridors (to be incorporated into NS-R3).

Credit Submission: Construction Rating

For Habitat Creation and/ or Restoration Credits:

☐ Plans, narrative and photographic evidence of implementation of Habitat Creation or Restoration Strategy; and

☐ Documentation of any failures identified during construction and proposed rectification strategies of habitat creation/ restoration.

For Ecological Corridors Credits:

☐ Photographs and as built landscape drawings clearly indicating the ecological corridors and planted species.

Calculations and Methodology

The Habitat Creation or Restoration Strategy must describe the following:

- The existing condition of the habitat creation or restoration area and the impacts that have caused or are continuing to cause the degradation or loss of habitat on the site.
- The habitat to be created or restored, including justification for the habitat type.
- Plans illustrating the location of the habitat creation / restoration area. Mark other existing or proposed areas of the same, or similar, habitat type and description of any existing or proposed connections between them.
- A description of the structure and function of the habitat type, including inter-relationships between topography, soil, microclimate, light and shade, flora and fauna and minimum habitat size for effective habitat function.
- A strategy for re-creation of the structure and function of the habitat type, linked to a series of KPIs providing the measurement tool for monitoring success of habitat creation or restoration of the site. These must be based on the KPIs established in NS-R1 and are to include the following as a minimum:
    - Soil;
    - Flora;
    - Fauna;
    - Microclimate;
    - Topography and views;
    - Drainage; and
    - Minimum habitat size for effective habitat function.
- Plant palette to be used.
- The methodology for habitat creation or restoration, including grading, soil restoration and seeding or planting of the site and the proposed strategies to mitigate the existing degrading factors.
- A 10 year monitoring and management strategy, including monitoring of soil conditions, health, species diversity and abundance (to be incorporated into NS-R3).

The species qualifying for this credit must be native or adaptive plant species and drought and / or saline tolerant, with a proven track record to survive and thrive in an environment similar to the proposed site.

Appropriate candidate areas for habitat creation or restoration include but are not limited to the following *Priority Habitats*: Intertidal Mudflats, Mangroves, Vegetated Sandy Beaches, Seagrass, Coral, Wadis, Sand Sheets and Low Dunes, Interdunal Plains and High Dunes, Alluvial Plains, Jebels, or other significant habitat types.

Where possible, the habitat type to be created must be located in one area of the site and be connected to the same or similar habitat type either within the site or adjacent to the site.

The Credit can also be awarded if a combination of on-site and off-site measures have been implemented but this has to be cleared in advance by the UPC.

Ecological corridors may be fragmented by roads up to Boulevard width, as defined by the UPC Urban Street Design Manual. Underpasses or 'green bridges' must be provided under/over highways to provide continuous habitat.

References

See NS-R1 Natural Systems Assessment

Credit Section
LBo: Livable Outdoors

The Natural Systems part of this document emphasize the primary elements that must be discovered, embraced and nurtured for all forms of life to flourish. This section, Livable Outdoors focus on those elements that influences the quality of human life and are in the direct and deliberate control of the design and development team.

The design of outdoor space is fundamental to an individual's well-being and, as a direct consequence of this, the prosperity of a city. Not only does this relate to public spaces, but also to commercial and private outdoor space.

"Our ultimate goal is to create a cohesive, contemporary and sustainable urban fabric for this new city and prosper as an attractive, livable place that preserves the Emirate's unique culture and environment."

— H.E. Falah Mohamed Al Ahbabi – General Manager, Abu Dhabi Urban Planning Council.

In order to be considered truly sustainable, new development must go beyond the environment to address the other three pillars of Estidama – social, cultural and economic. This requires consideration of issues such as increased mobility and access to community facilities and connectivity and comfort of the public realm to encourage increased pedestrian activity.

Establishing an iterative and inclusive design process where stakeholders and key design professionals can contribute to, and help evaluate, a range of alternative solutions will greatly enhance a development's success in terms of sustainability, livability and market performance.

This section aims to address these issues by encouraging:

- the provision of outdoor space – private, as well as communal, to promote active urban environments;
- the provision of shaded walkways and other measures to provide more thermally comfortable outdoor environments;
- the provision of local amenities;
- the use of alternative modes of transport such as buses, trams and metros (once completed), car sharing, the use of alternative fuel vehicles, cycling and walking; and
- the reduction of urban light pollution.

CREDITS COVERED IN THIS SECTION

LBo	Livable Outdoors					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
LBo-R1	Plan 2030	R	R	R	R	R
LBo-R2	Urban Systems Assessment	R	R	R	R	R
LBo-R3	Outdoor Thermal Comfort Strategy	R	R	R	R	R
LBo-1	Improved Outdoor Thermal Comfort	2	2	2	2	2
LBo-2	Pearl Rated Communities	1	1	1	1	1
LBo-3	Accessible Community Facilities	1	1	1	1	1
LBo-4	Active Urban Environments	1	1	1	1	1
LBo-5	Private Outdoor Space	1	n/a	n/a	1	n/a
LBo-6	Public Transport	3	3	3	3	3
LBo-7	Bicycle Facilities	2	2	2	2	2
LBo-8	Preferred Car Parking Spaces	1	1	1	1	1
LBo-9	Travel Plan	1	1	1	1	1
LBo-10	Light Pollution Reduction	1	1	1	1	1
	TOTAL	**14**	**13**	**13**	**14**	**13**

LBo-R1: Plan 2030

Intent	To ensure that all new development supports the vision for the Emirate of Abu Dhabi, as defined by the applicable Plan 2030, and/or Development Code, and/ or Area Plan.
Credit Requirements	**GENERAL** Demonstrate that the proposed development is located within an Urban Growth Boundary as identified by UPC's adopted Framework Plans. Demonstrate that the proposed development's Floor Area Ratio (FAR), dwelling units per hectare (du/ha), building height, building mass, transportation and open space networks are consistent with the applicable Plan 2030 and/or Development Code and/or Area Plan. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ A letter from the UPC confirming that the proposed development is: ▫ Located within an established Urban Growth Boundary; and ▫ Did not require significant variance or special relief from Plan 2030, Development Code and/or Area Plan for approval.
Credit Submission: Construction Rating	There is no required submission at this stage.
Calculations and Methodology	Development Code relationship to other Plans, Policies and Regulations: ▪ The Development Code will generally conform to Plan 2030. In cases where there is a conflict between the Code and Plan 2030 or Plan Districts, the Code governs. ▪ Outside of Plan Districts, when there are two Code regulations or guidelines on the same subject, the more restrictive governs, except were a less restrictive provision is clearly intended (e.g. greater height around transit stations). ▪ When a Plan District regulation or guideline and a Code regulation or guidelines address the same topic, the Plan District guidelines govern. ▪ When there is no regulation or guideline in a Plan District to address an issue but there is an appropriate regulation or guideline in the general Code, the Code provisions apply. ▪ In case of conflict on any subject with any other plan, policy, regulation or guideline, including affection plans imposed or issued by other agencies in the Emirate of Abu Dhabi, the Code provisions govern. The Code may refer to plans, policies and guidelines, created by the Urban Planning Council, the ADM or external agencies that supplement regulations and guidelines in this Code.
References	▪ Plan 2030 relevant to the site ▪ Development Codes relevant to the site. ▪ Area Plans relevant to the site. Please refer to the UPC and/or Estidama Website for the latest relevant documents or contact the UPC directly.

LBo-R2: Urban Systems Assessment

Intent	To ensure that, before the design process begins, a thorough understanding of the project site is developed within its urban context to better inform project programming, connectivity and built form.
Requirements	**GENERAL** Demonstrate that, before the start of the design process and site clearance, an urban systems assessment has been carried out for the project site and at the following scales: ▪ Local, ▪ Sub-regional, and ▪ Regional scale. Based on the urban systems analysis, identify opportunities and constraints associated with the development and present them in an Urban Systems Assessment Report. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Urban Systems Assessment report including: ▫ Narrative; ▫ Maps; and ▫ Site photographs. Maps, diagrams and site photographs must clearly identify the existing site conditions. ☐ CV of the appointed suitably qualified professional.
Credit Submission: Construction Rating	There is no required submission at this stage
Calculations and Methodology	The urban systems analysis must include a detailed assessment of the following elements, as applicable to the various scales: ▪ Distance and access to community facilities as defined by the UPC Community Facility Requirements; ▪ Significant areas of public interest (e.g. public beaches, cultural and heritage landmarks); ▪ Solar orientation and shading patterns; ▪ Adjoining street patterns; ▪ Access to public transit stops (existing and proposed); ▪ Bicycle and pedestrian paths; ▪ Utility plots and corridors; ▪ Job availability; and ▪ Land uses, including retail centres, food provision and/ or food opportunities (markets, shops, cafés/ restaurants and/or food production plots). Site Scale refers to the project itself, defined by the specific site project boundaries. Local Scale/ Sub-Regional Scale and Regional Scale are to be determined, based on the project size, by the suitably qualified professional.

The Urban Systems Assessment is to be undertaken in combination with NS-R1 Natural Systems Assessment.

The Urban Systems Assessment must be documented as a consolidated assessment report and include the following:

- Narrative- the written component of the report which highlights the key elements, key issues and the opportunities and constraints at the project site, local, sub-regional and regional scale. Additionally, this should include a section which summaries how this information is reflected in the final site plan solution, supported by graphics.
- Maps and Diagrams- the graphic component should highlight the existing situation and opportunities and constraints relating to the elements explored.

A suitably qualified professional is an individual with:

- a degree in a relevant subject (e.g. Architecture, Town Planning and/or Landscape Architecture),
- a minimum of five years relevant work experience,
- a proven track record on working on similar projects in the region.

References

- Plan 2030 (Abu Dhabi, Al Ain, Western Region or Eastern Region) www.upc.gov.ae
- Abu Dhabi Urban Planning Council , Development Review Process www.upc.gov.ae/en/DevelopmentReview/DevelopmentReviewProcess.aspx
- Abu Dhabi Urban Planning Council, Coastal Development Guidelines www.upc.gov.ae

LBo-R3: Outdoor Thermal Comfort Strategy

Intent

To increase outdoor thermal comfort during transition months and reduce thermal discomfort during summer months in public spaces and walkways.

Credit Requirements

General

Demonstrate that an outdoor thermal comfort strategy has been employed to improve the building's exterior microclimate. The strategy is to consider the following as appropriate within the project's specific context:

- Orientation;
- Shading;
- Selection of high-albedo surfaces;
- Ventilation;
- Evaporative cooling;
- Radiative cooling; and
- Thermal mass.

Shade measures (cover or shade) must be provided in all applicable spaces and achieve the following minimum % shading:

Space Type	Minimum % shading
Exterior Surface Parking with more than 10 spaces (including parking on roof surfaces)	40%
Public Open Spaces (including privately owned)	60%
Primary Pedestrian Walkways (based on 1.8m width within the through zone)	75%
Secondary Pedestrian Walkways (based on 1.8m width within the through zone)	75%
Cycle Tracks	50%
Playgrounds	90%

Additional Requirement/Clarifications

- Where cover is provided by structures such as canopies or other architectural elements, the outer surface of the shading element must have a minimum Solar Reflectance Index (SRI) of 29.
- Shade from trees is to be measured at 3 years growth.
- Public realm spaces shade requirements excludes active recreational areas such as playing fields and ball courts.

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ Outdoor Thermal Comfort Strategy report highlighting all measures contributing to improving the building's exterior microclimate including:
  - narrative;
  - drawings of the public realm spaces and priority shade areas;
- ☐ Plan and tabulated results showing achievement of % of shading of applicable spaces at 1:00pm clock time on the Equinox and Summer Solstice; and
- ☐ Extracts from specifications relating to the SRI of all cover elements.

Credit Submission: Construction Rating	☐ Updated outdoor thermal comfort strategy including narrative supported by as-built drawings and photographs of the applicable shade areas, highlighting all measures contributing to improving the exterior microclimate, including planned or existing features; and ☐ Evidence that all purchased and installed covers have compliant outer surface SRIs.
Calculations and Methodology	▪ Primary pedestrian walkways are those located along boulevards, avenues, streets or access lanes as defined in the Abu Dhabi Urban Street Design Manual (Chapter 5). ▪ Secondary pedestrian walkways are all other walkways, including sikkas. ▪ Through zones are defined in the UPC Urban Street Design Manual. ▪ Shade calculations must be undertaken on the equinox (March 21st) and the summer solstice (June 21st) at 1.00pm clock time. The compliant shaded area must be in shade at both the equinox and summer solstice. ▪ In all calculations, shade from adjacent buildings and / or structures can be included. ▪ Dappled shade of more than 60%, such as that created by a grid or lattice, may be considered fully shaded. Dappled shade less than 60% must be calculated based on the actual shaded portion. ▪ SRI values for the outer surface of cover elements can be calculated based on solar reflectance and emittance numbers as defined in the American Society of Testing and Materials Standard E1980-01. Alternatively manufacturer's evidence can be supplied where the testing is in accordance with the referenced standards below.
References	▪ ASTM E1980 - 01 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces ▪ ASTM E1918-06, Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field ▪ ASTM C1549-09, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer ▪ ASTM E 408-71(2008), Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques ▪ ASTM C1371-04a, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers ▪ Abu Dhabi Urban Street Design Manual ▪ Community facilities requirements, Urban Planning Council Please refer to the UPC and/or Estidama Website for the latest relevant UPC documents or contact the UPC directly.

LBo-1: Improved Outdoor Thermal Comfort

Intent

To improve outdoor thermal comfort during transition months and further reduce thermal discomfort during summer months in public spaces and walkways.

Credit Requirements

General

Demonstrate that the outdoor thermal comfort strategy has been improved beyond the minimum established under credit LBo-R3 Outdoor Thermal Comfort Strategy by increasing the shade measures as follows :

Space Type	1 Credit Point	2 Credit Points
Surface car parking (including parking on roof surfaces)	50 %	55 %
Public Open Space (including privately owned)	65 %	70 %
Primary Pedestrian Walkway (based on 1.8m width within the through zone)	80 %	85 %
Secondary Pedestrian Walkway (based on 1.8m width within the through zone)	80 %	85 %
Cycle tracks	55 %	65 %

Additional Requirement/Clarifications

- Where cover is provided by structures such as canopies or other architectural elements, the outer surface of the shading element must have a minimum Solar Reflectance Index (SRI) of 29.
- Shade from trees should be measured at 3 years growth.
- Public open space shade requirements exclude active recreational areas such as playing fields and ball courts.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Meet shading requirements for 1 credit point.
2	Meet shading requirements for 2 credit points.
2 (maximum)	**Construction Rating**
1	Meet shading requirements for 1 credit point.
2	Meet shading requirements for 2 credit points.

Credit Submission: Design Rating

- ☐ Updated Outdoor Thermal Comfort Strategy report from LBo-R3 with additional section that compares and demonstrates shading improvements;
- ☐ Plan and tabulated results showing achievement of % of shading of applicable spaces at 1:00pm clock time on the Equinox and Summer Solstice; and
- ☐ Extracts from specifications relating to the SRI of all cover elements.

Credit Submission: Construction

- ☐ Updated outdoor thermal comfort strategy including narrative supported by as-built drawings and photographs of the applicable shade areas, highlighting all measures contributing to improving the exterior microclimate, including planned or existing

Rating	features; and ☐ Evidence that all purchased and installed covers have compliant outer surface SRIs.
Calculations and Methodology	▪ Primary pedestrian corridors are those pedestrian networks located along boulevards, avenues, streets or access lanes as defined in the Abu Dhabi Urban Street Design Manual (Chapter 5). ▪ Secondary pedestrian walkways are all other walkways, including sikkas. ▪ Through zones are defined in the UPC Urban Street Design Manual. ▪ Shade calculations must be undertaken on the equinox (March 21st) and the summer solstice (June 21st) at 1.00pm clock time. The compliant shaded area must be in shade at both the equinox and summer solstice. ▪ In all calculations, shade from adjacent buildings is to be included. ▪ Dappled shade of more than 60%, such as that created by a grid or lattice, may be considered fully shaded. Dappled shade less than 60% must be calculated based on the actual shaded surface. ▪ SRI values for the outer surface of cover elements can be calculated based on solar reflectance and emittance numbers as defined in the American Society of Testing and Materials Standard E1980-01. Alternatively manufacturer's evidence can be supplied where the testing is in accordance with the referenced standards in LBo-R3.
References	▪ Refer to LBo-R3 Outdoor Thermal Comfort Strategy.

LBo-2: Pearl Rated Communities

Intent

To encourage new buildings to be built within Pearl Rated communities.

Credit Requirements

General

Demonstrate that the building location is within a Pearl Rated community.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Demonstrate that the building is located within a Pearl Rated community.
1 (maximum)	**Construction Rating**
1	Demonstrate that the building is located within a Pearl Rated community.

Credit Submission: Design Rating

☐ Pearl Community Rating Certificate for the community in which the building is located.

Credit Submission: Construction Rating

☐ Pearl Community Rating Certificate for the community in which the building is located.

Calculations and Methodology

None

References

None

LBo-3: Accessible Community Facilities

Intent

To minimize reliance on private car use by locating buildings in areas with a mix of uses and amenities.

Credit Requirements

GENERAL

Demonstrate the building is located within 350m safe walking distance (from the building entrance to any publicly accessible building entrance) of any five of the following:

- Mosque
- Women's Center / Youth center
- Kindergarten / Daycare
- School
- Library
- Post Office
- Police station
- Medical Services / Pharmacy
- Grocery store or supermarket
- Public open space that contains shaded playgrounds and/or shaded picnic areas
- Retail comprising any of :
  - Bank / ATM
  - Restaurant
  - General Retail shopping

Facilities inside a building also count towards this Credit.

Amenities scheduled for opening within three years of the project's construction completion can contribute to the project meeting the Credit Requirements.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Demonstrate that the building is located within 350m safe walking distance of any of the five listed amenities.
1 (maximum)	**Construction Rating**
1	Demonstrate that the building is located within 350m safe walking distance of any of the five listed amenities.

Credit Submission: Design Rating

- ☐ Brief narrative demonstrating how the project meets the requirements, including a list of all qualifying facilities;
- ☐ Land use map indicating the locations of all amenities meeting the criteria, and pedestrian walking routes from the building to the amenities, noting specific distances for each route; and
- ☐ For amenities scheduled to open within three years of the building construction completion date, provide a copy of the development approval or other evidence from the municipality.

Credit Submission:

- ☐ Updated narrative on how the project meets the Credit Requirements, including an updated list of all qualifying facilities;

Construction Rating	☐ Updated land use map indicating the locations of all amenities meeting the criteria and the pedestrian walking routes from the building to the amenities, noting specific distances for each route; and ☐ For amenities scheduled for opening within three years of the building construction completion date, provide a copy of the development approval or other evidence from the municipality.
Calculations and Methodology	Walking distances must be calculated using actual safe pedestrian routes from the main entrance of the building to the main entrance of the facility.
References	▪ Abu Dhabi Urban Planning Council *Development Code*, www.upc.gov.ae

LBo-4: Active Urban Environments

Intent

To encourage active lifestyles by providing building occupants and users with recreational public open spaces.

Credit Requirements

GENERAL

Demonstrate that outdoor spaces have been provided and programmed to encourage activity, including sport and recreation. The spaces must be specifically developed for any of, or any combination of, the following:

- Landscaped areas for recreation;
- Playground areas; and/or
- Sports field areas.

Develop and implement an Active Urban Environment Program which details the programming of spaces for the following types of uses:

- communal;
- women and children only; and
- men only.

If sports fields areas are provided, demonstrate that accessible showers and change rooms are located within 350 meters walking distance.

Funding arrangements must be in place for maintenance.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Demonstrate provision of outdoor spaces compliant with the Credit Requirements.
1 (maximum)	**Construction Rating**
1	Demonstrate provision of outdoor spaces compliant with the Credit Requirements.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project meets the Credit Requirements including planned uses for the area, accessibility and maintenance arrangements; and
- ☐ Site plans, marked up to clearly demonstrate how the area meets the requirements highlighting the planned uses for the area, including communal areas, areas for woman and children only, men only, and accessible shower locations.

Credit Submission: Construction Rating

- ☐ As-built site plans marked up to clearly demonstrate how the area meets the use requirements highlighting the uses for the areas; and
- ☐ Photographs of the areas.

Calculations and Methodology

None

References

None

LBo-5: Private Outdoor Space

Intent

To improve the occupiers quality of life by providing private outdoor space.

Credit Requirements

General

This credit is only applicable to residential developments.

Demonstrate that a private outdoor space is provided for at least 90% of the residential units. This space must be equal in size to at least 10% of the internal floor area of its associated unit and be a minimum of 2.0m wide x 3.0m long.

To qualify for the credit, the private external spaces must have the following characteristics:

- Be directly adjacent to and directly accessible from the unit;
- 95% of the balconies must be at least 90% shaded from direct sunlight for a minimum of three hours between 9am and 5pm, as measured on 21st July; and
- Include a facility for drying clothes outdoors in a visually shielded area.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Residential Only: Provide 90% of units with outdoor amenity space as per the Credit Requirements
1 (maximum)	**Construction Rating**
1	Residential Only: Provide 90% of units with outdoor amenity space as per the Credit Requirements

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project meets the Credit Requirement, including calculations demonstrating compliance with the space requirement;
- ☐ Floor plan for all unit layouts clearly indicating size of the unit and the outdoor space, the location of outdoor space, access from the unit and design details of clothes drying area;
- ☐ Drawings of the façade, plans, balconies, projections and shading devices including materials;
- ☐ Evidence of any design features to mitigate or control solar penetration or climatic extremes (e.g. double skin envelopes); and
- ☐ Report including a detailed hour by hour summary, including computer model snapshots, of each balcony floor for each of the three successful shaded hours.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project meets the Credit Requirement, including calculations demonstrating compliance with the space requirement;
- ☐ As built typical floor plan for all unit layouts clearly indicating size of the unit and the outdoor space, the location of outdoor space, access from the unit and design details of clothes drying area;
- ☐ As-built drawings of the façade, plans, balconies, projections and shading devices (including materials) and any other design features to mitigate or control solar penetration or climatic extremes (e.g. double skin envelopes); and
- ☐ Report including a detailed hour by hour summary, including computer model

	snapshots, of each balcony floor for each of the three successfully shaded hours. The report from the Design Rating can be submitted provided there have been no changes to the design.
Calculations and Methodology	For every unit size, calculations must indicate total indoor unit area in square meters, size of qualifying outdoor area in square meters and the relationship of the size of the outdoor area to the indoor area expressed as a percentage. External Shading of Balcony Percentage Calculation: Calculation of the shade percentage must be undertaken by measuring the total shaded area of each balcony over each whole hour between the times specified on 21st July.
References	None

LBo-6: Public Transport

Intent

To encourage the use of public transport by building occupants and visitors.

Credit Requirements

General

Demonstrate that the building is within 350 meters actual safe walking distance to public transport nodes as follows:

- 2 Credit Points: at least one tram and/or bus stop with maximum 15 minute midday single-direction frequency.
- 3 Credit Points: where the above requirement is met AND the project is also within 350m safe walking distance of a metro or regional rail station.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
3 (maximum)	**Design Rating**
2	Demonstrate that the building is within 350m of a tram and/or bus stop with a 15 minute frequency.
3	Demonstrate that the building is also within 350m of a metro or regional rail station.
3 (maximum)	**Construction Rating**
2	Demonstrate that the building is within 350m of a tram and/or bus stop with a 15 minute frequency.
3	Demonstrate that the building is also within 350m of a metro or regional rail station.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project meets the Credit Requirements, including the number of transit stops, the distance to each and the frequency of service accessible at each stop;
- ☐ Site plan of building and surrounding environment clearly marked to indicate locations of all transit stations, the safe pedestrian walking routes from the project to the station and the distances of each route; and
- ☐ For planned public transport, confirmation from the Department of Transport (DOT) of the timetable for opening of the services must be referenced.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project meets the Credit Requirements, including the number of transit stops, the distance to each and the frequency of service;
- ☐ As-built site plan of building and surrounding environment clearly marked to indicate locations of all transit stations, the safe pedestrian walking routes from the project to the station and the distances of each route; and
- ☐ For planned public transport, confirmation from the Department of Transport (DOT) of the timetable for opening of the services referenced.

Calculations and Methodology

Route length will be calculated along the most direct safe pedestrian route, from the main building entrance to the transport node.

Planned and funded metro or light rail transit stations can contribute to the project meeting the Credit Requirements if they are scheduled for opening within three years of construction completion of the project.

Planned bus stops and routes can contribute to the project meeting the Credit Requirements if they are scheduled for operation within a year of construction completion of the project. Confirmation of frequency of the bus service is required for the transport company due to operate the service.

References

- *Surface Transport Masterplan*, Abu Dhabi Department of Transport, April 2009, www.dot.abudhabi.ae

LBo-7: Bicycle Facilities

Intent

To minimize greenhouse gas emissions, improve connectivity and encourage bicycle use (particularly during the cooler winter months).

Credit Requirements

General

Demonstrate commitment to sustainable travel through provision of cycle parking in safe, secure and convenient locations.

- 1 Credit Point: An appropriate number of cycle parking spaces (for each building type), of the appropriate quality, must be provided at a convenient location. All parking spaces must comply with the following:
  - The stands must be solid (and securely fixed to the ground) and allow both the wheel and the frame of the cycle to be locked safely to the structure (ideally u-shaped steel structure type 'Sheffield' stands or similar);
  - Each bicycle space must be at least 2 x 0.75 m;
  - There must be an aisle at least 1.5m wide alongside the bicycle parking to allow for bicycle maneuvering;
  - All parking spaces must be shaded; and
  - If the parking is not visible from the street and the building, clear signage must be provided; and
  - Specifically for:
    - Long-term commuter parking (for commuters and residents): The occupant parking must be off the street either inside a communal bicycle parking room/area (this can be internal or external provided it is sheltered and secure) or conveniently located within a garage (with safe entrance and exit point for bicycles only); or
    - Short-term visitor parking (for visitors and students): All of the stands must be located within 30m walking distance of the entrance point of the building and be conveniently accessible for everybody from the adjacent road/ cycle path.

- 2 Credit Points: In addition to above, provide shower facilities for staff at a minimum of one shower per gender for every 5,000 m^2, or fraction thereof, of GFA, up to a maximum of 10 showers per gender. Provide adjacent dedicated clothes changing areas (separate areas for men and women) and clothes lockers provided at a ratio of one locker per bicycle parking space.

Please note this this criteria is not applicable to Multi- Residential – see below for specific details for Multi-Residential.

Additional Requirement/Clarifications

Offices

Provide bicycle parking spaces catering for both commuters and visitors according to below:

- Long-term commuter parking: A minimum of 1 space per 500 m^2 GFA
- Short-term visitor parking: A minimum of 1 space per 500 m^2 GFA

Retail

Provide bicycle parking spaces catering for both commuters and visitors according to below:

- Long-term commuter parking: A minimum of 1 space per 500 m^2 GFA
- Short-term visitor parking: A minimum of 1 space per 500 m^2 GFA

Multi-Residential Buildings

Provide bicycle parking spaces catering for both occupants and visitors according to below:

- Long-term occupant parking: A minimum of 1 space per unit
- Short-term visitor parking: A minimum of 1 space per 4 units

2 Credit Points: In addition to above, provide cycling paths on the development site complying with the following:

- Cycle lanes providing direct access to any cycle storage facilities provided on the site;
- Cycle lanes connecting to any cycle lanes outside the development boundaries and/ or connecting to adjacent roads;
- The cycle lanes meet the following minimum dimensions:
    - Where pedestrian and cycle routes are shared the minimum total width of the combined path is 3m;
    - Where the cycle lane is segregated from both the pedestrian route and carriageway the minimum width of the cycle path is 2m; and
- The routes must also comply with the Urban Street Design Manual.

Schools

Provide bicycle parking spaces catering for both commuters and visitors according to below:

- Long-term commuter parking: A minimum of 1 space per classroom
- Short-term visitor parking: A minimum of 2 spaces per classroom (schools up to K-6 are exempt from this requirement)

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Meet the Credit Requirements for bicycle parking facilities according to above.
1	Meet the Additional Credit Requirements for shower, locker and changing facilities and/or cycle lanes according to above.
2 (maximum)	**Construction Rating**
1	Meet the Credit Requirements for bicycle parking facilities according to above
1	Meet the Credit Requirements for shower, locker and changing facilities and/or cycle lanes according to above.

Credit Submission: Design Rating

- ☐ Brief narrative with calculations showing how the project meets the Credit Requirements, including numbers of bicycle parking spaces, location of parking, type of stands and security arrangements, description of any cycle paths, showers and clothes lockers; and
- ☐ Plans and/or drawings showing the location of the bicycle and shower facilities, distances from main building entrances, locations of signage and/or cycle paths, as appropriate.

Credit Submission: Construction Rating

- ☐ Updated narrative with calculations showing the project meets the Credit Requirements, including numbers of bicycle parking spaces, where the parking is situated, type of stands and security arrangements, description of any cycle paths, showers and clothes lockers;
- ☐ As-built plans and/or drawings showing the location of the bicycle and shower facilities, distances from main building entrances, locations of signage and/or cycle paths, as appropriate; and
- ☐ Photographs of cycle parking spaces, changing facilities, clothes lockers and cycle lanes as appropriate.

Calculations and

The bicycle parking also must to comply with all the minimum requirements as set out

Methodology	by the Abu Dhabi Urban Planning Council's *Development Code*. The distance from the furthest cycle parking stand to the nearest building access is the safe walking distance. The submitted drawings will be expected to show the means of access to the external highway/cycle paths from the parking spaces. The number of bicycle spaces can be halved if a public bicycle sharing scheme is in place. In order to comply the sharing scheme needs to meet the following requirements: ▪ Bicycles are available at strategic locations throughout the city; ▪ The average distance between service terminals in inner city locations is around 500 m; ▪ The service terminal is located within 500m of the building entrance; and ▪ The scheme is open to everybody and operated in a way as can be seen as 'bicycle transit' i.e. intended to be used for one way rides to work, (e.g. education, shopping centers etc).
References	▪ Abu Dhabi Urban Planning Council's *Development Code*, www.upc.gov.ae ▪ Abu Dhabi Urban Planning Council's *Urban Street Design Manual*, 2010, www.upc.gov.ae

LBo-8: Preferred Car Parking Spaces

Intent

To encourage car sharing and more fuel-efficient forms of personal transport.

Credit Requirements

General

6% of parking spaces provided must be identified for the sole use of priority vehicles (electric vehicles, gas vehicles and hybrids or those forming part of a defined and approved car-sharing scheme or car club).

The spaces must be optimally located for building access and half of the spaces must be supplied with vehicle charging points.

Additional Requirement/Clarifications

A mechanism of enforcement of the above restrictions must be implemented to ensure that access to the priority spaces is safeguarded for priority vehicles.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Design Preferred Parking Spaces complying with the Credit Requirements.
1 (maximum)	**Construction Rating**
1	Provide Preferred Parking Spaces complying with the Credit Requirements.

Credit Submission: Design Rating

- ☐ Floor plans showing locations of all Preferred Parking Spaces and charging points;
- ☐ Extracts from specifications indicating provision of suitable charging points and electrical system capable of supplying the required charging load; and
- ☐ Evidence of an enforcement scheme.

Credit Submission: Construction Rating

- ☐ As-built floor plans showing locations of all Preferred Parking Spaces and charging points;
- ☐ Photos of typical Preferred Parking Spaces indicating location and signage;
- ☐ As-built mechanical drawings indicating provision of suitable charging points and electrical system capable of supplying the required charging load; and
- ☐ Evidence of an enforcement scheme.

Calculations and Methodology

The means of enforcing the preferred use of priority parking spaces is at the discretion of the building user/operator but evidence of a robust strategy will be expected to be demonstrated.

Preferred Car Parking Spaces are spaces specifically:

- for electric vehicles, gas vehicles and hybrids or those forming part of a defined and approved car-sharing scheme or car club;
- supplied with vehicle charging points; and
- are optimally located for the building access.

References

None

LBo-9: Travel Plan

Intent

To reduce single occupancy vehicle use by managing the demand for travel and by maximizing the availability of alternatives to traveling by car.

Credit Requirements

General

Demonstrate the development of a Travel Plan. The Travel Plan must include:

- details of the type of measures proposed to manage the demand for travel by car;
- targets for reducing car travel;
- means of monitoring the effectiveness of the Plan; and
- remedial measures that will be implemented in the event that the stated targets are not delivered.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Develop a Travel Plan for the project.
1 (maximum)	**Construction Rating**
1	Update and implement the Travel Plan for the project.

Credit Submission: Design Rating

☐ Travel Plan. The plan will be expected to include details of:

- Proposed targets for the reduction in single occupancy car journeys;
- The type of measure likely to form part of the plan for delivering the stated target;
- The program of monitoring and review to record the effectiveness of the plan; and
- Details of mitigating measures to be initiated in the event that the stated plan targets are not achieved.

Credit Submission: Construction Rating

☐ Updated Travel Plan, as set out in Design Submission requirements above; and

☐ Evidence that Travel Plan has been implemented.

Calculations and Methodology

Successful plans will be expected to secure reductions in single-occupancy car use by between 5% and 10% in the first three years of operation.

References

- Abu Dhabi Department of Transport *Surface Transport Plan* 2009, www.dot.abudhabi.ae
- Abu Dhabi Urban Planning Council, www.upc.gov.ae

LBo-10: Light Pollution Reduction

Intent

To encourage the reduction of night time light pollution and its associated impacts on human and ecological health.

Credit Requirements

GENERAL

Demonstrate that the project meets the following lighting requirements:

Interior lighting

- The angle of maximum candela from each interior luminaire, as positioned in the building, must not exit through the windows. Alternatively, all non-emergency interior lighting must be controlled to automatically turn off outside the normal hours of occupancy. Manual override must be enabled to allow for any out-of-hours use.

Exterior lighting

- All non safety and security external lighting, including display, advertising and speciality lighting, must be automatically switched off between 23.00hrs and 07.00hrs and outside these hours if daylight levels are sufficient.
    - If safety lighting is provided and will be used between 23.00hrs and 07.00hrs, this part of the lighting system must comply with the lower levels of lighting recommended during these hours by IESNA RP-33-99 and IES RP-8. For example by using an automatic switch to reduce the lighting levels at 23.00 or earlier.
    - If security lighting is provided, it must be activated using motion sensors so that luminaires only turn on when someone is in the immediate area.

Lighting levels at the boundary and beyond

- All projects must be classified under one of the zones defined in the IECC 2009 Exterior Lighting Table 505.6.2(1). The exterior lighting must be designed to meet the following requirements:

Lighting Zone	Maximum Initial Illuminance at Site Boundary, Lux	Maximum Initial Illuminance at Specified Distance Beyond Site Boundary, Lux	Maximum % Uplight
LZ1: Parks and rural areas	<1	N/A	0%
LZ2: Residential areas	1.1	<1 at 3 meters	2%
LZ3: All other areas	2.2	<1 at 4.5 meters	5%

The percentage uplight is the percentage of the total initial designed fixture lumens emitted at an angle of 90 degrees or higher from nadir (straight down). Only the portion of uplight leaving the site is included. For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

If there is no external lighting on or around the assessed building, the credit will be awarded by default.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Demonstrate light pollution reduction in compliance with the Credit Requirements.
1 (maximum)	**Construction Rating**
1	Demonstrate light pollution reduction in compliance with the Credit Requirements.

Credit Submission: Design Rating

- ☐ Internal lighting layouts demonstrating that the maximum candela from internal luminaires does not exit through any transparent/translucent building surfaces, OR, that controls have been installed to automatically turn off interior lighting outside normal occupancy hours with a manual override capability to enable out-of-hours use;
- ☐ External lighting drawings and details of lighting controls and locations of daylight sensors. Specification and luminaire schedule confirming mounting heights and all information relating to the aiming of each luminaire;
- ☐ Control Strategy confirming which luminaires will be turned off during curfew and which luminaries will operate at the reduced levels. Specification confirming that the safety or security lighting used between 23.00 and 07.00 complies with the lower levels of lighting recommended in IESNA RP-33-99 and IES RP-8; and
- ☐ Report detailing the lighting calculations for the external lighting demonstrating that the required illuminances, both at the site boundary and at the specified distance beyond, and percentage uplight limits have been met.

Credit Submission: Construction Rating

- ☐ Revised Design submission to reflect any changes in the constructed building;
- ☐ As built electrical specifications and drawings confirming external lighting (including security lighting) and controls; and
- ☐ Photographic evidence confirming:
  - External lighting and controls; and
  - Cutoff luminaires, if provided, have been angled to limit spill light to potentially obtrusive directions.

Calculations and Methodology

Calculations must consider, at a minimum, lights such as: security, feature, foyer, display, landscape, car park lighting, external signage and advertising, 24 hour office lighting, and any light visible through skylights and atria.

High structure aircraft hazard lights are excluded from the calculations.

Any floodlighting used, for example for school sports grounds, for a limited amount of time in the evening can also be excluded from the calculations.

Safety lighting – Lighting provided to enhance occupant safety, often used outside of daylight hours to provide sufficient light levels to enable safe use of areas such as main entrances, pathways, steps and car parks.

Security lighting - Lighting provided to deter intruders and protect property.

References

- International Energy Conservation Code (IECC) 2009, www.energycodes.gov
- Illuminating Engineers Society of North America, IESNA RP-33-99, www.iesna.org
- Illuminating Engineering Society IES RP-8, www.iesna.org

Credit Section
LBi: Livable Indoors

Most people spend over 80 percent of their lives indoors[1] and considerable research links time spent indoors to health and wellbeing related issues. Creating a 'livable indoors' is therefore of benefit to all people and hence all buildings in Abu Dhabi.

Further research suggests that green buildings with improved indoor environmental quality can reduce the number of work days lost to sick leave by approximately three days per person per annum[2]. Similarly, an increase of almost five percent in productivity has been attributed to healthier indoor environments.

This credit section assists in developing buildings that address the challenges of improving occupant health and wellbeing whilst fostering economic growth anticipated from productivity gains, staff retention and reduced absenteeism.

The livable indoors section introduces many aspects that are important in the design of a building interior such as:

- Indoor Air Quality Management practices during construction and after occupation;
- Ventilation quality during normal building operation;
- Material selection to reduce harmful emissions;
- Improving thermal comfort by promoting beneficial design practices and outcomes that foster a well thought through HVAC strategy and a greater degree of occupant control; and
- Use of natural daylight, which is consistent and abundant in the region, together with appropriate artificial lighting aims to create visually comfortable environments.

In particular, the main theme of this section was based on the following primary considerations in relation to what constitutes a healthy and comfortable indoor environment:

When reviewing the livable indoors components, consideration must also be given to how they will relate to other aspects of the Pearl Rating System, such as the balance and inter-relationship with energy consumption.

1 EHSMS CoP 11 – Air Quality V1.2 July 2009, Environment Agency, Abu Dhabi.
2 CB Richard Ellis & University of San Diego, "Do green buildings make dollars and sense?", 2009

CREDITS COVERED IN THIS SECTION

LBi	Livable Indoors					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
LBi-R1	Healthy Ventilation Delivery	R	R	R	R	R
LBi-R2	Smoking Control	R	R	R	R	R
LBi-R3	Legionella Prevention	R	R	R	R	R
LBi-1	Ventilation Quality	3	3	2	3	3
LBi-2.1	Material Emissions : Adhesives & Sealants	1	1	1	1	1
LBi-2.2	Material Emissions : Paints & Coatings	1	1	1	1	1
LBi-2.3	Material Emissions : Carpet & Hard Flooring	1	1	1	1	1
LBi-2.4	Material Emissions : Ceiling Systems	1	1	1	1	1
LBi-2.5	Material Emissions : Formaldehyde Reduction	2	2	2	2	2
LBi-3	Construction Indoor Air Quality Management	2	2	2	2	2
LBi-4	Car Park Air Quality Management	1	1	1	1	1
LBi-5.1	Thermal Comfort & Controls : Thermal Zoning	1	1	1	1	1
LBi-5.2	Thermal Comfort & Controls : Occupant Control	2	2	n/a	2	2
LBi-5.3	Thermal Comfort & Controls : Thermal Comfort Modeling	2	2	2	2	2
LBi-6	High Frequency Lighting	1	1	1	1	1
LBi-7	Daylight & Glare	2	2	n/a	2	2
LBi-8	Views	1	1	n/a	1	1
LBi-9	Indoor Noise Pollution	1	1	1	1	1
LBi-10	Safe & Secure Environment	1	1	1	1	2
	TOTAL	**23**	**23**	**17**	**23**	**24**

LBi-R1: Healthy Ventilation Delivery

Intent	To protect the quality of air drawn into buildings for ventilation and to ensure minimum delivery of outdoor fresh air.
Credit Requirements	**GENERAL** Undertake and document an observational survey of local air quality according to sections 4.2 and 4.3 of ASHRAE 62.1.2007. Demonstrate that the building mechanical system meets the following requirements: ▪ Separation distances between outdoor air intakes and any exhausts or discharge points comply with ASHRAE 62.1.2007 or local code whichever is more stringent; ▪ All exhausts are located outside of the defined public realm or as defined by local code, whichever is more stringent; and ▪ Demonstrate that all of the occupied areas in the building comply with the minimum thresholds set out in ASHRAE 62.1:2007 using the ventilation rate procedure or local code, whichever is more stringent. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Documentation of an observational study of local air quality including photographs of surrounding sources of pollutant emissions; ☐ Mechanical system drawings marked-up to clearly show distances between air intake points and exhaust air or other discharge points and the distances from the air exhaust points to any defined public realm areas; ☐ Narrative describing how the mechanical design system meets the Credit Requirements, including description of mechanical ventilation system; and ☐ Spreadsheet calculations of fresh air ventilation rates based on the ventilation rate procedure for all zones.
Credit Submission: Construction Rating	☐ As-built mechanical system drawings marked-up to clearly show distances between air intake points and exhaust air or other discharge points and the distances from the air exhaust points to any defined public realm areas; ☐ Narrative describing how the mechanical design system meets the Credit Requirements, including description of mechanical ventilation system; and ☐ Commissioning results demonstrating compliance with minimum fresh air ventilation rate requirements.
Calculations and Methodology	The calculation process to determine minimum fresh air rates for various space usage types are documented in the reference standard.
References	▪ ASHRAE 62.1.2007 “Ventilation for Acceptable Indoor Air Quality”, www.ashrae.org

LBi-R2: Smoking Control

Intent

To eliminate or minimize exposure of building occupants to the harmful effects of tobacco smoke.

Credit Requirements

General

Demonstrate appropriate measures are incorporated into the building design to reduce exposure to tobacco smoke:

- Demonstrate that smoking is prohibited throughout the building(s) including car parks;
- Establish 25m smoke free zones around all entrances, outdoor air intakes and operable windows;
- Train all security staff for smoking control within and outside buildings;
- Locate any dedicated external smoking areas away from public or high use pedestrian thoroughfares and install suitable facilities for collecting ash and cigarette ends; and
- Install signage that at a minimum lists the negative health impacts of smoking and provides details on where to seek assistance for those aiming to stop smoking, visible in all dedicated external smoking areas.

Additional Requirement/Clarifications

Residential

- All residential units must be sealed with impermeable deck to deck partitions along the whole perimeter of the unit. All penetrations in walls, floors and ceilings must be sealed. All internal doors leading from residential units to common areas or between residential units must be weather-stripped. No smoking will be permitted within any and all common areas of the building including car parks.
- Establish 25m smoke free zones around all entrances, outdoor air intakes and operable windows.

Schools

- Smoking must be prohibited throughout school buildings and associated school grounds.

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ Written commitment from the building owner/developer that there will be a no smoking policy operated within the building (or common areas for residential buildings or additionally for school grounds) by inclusion in Contracts of Sale and Lease/Rent Agreements that smoking will be banned by future owners and tenants;
- ☐ Extracts from specifications and/or drawings indicating the locations of posted signage stating that the entire building is a no smoking environment and detailing the negative health impacts of smoking installed in all dedicated external smoking areas;
- ☐ Drawings indicating the location of dedicated outside smoking areas and facilities for collecting ash and cigarette ends which clearly indicate their distance from entrances, operable windows and air intakes; and
- ☐ For residential units, provide specifications for weather-stripping of doors and drawings that highlight impermeable deck to deck partitioning.

Credit Submission: Construction Rating

- ☐ Updated written commitment (if relevant) from the building owner / developer that there is a no smoking policy operated within the building (or common areas for residential buildings or additionally for school grounds) by inclusion in Contracts of Sale and Lease/Rent Agreements that smoking will continue to be banned by future owners and tenants;

- ☐ Photos of posted no smoking and health impact signage and facilities for collecting ash and cigarette ends;
- ☐ As-built drawings indicating the location of dedicated outside smoking areas and facilities for collecting ash and cigarette ends which clearly indicate their distance from entrances, operable windows and air intakes;
- ☐ Copy of training material for security staff; and
- ☐ For residential units provide in addition to the above, purchase receipts of weather-stripping and the following photographic evidence:
  - Weather-stripping installation;
  - Impermeable deck to deck partitioning installation; and
  - Sealing of penetrations to walls, floor and ceilings.

Calculations and Methodology	None
References	None

LBi-R3: Legionella Prevention

Intent	To manage the risk of Legionella in water based building systems.
Credit Requirements	**GENERAL** ▪ Develop and implement a Legionella Management Plan for all relevant water based systems; ▪ Follow the requirements and guidance in Part 1 and Part 2 of 'Legionnaire's Disease- The Control of Legionella Bacteria in Water Systems', Approved Code of Practice and Guidance (L8), 3rd Edition 2000, UK Health and Safety Executive; and ▪ Implement the Legionnaire Management Plan for all at risk water based systems. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Narrative and drawings of the air conditioning systems regardless of whether water-based cooling towers are present or not. The Narrative must explain the approach to Legionella Management, or confirm no water-based systems are present; ☐ Narrative and drawings of the project's other water-based systems; and ☐ Legionella Management Plan for the treatment of Legionella in the project's water-based systems.
Credit Submission: Construction Rating	☐ Operations & Maintenance Manual (OMM); ☐ Narrative and As-Built drawings of the air conditioning systems regardless of whether water-based cooling towers are present or not. The Narrative must explain the approach to Legionella Management and how it integrates into the OMM, or confirm no water-based systems are present; ☐ Narrative and As-Built drawings of the project's other water-based systems. The Narrative must explain the approach to Legionella Management and how it integrates into the OMM; ☐ Legionella Management Plan for the treatment of Legionella in the project's water-based systems; and ☐ All Audit checklists associated with the Legionella Management Process including but not limited to plant installation and commissioning, testing, training and competency and record keeping.
Calculations and Methodology	The Legionella Management Plan must be set out in accordance with Part 1 of 'Legionnaire's Disease- The Control of Legionella Bacteria in Water Systems', Approved Code of Practice and Guidance (L8), 3rd Edition 2000, UK Health and Safety Executive. Relevant water based systems include but are not limited to: ▪ Water systems incorporating a cooling tower; ▪ Water systems incorporating an evaporative condenser; ▪ Hot and cold water systems; ▪ Other plant and systems containing water which is likely to exceed 20ºC and which may release a spray or aerosol during operation OR when being maintained; ▪ Humidifiers; ▪ Air washers; ▪ Spa baths and Pools; ▪ Car / bus washes; ▪ Wet scrubbers;

- Fountains and Water features (Indoor and Outdoor); and
- Sprinkler and hose reel systems.

The Legionella Management Plan must include:

- Risk Identification and Risk Assessment;
- Risk Management Plan for management responsibilities, training & competence;
- An Exposure Risk Prevention or Control Plan;
- Record Keeping Plan; and
- Responsibility Plan for manufacturers, importers, suppliers & installers.

A 'water system' or 'water based system' includes all plant / equipment and components associated with that system e.g. All associated pipe work, pumps, feed tanks, valves, showers, heat exchangers, quench tanks, chillers etc. The system must be considered as a whole and not as isolated parts / components. Dead legs and parts of the system used intermittently must be included as part of the system.

References

- 'Legionnaire's Disease- The Control of Legionella Bacteria in Water Systems', Approved Code of Practice and Guidance (L8), 3rd Edition 2000, UK Health and Safety Executive, www.hse.gov.uk
- Control of Legionella bacteria in water systems: Audit Checklists, 2003, UK Health and Safety Executive, www.hse.gov.uk

LBi-1: Ventilation Quality

Intent

To promote the provision of building systems that support the wellbeing and comfort of occupants by providing sufficient outside air ventilation.

Credit Requirements

GENERAL

Demonstrate that all of the occupied areas meet the following, as appropriate for the type of ventilation:

Mechanical Ventilation

- 1 Credit Point: Install permanent carbon dioxide (CO_2) monitoring and alert systems to ensure the adequate provision of outside air at all times. At a minimum, one CO_2 sensor must be installed at each return point. The CO_2 level must not be allowed to exceed 1000ppm.
- 1 Credit Point: After achieving the above credit point, demonstrate an increase in outdoor air ventilation of 15% above the outdoor air ventilation rates established in LBi-R1.

Mixed Mode Ventilation

- 1 Credit Point:
  - Comply with the Credit Requirement for CO_2 monitoring and alert systems for mechanically ventilated buildings (above) for the period when the building is in air conditioned mode; and
  - Ensure the CO_2 monitoring system has sensors located in the breathing zone and is capable of alerting occupants when additional fresh air is required. At a minimum CO_2 levels must not exceed 1000ppm; and
  - Undertake dynamic simulation modeling (DSM) for the natural ventilation period of operation, to demonstrate the effectiveness of the operable window open areas in terms of thermal comfort (as defined for Mixed Mode buildings in LBi-5.3 Thermal Comfort Modelling), internal CO_2 levels and ventilation rates. Guidance from CIBSE AM10:2005 must be followed for all natural ventilation strategies. Where a project is located in or has a form that precludes the assumptions of standard tabulated pressure coefficients across ventilation openings, the DSM model must be augmented with the results of either wind tunnel or Computational Fluid Dynamics (CFD) modeling to establish appropriate pressure coefficients at façade openings.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
3 (maximum)	**Design Rating**
1	CO_2 sensors at all return points
1	Ventilation exceeds minimum requirements by 15%
1	Mixed Mode Operation (not available to retail use type)
3 (maximum)	**Construction Rating**
1	CO_2 sensors at all return points
1	Ventilation exceeds minimum requirements by 15%
1	Mixed Mode Operation (not available to retail use type)

Credit Submission: Design Rating

Mechanical Ventilation

- ☐ Narrative of CO_2 monitoring systems and CO_2 alert set-points describing how the credit requirements will be met;
- ☐ Narrative describing how the mechanical design system will meet the Credit Requirements, including description of mechanical ventilation system;
- ☐ Calculations of fresh air ventilation rates based on the ventilation rate procedure for all zones; and
- ☐ Drawings of mechanical system, including locations of CO_2 monitoring systems, schematics clearly indicating ventilation systems and any air handling units.

Mixed mode Ventilation

- ☐ All credit submissions for mechanically ventilated buildings as noted above;
- ☐ Sections, elevations and plans showing details of all proposed natural ventilation openings;
- ☐ For automated window opening control systems, provide a description of proposed opening strategy; and
- ☐ Summary Report based on DSM modeling of Natural Ventilation Design Performance.

Credit Submission: Construction Rating

Mechanical Ventilation

- ☐ Updated narrative of CO_2 monitoring systems and CO_2 alert set-points describing how the credit requirements have been met;
- ☐ Updated narrative describing how the mechanical design system meets the Credit Requirements, including description of mechanical ventilation system;
- ☐ Commissioning results demonstrating compliance with minimum fresh air ventilation rate requirements; and
- ☐ As-Built Drawings of mechanical system, including locations of CO_2 monitoring systems, schematics clearly indicating ventilation systems and any air handling units.

Mixed mode Ventilation

- ☐ All credit submissions for mechanically ventilated buildings as noted above;
- ☐ Sections, Elevations and Plans showing details of all proposed natural ventilation openings;
- ☐ For automated window opening control systems, provide a description of proposed opening strategy; and
- ☐ Updated Summary Report based on DSM modeling of Natural Ventilation Design Performance.

Calculations and Methodology

Ventilation Rate Procedure is outlined in ASHRAE 62.1.2007.

DSM Modeling must use a suitable weather file representative of the project location. Also include within the narrative details of how the project has been designed in relation to CISBE Applications Manual 10:2005. Simulations of typical floors will be accepted where it can be demonstrated that this approach is a reasonable approximation of anticipated performance.

'Return point' typically includes return ducts for VAV systems, and spigot / bell mouth returns in ceiling voids for FCU systems.

'Dynamic Simulation Modelling (DSM)' software must be capable of simulating a minimum of 8760 hours based on historic weather data. In this credit, the software must be capable of modeling inter-zonal air movements, thermal comfort, internal CO_2 levels and, for Mixed Mode buildings, allow window opening controls to be set based on internal and/or external temperature.

'Open area' must be calculated by the design team and these areas must be consistent where relied upon in any energy or thermal modeling (for example in RE-R1, RE-1, or LBi-5.3).

References

- ANSI/ASHRAE 62.1:2007 Ventilation and Acceptable Indoor Air Quality, www.ashrae.org
- CIBSE AM10 : 2005 Natural Ventilation in Non-Domestic Buildings, www.cibse.org

LBi-2.1: Material Emissions: Adhesives & Sealants

Intent

Confirm the use of low emission adhesives and sealants to encourage the desirability of these spaces in relation to improved occupant health.

Credit Requirements

GENERAL

Demonstrate that a minimum of 95% (by weight) of all adhesives and sealants used on the building interior must not exceed the prescribed VOC limits in South Coast Air Quality Management District Rule 1168, some of which are reproduced in the table below.

The VOC limits of the remaining non compliant adhesives and sealants must be no more than 50% higher than values listed for each product type.

Product Type	Maximum grams of VOC per liter of adhesive or sealant, less water and exempt compounds
Indoor Carpet Adhesive	50
Carpet Pad Adhesive	50
Wood flooring Adhesive	100
Rubber flooring Adhesive	60
Sub-floor adhesive	50
Ceramic tile adhesive	65
Cove base adhesive	50
Plasterboard and wall panel adhesive	50
Multipurpose construction adhesive	70
Structural glazing adhesive	100
Architectural sealants	250

ADDITIONAL REQUIREMENT/CLARIFICATIONS

Schools

100% of all adhesives and sealants must be compliant.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	95% of all adhesives & sealants meet criteria; or Schools : 100% of all adhesives & sealants meet criteria
1 (maximum)	**Construction Rating**
1	95% of all adhesives & sealants meet criteria; or Schools : 100% of all adhesives & sealants meet criteria

Credit Submission: Design Rating

☐ Narrative with extracts from specifications for all interior adhesives and sealants in relation to the project confirming which products will and will not comply with the requirements. Establish estimates for quantities of products likely to be used in the case where projects are aiming to meet the VOC limits for 95% of products and enter these into the LBi-2.1 Adhesives and Sealants template.

Credit Submission: Construction Rating

☐ Billing/purchase receipts for all interior adhesives and sealants used in the project;

☐ Tracking sheet, signed by the construction managers for receipt of all adhesives and sealants;

☐ Enter all compliant and non-compliant adhesives and sealants into the LBi-2.1 Adhesives

and Sealants template, their VOC content, the allowable VOC content and the quantity used; and

☐ Material Safety Data Sheets and Technical Data Sheets for all interior adhesives and sealants.

Calculations and Methodology	None
References	▪ South Coast Air Quality Management District (California, US) – Rule 1168 "Adhesive and Sealant Applications", www.aqmd.gov

LBi-2.2: Material Emissions: Paints & Coatings

Intent

Confirm the use of low emission Paints and Coatings to encourage the desirability of these spaces in relation to improved occupant health.

Credit Requirements

GENERAL

Demonstrate that the interior surface area covered by paints and coatings in the project meet or are less than the maximum VOC content limits values for paints and coatings for 95% of all surface areas covered by paints and coatings per Annex II, Phase II, Table A of European Directive 2004/42/CE: 2004. The VOC limits of the remaining non-compliant paints and coatings must be no more than 50% higher than the values listed above for each product type.

All paints and coatings must have fungal resistance.

Maximum VOC content limits :

Product Category	Type**	Phase II (g/l)*
Interior matt walls and ceilings (Gloss <25 @60°)	WB SB	30 30
Interior glossy walls and ceilings (Gloss >25 @60°)	WB SB	100 100
Interior trim and cladding paints for wood and metal	WB SB	130 300
Interior trim varnishes and wood stains, including opaque wood stains	WB SB	130 400
Interior minimal build wood stains	WB SB	130 700
Primers	WB SB	30 350
Binding Primers	WB SB	30 750
One-pack performance coatings	WB SB	140 500
Two-pack reactive performance coatings for specific end use such as floors	WB SB	140 500
Multi-colored coatings	WB SB	100 100
Decorative effect coatings	WB SB	200 200

*g/l of ready to use product
** WB = Water Based, SB = Solvent Based

ADDITIONAL REQUIREMENT/CLARIFICATIONS

Schools
100% of all surface areas covered by paints and coatings must have VOC limits no more than the limits prescribed per Annex II, Phase II, Table A of European Directive 2004/42/CE: 2004.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	95% of all surface areas meet criteria Schools : 100% of all surface areas meet criteria
1 (maximum)	**Construction Rating**
1	95% of all surface areas meet criteria Schools : 100% of all surface areas meet criteria

Credit Submission: Design Rating

- ☐ Narrative with extracts from specifications for all interior paints and coatings in relation to the project confirming which products will and will not comply with the requirements. Establish estimates for quantities of paint and coating products likely to be used and enter these in the LBi-2.2 Paints and Coatings template.

Credit Submission: Construction Rating

- ☐ Billing / purchase receipts for all interior paints and coatings used in the project;
- ☐ Tracking sheet, signed by the construction managers for receipt of all paints and coatings;
- ☐ Enter all compliant and non-compliant paints and coatings into the LBi-2.2 Paints and Coatings template, their VOC content, the allowable VOC content and the total quantity used; and
- ☐ Material Safety Data Sheets (MSDS) and Technical Data Sheets for all interior paints and coatings.

Calculations and Methodology

None

References

- Annex II, Table A of Directive 2004/42/CE of the European Parliament and of The Council of 21 April 2004, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:143:0087:0096:EN:PDF

LBi-2.3: Material Emissions: Carpet & Hard Flooring

Intent

Confirm the use of low emission flooring systems to encourage the desirability of these spaces in relation to improved occupant health.

Credit Requirements

General

Demonstrate that 100% of all surface areas covered by carpets and cushion and hard floor and associated finishes comply with the following requirements:

Carpet

Demonstrate that all carpet and carpet cushion meet or exceed the Carpet and Rug Institute Green Label or Green Label Plus Program or Greenguard Indoor Air Quality Certification Program for Carpets.

Hard Flooring

Demonstrate that all hard flooring systems and finishes have achieved FloorScore Certification or Greenguard Indoor Air Quality Certification for low emitting products.

or

For Wood Flooring

Confirm that ALL wood flooring products do not exceed class E1 for formaldehyde content and do not exceed 5 parts per million (ppm) for Pentachlorophenol (PCP) content. Wood products must be tested, classified and appropriately marked according to the requirements of BS EN 14342:2005. All remaining non-wood flooring must comply with the requirements above.

To achieve this credit, any adhesives associated with the carpet, carpet cushion or hard flooring system must meet LBi-2.1 – Materials Emissions : Adhesives and Sealants

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	100% of all carpets, carpet cushion, hard flooring and associated finishes comply
1 (maximum)	**Construction Rating**
1	100% of all carpets, carpet cushion, hard flooring and associated finishes comply

Credit Submission: Design Rating

☐ Narrative and extracts from specifications for all carpet, carpet cushion, hard flooring, associated finishes and adhesives (as appropriate) in relation to the project. Confirm that the specification complies with the credit requirements.

Credit Submission: Construction Rating

☐ Brief narrative (with submitted As-Built drawings as required) describing the locations of all carpets, carpet cushion, hard flooring products and finishes installed in the project. Enter all types of carpet, carpet cushion, hard flooring products and finishes installed in the project into the LBi-2.3 Carpet and Hard Flooring template. Confirm that all products comply with the requirements outlined. Also upload all associated Material Safety Data Sheets and Technical Data Sheets for these products to demonstrate compliance with the credit requirements.

Calculations and Methodology	None
References	▪ Carpet and Rug Institute – GreenLabel and Green Label Plus Program, www.carpet-rug.org ▪ The FloorScore Program from the Resilient Floor Covering Institute: Certification of flooring products for indoor air quality compliance. Products covered under this program include (Tile, Rubber flooring, engineered hardwood flooring, bamboo flooring, polymeric flooring, linoleum flooring, sheet vinyl flooring, vinyl tile, vinyl composition tile),www.rfci.com/int_FloorScore.htm ▪ Greenguard Indoor Air Quality Certification Program from the Greenguard Environmental Institute. Products covered under this program include Laminate Flooring, Carpet, Resilient Flooring, Wood Flooring, Stone / Terrazzo flooring, flooring underlay, wood floor finishes, hard surface floor finishes. www.greenguard.org ▪ BS EN 14342:2005 “Wood Flooring. Characteristics, evaluation of conformity and marking”, www.bsigroup.com

LBi-2.4: Material Emissions: Ceiling Systems

Intent

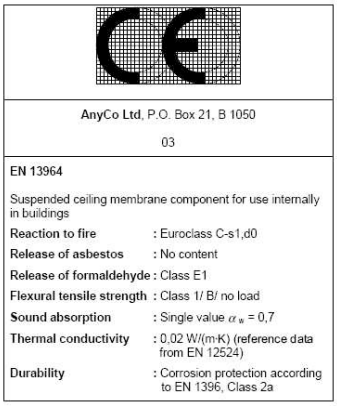
Confirm the use of low emission ceiling systems to encourage the desirability of these spaces in relation to improved occupant health.

Credit Requirements

General

Suspended Ceiling Systems
Demonstrate that all suspended ceiling systems comply with the requirements of BS EN 13964: 2004 section 4.5, in relation to asbestos (no asbestos) and formaldehyde content (which must meet class E1 at a minimum and be tested, classified and appropriately marked).

Non-Suspended Ceiling Systems
Comply with the requirements listed in LBi-2.1 for any Adhesives and Sealants.
Comply with the requirements listed in LBi-2.2 for any Paints and Coatings.


AnyCo Ltd, P.O. Box 21, B 1050

03

EN 13964

Suspended ceiling membrane component for use internally in buildings

Reaction to fire	: Euroclass C-s1,d0
Release of asbestos	: No content
Release of formaldehyde	: Class E1
Flexural tensile strength	: Class 1/ B/ no load
Sound absorption	: Single value α_w = 0,7
Thermal conductivity	: 0,02 W/(m·K) (reference data from EN 12524)
Durability	: Corrosion protection according to EN 1396, Class 2a

Permission to reproduce extracts from BS EN 13964: 2004 is granted by BSI*

Additional Requirement/Clarifications

For any wood based paneled ceilings, comply with the requirements of BS EN 13986:2004 in relation to limits and testing requirements for formaldehyde VOC content (which must meet class E1 at a minimum) and do not exceed 5 parts per million (ppm) for Pentachlorophenol (PCP) content.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	All ceiling systems meet credit criteria
1 (maximum)	**Construction Rating**
1	All ceiling systems meet credit criteria

Credit Submission: Design Rating

☐ Narrative describing all ceiling systems along with extracts from specifications for all ceiling systems and their components in relation to the project. Confirm that all components comply with the credit requirements.

Credit Submission: Construction Rating

☐ Billing/purchase receipts for all aspects relating to the ceiling systems of the project;
☐ Tracking sheet, signed by the construction managers for receipt of all products requiring compliance with the requirements; and
☐ Material Safety Data Sheets and Technical Data Sheets for all products requiring compliance with the credit requirements.

Calculations and Methodology

None

References

- BS EN 13964: 2004 “Suspended Ceilings – Requirements and Test Methods”, section 4.5, www.bsigroup.com
- BS EN 13986:2004 “Wood-based panels for use in construction – Characteristics, evaluation of conformity and marking”, sections 5.7 and 5.18, www.bsigroup.com
- See also LBi-5.1 Adhesives and Sealants and LBi-5.2 Paints and Coatings.

* British Standards can be obtained in PDF or hard copy formats from the BSI online shop: www.bsigroup.com/Shop or by contacting BSI Customer Services for hardcopies only: Tel: +44 (0)20 8996 9001, Email: cservices@bsigroup.com.

LBi-2.5: Material Emissions: Formaldehyde Reduction

Intent

To mitigate the health risks associated with formaldehyde in building materials and products.

Credit Requirements

GENERAL

- 1 Credit Point; Demonstrate that all internal construction materials do not exceed formaldehyde VOC content class E1 levels.
- 1 Credit Point: In addition to achieving the requirement above, demonstrate that all installed furniture does not exceed formaldehyde VOC content class E1 levels.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

Schools
For schools to earn points in this credit, they must achieve both Credit Points.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	All internal construction materials meet formaldehyde class E1 levels (available to schools only in association with additional credit requirement). Schools must achieve this credit point
1	All internal construction and furniture meets formaldehyde class E1 levels. Schools must achieve this credit point
2 (maximum)	**Construction Rating**
1	All internal construction materials meet formaldehyde class E1 levels (available to schools only in association with additional credit requirement). Schools must achieve this credit point
1	All internal construction and furniture meets formaldehyde class E1 levels. Schools must achieve this credit point

Credit Submission: Design Rating

- ☐ Interior finish schedule highlighting products likely to contain formaldehyde;
- ☐ Interior furniture schedule highlighting products likely to contain formaldehyde; and
- ☐ For all products containing formaldehyde, provide extracts from relevant specifications showing how credit requirements are met.

Credit Submission: Construction Rating

- ☐ As Built interior finish schedule for all installed products highlighting products containing formaldehyde;
- ☐ Schedule for all installed furniture highlighting products containing formaldehyde; and
- ☐ For all products containing formaldehyde, provide either Manufacturer's Data sheets.

or

- ☐ Third party evidence showing certification of formaldehyde content tested, according to appropriate testing standards (see reference standards) by one of the following:
  - Reputable certified independent testing laboratory; or
  - Certification from a reputable third party assessment body.

Calculations and Methodology	**Product Testing for Formaldehyde Content** All products must be tested according to the reference standards or demonstrated equivalent testing standards.
References	• EN 717-1 for initial type testing, www.bsigroup.com • EN120 and EN 717-2 for factory production control, www.bsigroup.com

LBi-3: Construction Indoor Air Quality Management

Intent

To implement construction practices that promote a high degree of indoor air quality (IAQ) for construction workers and building occupants.

Credit Requirements

GENERAL

Demonstrate the development and implementation of a comprehensive Construction IAQ Management Plan. At a minimum the plan must address the following:

- Source Control;
- Building Flush Out; and
- Resuming Normal Building Operation.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Develop a construction IAQ plan
2 (maximum)	**Construction Rating**
2	Implement the construction IAQ plan

Credit Submission: Design Rating

- ☐ Construction IAQ Management Plan;
- ☐ Completed IAQ Planning Checklists and evaluations of proposed control measures as per Appendix C of SMACNA IAQ guidelines for occupied buildings under construction; and
- ☐ Assessment of the duration required for pre-occupancy flush-out as follows:
  - Estimation of pre-occupancy flush-out based on likely ambient conditions according to the project schedule.
  - Estimation of pre-occupancy flush-out based on the most onerous ambient conditions to demonstrate possible maximum impact of project delays.

Credit Submission: Construction Rating

- ☐ Construction IAQ Management Plan, if amended from Design Rating submission;
- ☐ Completed IAQ Planning Checklists and evaluations of proposed control measures (if changed from the Design Rating stage) as per Appendix C of SMACNA IAQ guidelines for occupied buildings under construction, 2007, 2nd Edition. Provide a summary report detailing the reasons for each change;
- ☐ Time stamped photographs demonstrating the storage and protection of all absorptive materials from moisture damage; and
- ☐ Summary report including:
  - IAQ Inspection Checklists as per Appendix D of SMACNA IAQ guidelines for occupied buildings under construction, 2007, 2nd Edition. Include time stamped photographic evidence taken by the site supervisors showing each installed control measure. Weekly photos must be provided at a minimum;
  - Time stamped photographic evidence of the building cleaning phase prior to occupancy;
  - Results of the HVAC testing and balancing phase;
  - Ambient humidity levels during the building flush-out period, including demonstrable results of the fresh air delivery rate and duration of both the pre-occupancy and post-occupancy flush-out phases; and
  - Demonstrable results of how the air conditioning systems have been reset according to the building design basis for ongoing operation.

Calculations and Methodology

The Construction IAQ Management Plan must address the following:

Step 1 - Source Control

- Design for and implement an IAQ management plan according to the measures stipulated in SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 2007, 2nd Edition;
- Protection of all absorptive materials from moisture damage; and
- When permanently installed air handling equipment needs to be operated during construction to serve other areas of the building, installation of MERV 8 or G4 class filters in each return air grille during construction and replacement with new filters of identical class immediately prior to occupancy.

Step 2 - Building Flush Out

- Thoroughly clean the building prior to commencement of building flush out;
- Complete testing and balancing of HVAC equipment;
- Assess the ambient humidity and temperature for the duration of the anticipated building flush-out period;
- Determine the maximum fresh air delivery rate that can be provided to the whole building through its mechanical systems such that the humidity and temperature of the air will not exceed the buildings design basis for normal building operation;
- Provide this fresh air quantity (at design basis humidity and temperature conditions) to the building continuously and prior to building occupation, for a period of no less than nine consecutive days and at a fresh air rate of 2ach to all spaces or until 1,185m^3 per m^2 internal floor area of fresh air has been delivered; and
- Continue to provide fresh air continuously, post occupation, for a period of no less than twenty four consecutive days and at a fresh air rate of 2ach to all spaces or until an additional 3,160m^3 per m^2 internal floor area of fresh air has been delivered. The fresh air rate must equal or exceed the minimum rate determined in LBi-R1 or the increased rate in LBi-1 if pursued, whichever is greater and commence at least 2 hours prior to occupancy and continue during all occupied times in the post occupancy building flush out period.

Step 3 – Normal Building Operation

- The air conditioning systems must be reset according to the building design basis for ongoing operation.

Building design basis relates to design humidity and air temperature set points.

'Continuously' is defined as 24 hours per day.

Fresh air rate in ach (air changes per hour) must be calculated based on fresh air quantity alone excluding re-circulated air quantities.

References

- SMACNA IAQ Guidelines for Occupied Buildings Under Construction, 2007, 2nd Edition, www.smacna.org
- BS EN 779 2002 "Particulate air filters for general ventilation – determination of the filtration performance", www.bsigroup.com

LBi-4: Car Park Air Quality Management

Intent

To facilitate the provision of adequate air quality within enclosed car parks.

Credit Requirements

GENERAL

Demonstrate that the ventilation design meets or exceeds requirements for pollutant concentrations in car parks. This will be achieved via continuous measurement of the following pollutants:

Air Pollutant	Averaging Time	Maximum concentration
Carbon Monoxide (CO)	15 minutes	100 mg / m^3
Nitrogen Dioxide (NO_2)	1 hour	200 µg/m^3
Particular Matter PM10	24 hours	50 µg/m^3

Where the project does not contain any enclosed car parks (75% enclosure), the credit is automatically awarded.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Requirement Achievement

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Ensure car parking ventilation design meets the credit requirements.
1 (maximum)	**Construction Rating**
1	Ensure car parking ventilation design meets the credit requirements.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project intends to meet the credit criteria;
- ☐ Drawings or extracts from specifications indicating the proposed location of air quality sensors, outdoor air intakes and outlets, and the air quality alert system; and
- ☐ BMS point schedules.

Credit Submission: Construction Rating

- ☐ Update narrative describing how the project meets the credit criteria;
- ☐ Description and as-built drawings of all air quality sensors, outdoor air intakes and outlets, and the air quality alert system; and
- ☐ Commissioning report showing appropriate calibration, set-points and control sequences (as relevant) of all air quality sensors and alert systems.

Calculations and Methodology

Install and connect an air quality alert system to the BMS. The ventilation provided must provide sufficient dilution at all times, in particular during peak operating hours when queuing and congestion may occur.

Set trigger values for each of these pollutants, taking into account response times so ventilation rates will adjust and these maximum values are not exceeded. The levels in all instances must comply with WHO Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition in relation to carbon monoxide and nitrogen dioxide and particulate matter PM10 from ASHRAE 62.1.2007.

Demonstrate that the monitoring locations selected are considered worst-case within the car park area. For example, monitoring must not take place immediately adjacent to air distribution vents, where pollutant levels would be lower as a result of dilution.

The number of monitoring points will depend on the size of the car park. No part of the car park must be more than 25 meters from a sampling point. Each area that is serviced by a separate ventilation system will require a separate monitoring point and at least one monitoring point will be required on each level. In addition, at least one sampling point must be provided at each of the entrances and exits of the car park.

Monitoring must take place within the breathing zone. This is the region within an occupied space between 1 and 1.8m above the floor and more than 0.1 m from walls or air conditioning equipment.

Outdoor air intakes must be placed away from known sources of pollution such as busy roads or boiler exhausts.

The system presented in this credit must be consistent with the system included in the energy model (e.g. variable speed drive fans).

75% enclosure is defined as a car park with a roof and 75% of the wall area perimeter enclosed.

References

- ANSI/ASHRAE 62.1:2007 Ventilation and Acceptable Indoor Air Quality www.ashrae.org
- World Health Organization Guidelines 2000 Air Quality Guidelines for Europe 2nd Edition. www.who.int

LBi-5.1: Thermal Comfort & Controls: Thermal Zoning

Intent

To promote logical thermal zoning strategies in relation to the on-floor ventilation system, to achieve improved occupant comfort, future flexibility and energy efficiency.

Credit Requirements

GENERAL

Demonstrate that all spaces within the building(s) have been modeled to determine zonal cooling demand and designed to have separately controllable thermal zones, as follows:

Design for separate zones and controls for a maximum of 35m^2 of open plan space on the perimeter of the building and a maximum of 70m^2 of open plan space in the internal areas of the building. Each thermal zone must have thermostats that allow control over air speed or temperature as a minimum.

For private enclosed spaces intended for individual use, one thermostatic controller must be provided that allows control over air speed or temperature as a minimum.

Multi-occupant spaces intended for group activities (meeting rooms, classrooms, lecture theatres, conference halls etc) must at least have one thermostatic controller. In the case where these spaces have movable internal partitions intended to sub-divide spaces, each space must have at least one thermostatic controller.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

For speculative developments designed for an unknown tenant, contract lease requirements must specify that the fit-out will meet the requirements for thermal zoning and thermostatic controllers.

Retail

As a minimum, separate thermal zones must be provided for each tenancy. For larger open plan retail spaces over 100m^2, follow the general guidance above. Particular attention must be given to retail areas that have substantially higher or varying levels of internal load.

Residential

Separate controls for each living area and each bedroom (including maids' rooms). For common areas follow the requirements relating to general spaces.

Schools

Separate zones and controls for each classroom, administrative office.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Compliant thermal zoning strategy and controls
1 (maximum)	**Construction Rating**
1	Compliant thermal zoning strategy and controls

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project will meet the Credit Requirements. Zoning must match that in Credit RE-R1 Minimum Energy Performance;
- ☐ Drawings of the mechanical ventilation systems, clearly indicating zone boundaries and zone references. Drawings must also highlight locations for thermostatic controllers intended for occupant control;

	☐ Spreadsheet listing of each zone including its reference name, zone floor area, zone air temperature, zone resultant or operative temperature, zone peak cooling loads and floor peak simultaneous cooling loads; and Submission of spreadsheet results and associated plans for 'typical floors' will only be accepted where equivalency can be demonstrated.
Credit Submission: Construction Rating	☐ Updated narrative describing how the project meets the Credit Requirements. Zoning must match that in Credit RE-R1 Minimum Energy Performance; ☐ As-built drawings of the mechanical ventilation systems, clearly indicating zone boundaries and zone references. Drawings must also highlight locations for thermostatic controllers intended for occupant control; ☐ Spreadsheet listing of each zone including its reference name, zone floor area, zone air temperature, zone resultant or operative temperature, zone peak cooling loads and floor peak simultaneous cooling loads; and ☐ Extract from IDP-R4 Commissioning report verifying the individual zones operate as intended. Submission of spreadsheet results and associated plans for 'typical floors' will only be accepted where equivalency can be demonstrated.
Calculations and Methodology	Modeling Guidelines: ▪ Modeling of zonal cooling demand must be undertaken by dynamic simulation modeling software; ▪ The sizes of zones must not exceed the credit requirements; ▪ Cooling demand for each zone must be determined in relation to the design basis for humidity and temperature set-points; ▪ Schedules for occupancy, small power and lighting must be accounted for; ▪ The building envelope thermal parameters and any associated shading must be reflected in the model; and ▪ For each zone, extract the peak cooling demand and at this hour, extract the air temperature and resultant or operative temperature. Perimeter space includes those areas that have a thermal connection to the outdoors through the façade of the building. Typically these areas will experience higher thermal loads as a result. The depth of perimeter thermal zones must be 5m from the perimeter wall. Internal space includes those areas that have no thermal connection to the outdoors through the façade of the building. Interior spaces are those spaces that extend beyond 5m from the perimeter wall.
References	None

LBi-5.2: Thermal Comfort & Controls: Occupant Control

Intent

To promote projects that provide individual comfort controls for the wellbeing, productivity and thermal comfort of occupants.

Credit Requirements

General

For all space types, credits here will only be awarded where LBi-5.1 is achieved.

Demonstrate individual control as follows:

Mechanical Ventilation

The ventilation/temperature control system allows for occupant control over at least air temperature and / or air speed as follows:

- 1 Credit Point: a minimum of one control per two occupants in the occupied area (only applies to spaces such as teachers work areas and administrative offices within schools).
- 1 Credit Point: In addition to the achieving the requirements above, provide occupancy sensors linked to HVAC control systems that automatically modulate temperature and air flowrate based on occupancy down to a minimum design setback in all multi-occupant spaces.

Comfort control can be provided by thermostatic controllers linked to on-floor plant or via supply air terminals directly controllable and easily accessible by occupants that allow control of temperature and/or flowrate (such as terminals located at floor level, within workstations or via overhead terminals). Where thermostatic controllers are used in conjunction with on-floor plant, the plant must be capable of serving no more than two occupants.

For private enclosed spaces intended for individual use, one thermostatic controller must be provided that allows control over air speed or temperature as a minimum.

Any fully enclosed individual space that is less than 35m^2 need only have one ventilation / temperature control system.

In all space types, multi-occupant spaces intended for group activities (meeting rooms, school classrooms, lecture theatres, conference halls etc) must have at least one thermostatic controller. Where these spaces have movable internal partitions intended to sub-divide spaces, each space must have at least one thermostatic controller.

Mixed-mode Ventilation

Where buildings are designed and built for mixed-mode operation to achieve higher energy savings comply with :

The requirements above for mechanically ventilated buildings, and

- 1 Credit Point: The provision for operable windows as per ASHRAE 62.1.2007, paragraph 5.1 Natural Ventilation for the 50% of the occupied area.
- 2 Credit Points: The provision for operable windows as per ASHRAE 62.1.2007, paragraph 5.1 Natural Ventilation for the 75% of the occupied area.

Additional Requirement/Clarifications

Retail

All Retail areas are excluded from achieving this credit. For mixed use developments involving retail spaces submitted under a single application for a Pearl Rating, project teams should not include calculations and area schedules associated with retail areas.

Residential

For mechanical ventilation systems meet the requirements of LBi-5.1 Thermal Zones, and meet the provisions for operable windows as per ASHRAE 62.1.2007 paragraph 5.1 for at

least:

- 1 Credit Point: 50% of the living areas and bedrooms within the residential unit.
- 2 Credit Points: 75% of the living areas and bedrooms within the residential unit.

Where any of the living areas have movable internal partitions intended to sub-divide spaces, each space must have at least one thermostatic controller.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	General: 1 control per 2 occupants General (Mixed Mode) : 50% occupied area Residential: Mixed Mode for 50% of living / bedroom areas Multi-Occupant Spaces (Office, Residential, Schools): 1 control per space (more if movable partitions present) Retail: Does not apply to retail.
1	General: 1 control per 2 occupants & modulating HVAC systems in multi-occupant spaces General (Mixed Mode): 75% of occupied area Residential: Mixed Mode for 75% of living / bed room areas Multi-Occupant Spaces (Office, Residential, Schools): 1 control per space (more if movable partitions present) Retail: Does not apply to retail.
2 (maximum)	**Construction Rating**
1	General: 1 control per 2 occupants General (Mixed Mode): 50% of occupied area Residential: Mixed Mode for 50% of living / bedroom areas Multi-Occupant Spaces (Office, Residential, Schools): 1 control per space (more if movable partitions present) Retail: Does not apply to retail.
1	General : 1 control per 2 occupants & modulating HVAC systems in multi-occupant spaces General (Mixed Mode): 75% of occupied area Residential: Mixed Mode for 75% of living / bedroom areas Multi-Occupant Spaces (Office, Residential, Schools): 1 control per space (more if movable partitions present) Retail: Does not apply to retail.

Credit Submission: Design Rating

Mechanical Ventilation

- ☐ Brief narrative describing how the project meets the Credit Requirements;
- ☐ Mechanical system drawings showing locations of all air supply terminals and radiant cooling systems or other individual control devices;
- ☐ Plans showing locations of all thermostatic controllers intended for occupant control, also showing locations of any movable internal walls intended to subdivide spaces; and
- ☐ BMS point schedule.

Mixed-mode Ventilation

- ☐ All documentation as above for mechanical ventilation; and
- ☐ Drawings and elevations clearly indicating the size and location of ventilation openings and ventilation controls along with open area spreadsheet for each aperture type.

Credit Submission: Construction Rating

Mechanical Ventilation

- ☐ Updated brief narrative describing how the project meets the Credit Requirements;
- ☐ As-built mechanical system drawings showing locations of all air supply terminals and radiant cooling systems or other individual control devices;

- ☐ Plans showing locations of all thermostatic controllers intended for occupant control, also showing locations of any movable internal walls intended to subdivide spaces; and
- ☐ BMS point schedule.

Mixed-mode Ventilation

- ☐ All documentation as above for mechanical ventilation; and
- ☐ As-built drawings and elevations clearly indicating the size and location of ventilation openings and ventilation controls along with open area spreadsheet for each aperture type.

Calculations and Methodology	The open area associated with 'operable windows' would need to be calculated by the design team and these areas must be consistent where relied upon in any energy or thermal modeling used to demonstrate energy savings through mixed mode periods of operation (for example in RE-R1 and RE-1) or thermal comfort criteria during the natural ventilation period of mixed mode (for example in LBi-5.3).
References	▪ ANSI / ASHRAE 62.1.2007, Ventilation for Acceptable Indoor Air Quality, www.ashrae.org

LBi-5.3: Thermal Comfort & Controls: Thermal Comfort Modeling

Intent

To promote projects that are designed to deliver optimal thermal comfort.

Credit Requirements

General

Demonstrate that thermal modeling has been undertaken during the design process and that the occupied areas, or living areas and bedrooms for residential spaces, perform as follows:

Mechanical Ventilation

Demonstrate that the Predicted Mean Vote (PMV) and Predicted Percentage Dissatisfied (PPD) levels, calculated in accordance with ISO 7730 : 2005, are achieved during standard operating hours of occupancy for 98% of the year.

- 1 Credit Point: Category C : PMV levels between -0.7 and +0.7 (15% PPD)
- 2 Credit Points: Category B : PMV levels between -0.5 and +0.5 (10% PPD)

Mixed Mode Ventilation

Demonstrate compliance with requirements above for the fully mechanically ventilated period of operation, and comply with the requirements of ASHRAE 55-2004 section 5.3, achieving 90% acceptability limits for the naturally ventilated period of operation.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Category C Performance: PMV levels between -0.7 and +0.7 (15% PPD) & 90% acceptability limits for Mixed Mode (if applicable).
1	Category B Performance: PMV levels between -0.5 and +0.5 (10% PPD) & 90% acceptability limits for Mixed Mode (if applicable).
2 (maximum)	**Construction Rating**
1	Category C Performance: PMV levels between -0.7 and +0.7 (15% PPD) & 90% acceptability limits for Mixed Mode (if applicable).
1	Category B Performance: PMV levels between -0.5 and +0.5 (10% PPD) & 90% acceptability limits for Mixed Mode (if applicable).

Credit Submission: Design Rating

Mechanical Ventilation Period of Operation

- ☐ Brief narrative describing how the project meets the Credit Requirements;
- ☐ Drawings of the mechanical ventilation systems, clearly indicating zone boundaries and zone references;
- ☐ Screen shots of simulation model Thermal Zones; and
- ☐ Spreadsheet listings as per LBi-5.1 augmented with PMV and PPD results from simulations. Note that zones must match the information provided in Credit LBi-5.1 Thermal Zoning.

Mixed-mode Ventilation Period of Operation

- ☐ Brief narrative describing how the project meets the Credit Requirements including discussion on period of year intended for natural ventilation, mean monthly temperatures during this period, window control strategy and tables of opening area per window type;
- ☐ Elevation drawings highlighting extent of operable window typologies used per façade;
- ☐ Section drawings for each operable window typology showing maximum window opening position for each operable window type; and

☐ Spreadsheet listing as per LBi-5.1 highlighting zonal indoor operative temperatures during natural ventilation period. Zoning information provided must match the information provided in Credit LBi-5.1 Thermal Zoning.

Submission of spreadsheet results and associated plans for 'typical floors' will only be accepted where equivalency can be demonstrated.

Credit Submission: Construction Rating

Mechanical Ventilation Period of Operation

☐ Brief narrative describing how the project meets the Credit Requirements;

☐ As-Built Plan Drawings of the mechanical ventilation systems, clearly indicating zone boundaries and zone references;

☐ Screen shots of simulation model Thermal Zones; and

☐ Spreadsheet listing as per LBi-5.1 augmented with PMV and PPD results from simulations. Note that zones must match the information provided in Credit LBi-5.1 Thermal Zoning.

Mixed-mode Ventilation Period of Operation

☐ Brief narrative describing how the project meets the Credit Requirements including discussion on period of year intended for natural ventilation, mean monthly temperatures during this period, window control strategy and tables of opening area per window type;

☐ As-Built Elevation drawings highlighting extent of operable window typologies used per façade;

☐ As-Built Section drawings for each operable window typology showing maximum window opening position for each operable window type; and

☐ Spreadsheet listing as per LBi-5.1 highlighting zonal indoor operative temperatures during natural ventilation period. Zoning information provided must match the information provided in Credit LBi-5.1 Thermal Zoning.

Submission of spreadsheet results and associated plans for 'typical floors' will only be accepted where equivalency can be demonstrated.

Calculations and Methodology

Dynamic Simulation Modeling (DSM) software must be capable of hourly simulations covering a period 8,760 hours.

For DSM software incapable of calculating PMV / PPD, designers may use equations 1 to 5 of EN ISO 7730 to establish these values from DSM results. For spaces served by fully mixed all air systems, such as provided by Fan Coil Units or Variable Air Volume systems, in which the relative humidity is centered on 50% +/- 10% and the air speed can be assumed to be less than 0.1ms^{-1} use figure A1 for the relevant category being pursued in conjunction with DSM results.

Consideration must be given to appropriate metabolic rates and clothing indices for the intended space usage and mix of local and western attires.

For sedentary activities, such as for desk based office workers, inclusion of thermal insulation associated with 'standard office chairs' (as per Table C.3) must also be included in the clothing index unless it can be proven that other types such as 'net/metal chairs' will be installed.

References

- EN ISO 7730 : 2005 "Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria", www.bsigroup.com
- ASHRAE 55-2004, "Thermal Environmental Conditions for Human Occupancy", www.ashrae.org

LBi-6: High Frequency Lighting

Intent

To promote indoor visual comfort through the use of high frequency lighting solutions.

Credit Requirements

General

No incandescent lamps may be installed in the internal environment, and all internal and permanently installed fluorescent lighting installations must incorporate high frequency electronic ballasts. For projects with no control over fit-out of lighting installations, provide contractual extracts from the tenant lease highlighting how this credit will be met.

Install occupancy sensors in all rooms intended for individual occupancy, conferencing or meeting rooms, open plan offices spaces and hallways or corrirdors.

Additional Requirement/Clarifications

Residential

No incandescent lamps may be installed in the internal environment, and 95% of all permanently installed internal lighting installations (by number of fittings) must incorporate high frequency electronic ballasts.

Install occupancy sensors in all communal spaces of the building including hallways.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	General: All high frequency fluorescent ballasts and occupancy sensors meeting credit requirements. Residential: 95% high frequency fluorescent ballasts and communal area occupancy sensors meeting credit requirements.
1 (maximum)	**Construction Rating**
1	General: All high frequency fluorescent ballasts and occupancy sensors meeting credit requirements. Residential: 95% high frequency fluorescent ballasts and communal area occupancy sensors meeting credit requirements.

Credit Submission: Design Rating

- ☐ Confirmation that no incandescent lamps are to be installed.
- ☐ Extracts from specifications indicating requirements for high frequency electronic ballasts and occupancy sensors; or
- ☐ Comprehensive luminaire schedule including ballast specifications.
- ☐ Confirmation that all spaces comply with the requirements for occupancy sensors

Credit Submission: Construction Rating

- ☐ Confirmation that no incandescent lamps are installed.
- ☐ Purchase receipts and associated technical data sheets for all lighting system installations and occupancy sensors associated with all occupied spaces; and
- ☐ Representative photographs of lighting installations.

Calculations and Methodology

None

References

None

LBi-7: Daylight & Glare

Intent

To promote building designs that maximize the use of natural daylight indoors.

Credit Requirements

General

Install daylight sensors to light fittings that receive sufficient daylight illuminance.

Install occupancy sensors in all rooms intended for individual occupancy, conferencing or meeting rooms, open plan offices spaces and hallways or corridors.

Demonstrate that glare control devices have been designed and installed, such as:

- Automated or manually controlled internal or external glare control devices to all windows
- Automated glare control devices must be connected to the building management system

All manually controlled internal glare control devices must be no wider than 4 linear meters and be directly controllable by occupants.

Demonstrate a minimum daylight illuminance of 250 Lux on the working plane (762mm from finished floor level) for a percentage of the occupied area, as follows:

- 1 Credit Point: 50% of the occupied area
- 2 Credit Point: 75% of the occupied area

Additional Requirement/Clarifications

Occupied area spaces that are specifically intended to avoid daylight, such as auditoria, can be excluded from calculations.

Retail

All Retail areas are excluded from achieving this credit. For mixed use developments involving retail spaces submitted under a single application for a Pearl Rating, project teams must not include calculations and area schedules associated with retail areas.

Residential

Install occupancy sensors in all communal spaces of the building including hallways.

Demonstrate a minimum daylight illuminance of 200 Lux for each living area (excluding home theatre) and bedroom (excluding maids' room) as follows:

- 1 Credit Point: 50% of the net floor area per room and for each room
- 2 Credit Points: 75% of the net floor area per room and for each room

Schools

Install occupancy sensors in all rooms intended for individual occupancy, classrooms, open plan offices spaces and hallways.

Install glare control devices that comply with general requirements.

Demonstrate that a minimum daylight illuminance of 300 Lux on the working plane (762mm from finished floor level) for a percentage of the occupied areas as follows:

- 1 Credit Point: 75% of the occupied area
- 2 Credit Point: 90% of the occupied area

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	General : min 250 Lux for 50% of occupied area. Resi: min 200 Lux for 50% of living/bedrooms Schools : min 300 Lux for 75% of occupied area Retail development is not eligible. Meet requirements for occupancy sensors relevant to space type. Meet requirements for glare control relevant to space type.
1	General : min 250 Lux for 75% of occupied area Resi: min 200 Lux for 75% of living/bedrooms Schools : min 300 Lux for 90% of occupied area Retail development is not eligible. Meet requirements for occupancy sensors relevant to space type. Meet requirements for glare control relevant to space type.
2 (maximum)	**Construction Rating**
1	General : min 250 Lux for 50% of occupied area Resi: min 200 Lux for 50% of living/bedrooms Schools : min 300 Lux for 75% of occupied area Retail development is not eligible. Meet requirements for occupancy sensors relevant to space type. Meet requirements for glare control relevant to space type.
1	General : min 250 Lux for 75% of occupied area Resi: min 200 Lux for 75% of living/bedrooms Schools : min 300 Lux for 90% of occupied area Retail development is not eligible. Meet requirements for occupancy sensors relevant to space type. Meet requirements for glare control relevant to space type.

Credit Submission: Design Rating

☐ Brief report describing how the project meets the Credit Requirements including:

- Floor plans, elevations and sections;
- Extracts from specifications listing all glazing performance criteria;
- Extracts from specifications listing all glare control devices;
- Extracts from specifications indicating requirements for daylight and occupancy sensors;
- Simulation plots showing Isolux contours;
- Spreadsheet of areas meeting requirements; and
- Confirmation that all spaces comply with the requirements for daylight and occupancy sensors

Credit Submission: Construction Rating

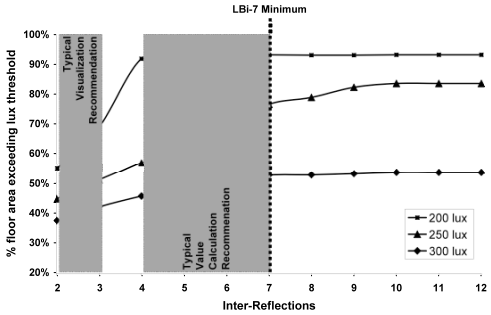
☐ Updated report describing how the project meets the Credit Requirements including:

- As-Built floor plans, elevations and sections;
- As-Built drawings of glare control devices and daylight and occupancy sensors;
- As-Built glazing performance criteria;
- Simulation plots showing Isolux contours;
- Spreadsheet of areas meeting requirements; and
- Representative photographs of daylight and occupancy sensor installations.

Calculations and Methodology

Calculation of Daylight Illuminance

Daylighting design software must be used to calculate internal daylight illuminance. Software calculation control parameters must be based on the higher settings recommended for calculation of values rather than lower settings required for visualization purposes. One such control setting, the number of inter-reflections which equates to the number of bounces of diffuse reflected indirect light, must be set to a minimum of 7.



Courtesy of Hilson Moran

The daylight illuminance in Lux must be calculated based on a CIE standard clear sky at 10am, 12pm and 2pm on the equinox and summer solstice excluding contributions from any artificial lighting. The report submitted must identify the key parameters used in the simulation, especially with regard to glazing visible light transmittance and the reflectance of all internal surfaces.

Offices and Schools
No glazed area below 762mm height from finished floor level can be included in the simulations.

References

None

LBi-8: Views

Intent

To provide building occupants with a visual connection to the outdoors.

Credit Requirements

General

Demonstrate that a minimum of 75% of all occupied areas have a direct line of sight to the outside through vision glazing.

For internal enclosed spaces such as cellular offices, vision glazing located in the internal wall must have a direct line of sight to the buildings external wall vision glazing. The direct line of site is between seated head height and the extent of the external wall vision glazing.

Additional Requirement/Clarifications

Residential

Demonstrate that a minimum of 75% of all bedrooms (excluding maids' rooms) and living areas (excluding home theatre rooms) have vision glazing. For each compliant space, the area of vision glazing must be a minimum of 10% of the floor area in each room served.

Retail

All Retail areas are excluded from achieving this credit. For mixed use developments involving retail spaces, project teams must not include calculations and area schedules associated with retail areas.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	General: 75% of occupied areas have views through vision glazing. Residential: 75% of bedrooms and living spaces have views and meet minimum vision glazing requirements. Retail not eligible for this Credit Point.
1 (maximum)	**Construction Rating**
1	General: 75% of occupied areas have views through vision glazing. Residential: 75% of bedrooms and living spaces have views and meet minimum vision glazing requirements. Retail not eligible for this Credit Point.

Credit Submission: Design Rating

General

- ☐ Brief narrative describing the how the project will meet the Credit Requirements, including a summary of all areas with access to views and calculations demonstrating that at least 75% of the occupied area meets the criteria; and
- ☐ Plan drawings marked up with sight lines and showing compliant and non-compliant shaded areas to demonstrate which areas meet the Credit Requirements. Section drawings marked up with sight lines to demonstrate how internal spaces comply with the credit requirements. For each, external wall thickness must be taken into account in terms of the way they restrict views through windows. Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the project meets the Credit Requirements.

Residential

- ☐ Brief narrative describing how the project will meet the Credit Requirements, including a tabulated summary of all compliant spaces with access to views along with

tabulated glazing areas and external wall areas to demonstrate a minimum of 50% glazed area within each external wall; and

- ☐ Plan drawings marked up to show compliant and non-compliant shaded areas to demonstrate which areas meet the Credit Requirements. Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the project meets the credit requirements.

Credit Submission: Construction Rating	**General** ☐ Updated narrative describing the how the project meets the Credit Requirements, including a summary of all areas with access to views and calculations demonstrating that at least 75% of the occupied area meets the criteria; and ☐ As-Built Plan drawings marked up with sight lines and showing compliant and non-compliant shaded areas to demonstrate which areas meet the Credit Requirements. Section drawings marked up with sight lines to demonstrate how internal spaces comply with the credit requirements. For each, external wall thickness must be taken into account in terms of the way they restrict views through windows. Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the project meets the Credit Requirements. **Residential** ☐ Updated narrative describing how the project meets the Credit Requirements, including a tabulated summary of all compliant spaces with access to views along with tabulated glazing areas and external wall areas to demonstrate a minimum of 50% glazed area within each external wall; and ☐ As-Built Plan drawings marked up to show compliant and non-compliant shaded areas to demonstrate which areas meet the Credit Requirements. Where the floor plate or layout varies by floor, provide as many drawings as necessary to demonstrate that the project meets the credit requirements.
Calculations and Methodology	Vision Glazing includes those windows within the vision area of 762mm to 2286mm height from finished floor level and excludes any frame area. Seated Head Height is 1.1m from finished floor level.
References	None

LBi-9: Indoor Noise Pollution

Intent

Provide acoustic conditions that are commensurate with the sensitivity and/or acoustic privacy requirements of the proposed use.

Credit Requirements

General

Demonstrate that internal ambient noise levels do not exceed 50 dB(A) L_{eq} in the area to be occupied.

Additional Requirement/Clarifications

Retail

Demonstrate that internal ambient noise levels do not exceed 50 dB(A)L_{eq} in the area to be occupied and 45 dB(A)L_{eq} for occupied spaces in restaurant areas.

Residential

Demonstrate that internal ambient noise levels do not exceed 35 dB(A)$L_{eq\ (8\ hour)}$ and 45 dB(A) $L_{max,\ fast}$ in bedrooms (night-time, 23:00 – 07:00 hours) and do not exceed 40 dB(A)L_{eq} in other areas.

Schools

All spaces within the school must be designed to meet the requirements laid out in Building Bulletin 93 (in particular tables 1.1 through to 1.6).

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	General : 40-50 dB(A)L_{eq} Retail : less than 50 dB(A)L_{eq} Restaurants : less than 45 dB(A)L_{eq} Residential : less than 35dB(A)$L_{eq(8hour)}$ and 45DB(A)$L_{max,fast}$ in bedrooms and less than 40dB(A)L_{eq} in other areas Schools : Meet the requirements of tables 1.1 to 1.6 in Building Bulletin 93 (BB93)
1 (maximum)	**Construction Rating**
1	General : 40-50 dB(A)L_{eq} Retail : less than 50 dB(A)L_{eq} Restaurants : less than 45 dB(A)L_{eq} Residential : less than 35dB(A)$L_{eq(8hour)}$ and 45DB(A)$L_{max,fast}$ in bedrooms and less than 40dB(A)L_{eq} in other areas Schools : Meet the requirements of tables 1.1 to 1.6 in Building Bulletin 93 (BB93)

Credit Submission: Design Rating

☐ Noise design report with the following details:

- Brief report describing how the project will meet the Credit Requirements, in relation to all relevant internal and external noise sources, noise control features of the design and any underlying assumptions;
- Results of calculations or supporting tests demonstrating compliance with the requirements (expressed in parameters that are consistent with the test and/or calculation methods);
- Plans, elevations and drawings representing typical floors marked up to clearly indicate noise control features; and
- Attested qualifications and professional memberships of the acoustic engineer.

Credit Submission: Construction Rating	☐ Noise field test report with the following details: ▫ The required noise levels have been met in all relevant internal areas; ▫ Results of field tests or calculations demonstrating compliance with the requirements (expressed in parameters that are consistent with the test and/or calculation methods); and ▫ Attested qualifications and professional memberships of the acoustic engineer.
Calculations and Methodology	For the purposes of the calculations or measurements, all operable windows must be considered open. Only noise from building services and external noise sources should be included, not noise from occupants or tenant equipment and appliances. Measurements and calculations must represent the noisiest areas of the building, typically near façades on busy streets. All calculations, measurements and acoustic reports must be signed off by a qualified acoustics engineer. A qualified acoustic engineer will be a member of a recognized professional body (e.g. Institute of Acoustics or Association of Noise Consultants) and will have either : ▪ an acoustics degree from a recognized institution (e.g. university), or ▪ a degree in an engineering-related discipline from a recognized institution (e.g. university) and a post-graduate acoustics qualification (e.g. diploma).
References	▪ Building Bulletin 93, "Acoustic Design of Schools - A design guide", Department for Education and Skills, www.teachernet.gov.uk

LBi-10: Safe & Secure Environment

Intent

To provide a safe and secure environment for building occupants and visitors.

Credit Requirements

General

Demonstrate appropriate safety & security risk mitigation for the development, through one of the following two approaches:

- Implementation of risk mitigation measures agreed in consultation with the UPC Safety & Security Team as part of the UPC Development Review Process; or
- Where consultation with the UPC Safety & Security Team is not mandated as part of the UPC Development Review Process, develop the following documents to demonstrate that safety & security have been incorporated into the development's planning and design stages:
  - Safety & Security Risk Assessment;
  - Safety & Security Strategy; and
  - Safety & Security Layout Plan.

Additional Requirement/Clarifications

Schools

- In addition to achieving the general requirements above, an additional credit point is available for development and implementation of a safety & security plan that addresses transit of pupils from pick-up locations to school grounds.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Develop & Implement Safety & Security Plan
1	Schools only: Transit Safety & Security Plan
2 (maximum)	**Construction Rating**
1	Develop & implement Safety & Security Plan
1	Schools only: Transit Safety & Security Plan

Credit Submission: Design Rating

☐ UPC Safety & Security Team Development Approval Confirmation;

or

☐ Safety & Security Risk Assessment;

☐ Safety & Security Strategy;

☐ Safety & Security Layout Plan(s); and

☐ Safety and security system drawings and extracts from specifications.

☐ School Transit Safety & Security Plan.

Credit Submission: Construction Rating

☐ UPC Safety & Security Team Development Approval Confirmation;

or

☐ Updated Safety & Security Risk Assessment;

☐ Updated Safety & Security Strategy;

☐ As built Safety & Security Layout Plan(s); and

☐ Certified safety & security as-built system drawings and photographs of installation(s).

☐ Updated School Transit Safety and Security Plan.

Calculations and Methodology

Safety & Security Risk Assessment

The risk assessment forms the basis for determining the extent of safety & security measures implemented for a specific development. The scope of the risk assessment, assumptions and relevant stakeholders must be identified.

Safety & Security Strategy

The strategy outlines the safety and security approach to mitigate the risks identified by the risk assessment. Measures must be designed to mitigate risk in accordance with international best practice and relevant guidelines issued by the Urban Planning Council and Abu Dhabi Safety & Security Agencies.

Safety & Security Layout Plan

The Safety & Security Layout Plan identifies the location of inherent and built-in safety & security measures (building site, building design and technologies). The plan must be drawn at a suitable scale to allow detailed review and include the following information:

- Proposed buildings and structure locations, indicating:
  - Land Use
  - Setback distances from boundaries, vehicle parking and transportation
  - Infrastructure i.e. roads, metro, railways
  - Locations of loading bays
  - Building heights / number of storeys
  - Peak occupancy
- Site spot elevations at 0.5m vertical intervals;
- Transportation infrastructure (roads, rail, metro), highlighting details such as tunnels, bridges, underpasses and podium structures;
- Emergency services vehicular access routes, marine approach or helipads;
- Any critical infrastructure (utilities) and exclusion zones;
- Building emergency exit locations, external evacuation routes and emergency refuge areas;
- Location of Safety & Security Community Facilities (if relevant)
  - Hospitals
  - Health clinics
  - CNIA facilities
  - Police stations
  - Civil Defence stations
  - Command & control centres e.g. Integrated Situational Awareness Centres, traffic management
- Location of physical security measures such as hardened facades, boundary treatments, and vehicle barriers; and
- Areas and access points benefiting from security lighting, CCTV coverage and access control.

School Transit Safety & Security Plan

The plan must cover and list all government agency requirements and address the following additional requirements:

- Meet or exceed all vehicle registration guidelines published by the Department of Transport related to school buses;
- All school buses must be serviced quarterly at a minimum, maintain full service history documentation and undergo weekly tire, oil, coolant, washer fluid, light and indicator, windscreen, windscreen wiper, brake and seat belt function checks;
- School premises must demonstrate and provide easily accessible and adequate pick-up and drop-off facilities for school buses AND parent vehicles on-site that eliminate impacts on traffic flows on all public roads. Traffic control or calming measures at these facilities must also be addressed; and
- Develop and employ a scheme that enables parents and school staff to determine pupils who are absent from school buses at the time of transit to and from school.

References

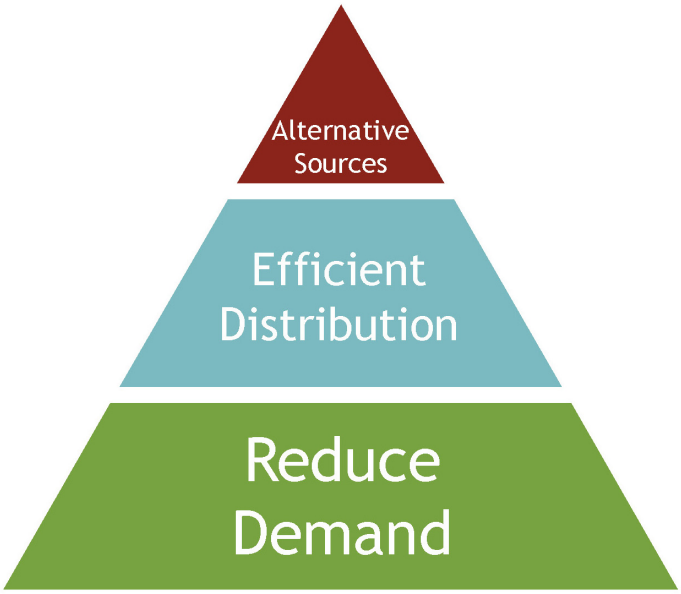
None

Because of Abu Dhabi's limited annual rainfall, hot climate, and the significant energy embodied in potable water due to desalinization, water conservation is a priority for Estidama. As discussed in the April 2006 UAE Initial National Communication to the United Nations on climate change, it is a distinct possibility that the UAE will become even drier due to the effects of global warming. Coupled with projected population increases, the importance of accelerating water conservation and reuse efforts is clear.

"One of the most important challenges for the Emirate is to balance water supply and demand as efficiently as possible given that the per capita consumption of fresh water is among the highest in the world and new water supplies are expensive"

— Abu Dhabi Water Resources Master Plan, EAD 2009

The Precious Water section of the Pearl Building Rating System: Design and Construction includes the Building Water Calculator that should be used throughout the entire design process. This calculator will help the development team to assess inputs and flows of water to and from the project with a holistic perspective, and assist in identifying how and where reductions in the use of potable water may be made.



CREDITS COVERED IN THIS SECTION

PW	Precious Water					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
PW-R1	Minimum Interior Water Use Reduction	R	R	R	R	R
PW-R2	Exterior Water Monitoring	R	R	R	R	R
PW-1	Improved Interior Water Use Reduction	15	15	15	15	15
PW-2.1	Exterior Water Use Reduction: Landscaping	8	8	8	8	10
PW-2.2	Exterior Water Use Reduction: Heat Rejection	8	8	8	8	8
PW-2.3	Exterior Water Use Reduction: Water Features	4	4	4	4	4
PW-3	Water Monitoring & Leak Detection	4	4	4	4	4
PW-4	Stormwater Management	4	4	4	4	4
	TOTAL	**43**	**43**	**43**	**43**	**45**

PW-R1: Minimum Interior Water Use Reduction

Intent	To develop and implement a comprehensive water strategy during the early stages of design as a tool to minimize the project's interior potable water consumption.
Credit Requirements	**GENERAL** Demonstrate that the project's predicted interior potable water consumption will be no greater than the baseline building water consumption using efficiency measures only. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Building Water Calculator confirming that the building's predicted interior potable water consumption will be no greater than the baseline building interior potable water consumption using efficiency measures only; ☐ Brief narrative describing all proposed water conservation strategies; ☐ Extracts from specifications for all proposed fixtures and fittings indicating flow rates and flow regulation systems; and ☐ Extracts from specifications for all proposed appliances including information on their water use.
Credit Submission: Construction Rating	☐ Updated Building Water Calculator (if changed from design), confirming that the building's predicted interior potable water consumption is no greater than the baseline building interior potable water consumption using efficiency measures only; ☐ Brief narrative describing all installed water conservation strategies; ☐ Manufacturer information for all installed fixtures and fittings indicating flow rates and flow regulation systems; ☐ Manufacturer information for all installed appliances including information on their water use; and ☐ Photographic evidence confirming installation of specified fixtures and appliances.
Calculations and Methodology	▪ The baseline and proposed building interior water consumption is determined using the Building Water Calculator which serves as the foundation for numerous calculations within the Precious Water section. ▪ Interior water use is defined as the water demand that relates solely to fixtures, fittings, and appliances. ▪ Efficiency measures are all measures which reduce the overall demand for water from the baseline requirement. Reductions in potable water cannot be claimed through the use of any recycled water within this prerequisite. ▪ Calculations are based on building occupancy and include all interior water use relating to fixtures, fittings and appliances. ▪ All tenant fit-out areas that are not under developer control must be modelled identically in both the baseline and proposed building unless tenant guidelines prescribing relied upon fixture flow rates etc are provided as part of IDP-R2 Tenant Fit-Out Design & Construction Guide. ▪ Baseline flow rates/volumes are based on the following:

Fixture of Fixture Fitting	Percentage Reduction
Bathroom Taps, private	6 liters/min at 417.7 kPa
Bathroom Taps, public	1.9 liters/min at 417.7 kPa
Shower Head	9.5 liters/min at 551.6 kPa
Kitchen Sink Faucet	6 liters/min at 417.7 kPa
Bidets	6 liters/min
Urinal	0.5 liters/flushing cycle
Toilets (Dual Flush)	6/4 liters/flushing cycle (full/low)

Occupancy

- Non-Residential
  - Occupancy is determined based on the number of Full Time Equivalent (FTE) permanent occupants and transient visitors.
  - The FTE is determined based on a typical 8 hour working day. The permanent FTE is then calculated as follows :

$$\text{Permanent FTE} = \frac{\sum \text{Working hours of all permanent staff per day}}{8}$$

  - Transient occupancies must be input as daily totals.
- Residential
  - Covers all primary spaces used for living and / or sleeping. Occupancy is based on number and size of residential units within the building.
- Mixed Use
  - Where a building is mixed use i.e. contains occupancies with different fixture uses, this will need to be documented within the building water calculator. A maximum of 8 different fixture use occupancies may be included (6 Non-Residential and 2 Residential).

Example :

A 40 storey building located in downtown Abu Dhabi includes ground floor retail, 20 office floors, 15 multi-residential floors and 4 penthouse floors. Only the penthouse floors are supplied with baths.

Based on the above, 4 different fixture uses would be required as follows :

- retail,
- office
- multi-residential
- penthouse

References

- Pearl Rating System Building Water Calculator

PW-R2: Exterior Water Monitoring

Intent

To encourage the provision of metering facilities on all exterior water uses enabling effective management of outdoor water consumption and prevention of leaks.

Credit Requirements

GENERAL

Demonstrate that easily accessible and clearly labelled water meters are provided and capable of monitoring the water consumption of, at a minimum, the following exterior water uses (where present):

- Heat rejection;
- External hose bibs;
- Irrigation systems;
- Swimming pools; and
- Water features.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the requirements of the credit will be achieved;
- ☐ Extracts from specifications and MEP drawings clearly indicating the type, extent and locations of all metering, and central monitoring system; and
- ☐ List of all exterior uses and corresponding metering equipment.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the requirements of the credit have been met;
- ☐ Manufacturer's data and as-built drawings clearly indicating the type, extent and locations of all metering, and central monitoring system;
- ☐ Photographic evidence confirming the installation of specified meters and central monitoring system; and
- ☐ Written commitment from the building owner to submit all exterior water monitoring data to Estidama (if requested).

Calculations and Methodology

- All meters must have data logging capability and be connected to a central monitoring system so that information on the exterior water consumption can be recorded. The monitoring system must have, at a minimum, the following capability:
  - Provide hourly, daily, weekly, monthly and annual water consumption for each end-use;
  - Compare consumption to previous days, weeks, months and years for trend analysis;
  - Determine 'out-of-range' values to alert building operators to unusually high consumption; and
  - Record peak water consumption for each end-use.
- The Building owner must provide a written commitment to supply all water monitoring data to Estidama (if requested). All reported information will be treated as confidential.

References

None

PW-1: Improved Interior Water Use Reduction

Intent

To promote further reductions in the project's interior potable water consumption through the use of efficient fixtures and appliances, and the use of recycled water.

Credit Requirements

GENERAL

- 1-15 Credit Points: Demonstrate using the Building Water Calculator that the proposed building has achieved the following reduction in potable water consumption compared to the baseline building:

Points Achieved	Percentage Reduction
1	4%
2	8%
3	12%
4	16%
5	20%
6	24%
7	28%
8	32%
9	36%
10	40%
11	44%
12	48%
13	52%
14	56%
15	60%

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
15 (maximum)	**Design Rating**
1-15	Achieve further reductions in the proposed building potable water consumption compared to the baseline building.
15 (maximum)	**Construction Rating**
1-15	Achieve further reductions in the proposed building potable water consumption compared to the baseline building.

Credit Submission: Design Rating

- ☐ Completed Building Water Calculator confirming the percentage reduction in potable water consumption compared to the baseline;
- ☐ Brief narrative describing all proposed water conservation strategies;
- ☐ Extracts from specifications for all proposed fixtures and fittings indicating flow rates and flow regulation systems;
- ☐ Extracts from specifications for all proposed appliances including information on their water use; and
- ☐ A composite utility schematic illustrating routing of recycled water mainline and

	laterals to all interior non-potable demands (where applicable).
Credit Submission: Construction Rating	☐ Updated version of the Building Water Calculator (if changed from design), confirming the percentage reduction in potable water consumption compared to the baseline; ☐ Updated narrative describing all installed water conservation strategies; ☐ Manufacturer information for all installed fixtures and fittings indicating flow rates and flow regulation systems; ☐ Manufacturer information for all installed appliances including information on their water use; ☐ As-built composite utility schematic illustrating routing of recycled water mainline and laterals to all interior non-potable demands (where applicable); ☐ Photographic evidence confirming installation of specified fixtures and appliances; and ☐ Photographic evidence confirming recycled water pipes have been separately color coded from pipes containing potable water (where applicable).
Calculations and Methodology	▪ The methodology is the same as PW-R1 Minimum Interior Water Use Reduction, except that further reductions in the building interior potable water consumption within this credit may be achieved through the use recycled water. ▪ All pipes containing recycled water must be color coded in order to easily distinguish them from potable water pipes.
References	▪ Pearl Rating System Building Water Calculator

PW-2.1: Exterior Water Use Reduction: Landscaping

Intent

To minimize landscaping water demands through effective plant selection, irrigation strategies, and promoting the use of recycled water.

Credit Requirements

General

Plant Selection

Demonstrate that the average irrigation requirement for all landscape areas (as outlined within the Calculations and Methodologies section) meets the following:

- 2 Credit Points: Average landscape irrigation demand < 4 liters/m^2/day
- 4 Credit Points: Average landscape irrigation demand < 2 liters/m^2/day

Irrigation System

- 1 Credit Point: Demonstrate that a Water Efficient Irrigation System has been incorporated into the landscape design.

Irrigation System Management

- 1 Credit Point: Demonstrate that an Irrigation Operation and Maintenance Plan has been developed.

Recycled Water

- 2 Credit Points:
  - Achieve at least two credit points related to Plant Selection; and
  - Demonstrate that 100% of the exterior irrigation demand can be served using the Exterior Water Allowance (as outlined in the Calculations and Methodology section); and
  - Where recycled water is not immediately available, demonstrate that a recycled water mainline loop has been installed which allows for the future switch from potable to recycled water for exterior irrigation demands when it becomes available; and
  - All pipes containing recycled water must be color coded in order to easily distinguish them from potable water pipes.

Additional Requirement/Clarifications

Schools

- 2 Credit Points: Where playing fields are present onsite demonstrate that non-water turf substitutes are installed in place of turf.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
8-10 (maximum)	**Design Rating**
2-4	Demonstrate that the average irrigation requirement for all landscaped areas has been minimized.
1	Demonstrate that a water efficient irrigation system has been incorporated into the landscape design.
1	Demonstrate that best practices for ongoing system management and operation have been established.
2	Demonstrate that 100% of the exterior irrigation demand can be served using the Exterior Water Allowance, and that a recycled water mainline loop has been installed where

	recycled water is not immediately available.
2	Schools only: Demonstrate that non-water turf substitutes are installed in place of turf.
8-10 (maximum)	**Construction Rating**
2-4	Demonstrate that the average irrigation requirement for all landscaped areas has been minimized.
1	Demonstrate that a water efficient irrigation system has been incorporated into the landscape design.
1	Demonstrate that best practices for ongoing system management and operation have been established.
2	Demonstrate that 100% of the exterior irrigation demand can be served using the Exterior Water Allowance, and that a recycled water mainline loop has been installed where recycled water is not immediately available.
2	Schools only: Demonstrate that non-water turf substitutes are installed in place of turf.

Credit Submission: Design Rating

Plant Selection

☐ Low Water Use Landscaping Strategy including:

- Completed Building Water Calculator;
- Site plan illustrating landscape areas, highlighting areas of hardscape and softscape along with their irrigation requirements, as well as water feature / swimming pool areas;
- Calculations detailing how the total annual average irrigation demand of all external softscape areas (liters/day) is determined; and
- Plant schedules for the development's landscape program that includes the following key data:
  - Plant names (common and botanic); and
  - Annual water demand at third year of growth.

Irrigation System

☐ Irrigation Strategy including:

- Narrative describing the project's irrigation approach, technology to be used and anticipated irrigation efficiency;
- System schematic indicating mainline routing, laterals, irrigation controller and meter locations as well as proposed landscape/hydrozones;
- System specifications including cut sheets and/or manufacturer's specifications for the following equipment:
  - Master controller(s);
  - Valves; and
  - Monitoring equipment including moisture sensors, wind sensors etc.

☐ Soil Amendment Strategy including:

- Narrative describing moisture retention approach for soil amendments including type, location, extent of application, and frequency of reapplication (if needed) to maintain effectiveness; and
- Techniques to be used to reduce plant evapotranspiration identified on a site plan.

Irrigation System Management

☐ Monitoring Strategy including:

- Brief narrative describing the monitoring strategy and how it is integrated into

the overall landscaping plan;

- System specifications including cut sheets and/or manufacturer's specifications for the following equipment:
  - Override sensors;
  - Backflow valves; and
  - Separate meters.

☐ Drawings showing the location of each device on a site plan.

Recycled Water

☐ Completed Building Water Calculator confirming that 100% of the exterior irrigation demand can be served using the Exterior Water Allowance; and

☐ A composite utility schematic illustrating routing of recycled water mainline and laterals.

Schools Only

☐ Confirmation that all playing fields use turf substitutes requiring no irrigation water;

☐ Site plans indicating location and size of playing fields; and

☐ Specification/manufacturer's details of turf substitutes.

Credit Submission: Construction Rating

☐ Revised As-Built documentation as per Design Rating; and

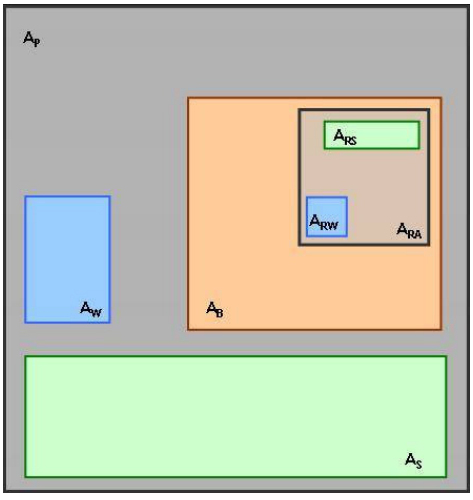
☐ Photographs of the installed irrigation systems, landscaping, school playing fields (where applicable), water recycling systems (where installed) and routing of recycled water mainline and laterals indicating their color code.

Calculations and Methodology

Plant Selection

- Landscaped area refers to the plot area excluding the building footprint and all water feature / swimming pool areas, and is made up of all hardscape and softscape areas. Where communal rooftop amenities are provided (e.g. podium/skylight gardens), any landscape associated with these spaces must also be included in the calculation.

The average irrigation demand for all landscaped areas is calculated as follows:



A_P = Plot Area,
A_B = Building Footprint Area,
A_S = Softscape Area (grade level)
A_W = Water Feature/Swimming Pool Area (grade level),
A_{RA} = Roof Amenity Area
A_{RS} = Softscape Area (roof level),
A_{RW} = Water Feature/Swimming Pool Area (roof level)

$$\text{Total Landscaped Area, } A_L = A_P - A_B - A_W + (A_{RA} - A_{RW})$$

I_S=Total annual average irrigation demand of all external softscape areas (liters/day)

$$\text{Average Landscape Irrigation Demand} = \frac{I_S}{A_L}$$

Note: Areas associated with school playing fields are excluded from the average landscape irrigation requirement calculation.

Irrigation System

A water efficient irrigation system must:

- Eliminate all surface spray components (except in public parks or playing fields);
- Irrigate only during non-daylight hours (except if sub-surface);
- Include moisture sensors that control the irrigation system to irrigate only when required;
- Provide irrigation zones, with independently controlled valves, segregated by plant water needs; and
- Utilize mulch and/or soil amendment techniques to reduce evapotranspiration.

Irrigation System Management

An Irrigation Operation and Maintenance Plan should include:

- Regular maintenance and operation efficiency performance monitoring;
- Procedures for alerting operator and shutting system down when flows exceed design range due to mainline, lateral, valve or emitter failure or there is a leak detected; and
- Irrigation systems must demonstrate that they incorporate sensors and valves connected to a central system by:
  - Providing override sensors tied to a centralized computer controller with a feedback loop to shut down zones that are malfunctioning; and
  - Including separate meters and backflow prevention at point of mainline connection.

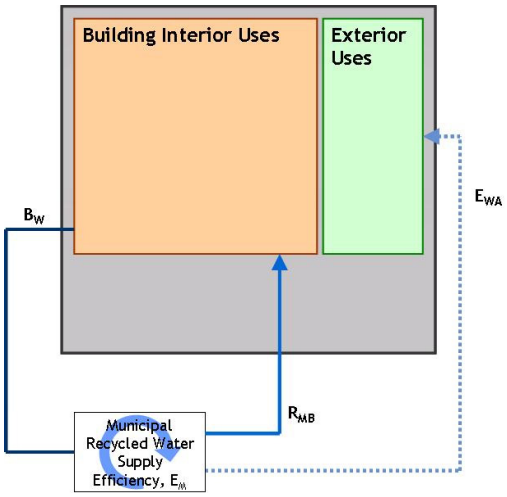
Recycled Water

The Exterior Water Allowance, E_{WA}, is based on achieving a water balance between the building wastewater and the project's exterior uses (irrigation, heat rejection and water features). It is a notional value that represents the amount of water that is allowed for exterior uses. Although recycled water may not physically be used for the project's exterior demand, it is offsetting the potable demand of exterior uses within the Emirate of Abu Dhabi and therefore the focus is placed on achieving this balance irrespective of whether recycled water is physically used.

Note: This offset approach only applies to exterior uses. To document reductions in potable water within the building (as in PW-1), recycled water must physically be used within the building in order to achieve reductions attributed to recycled water.

The E_{WA} that is available to serve the projects exterior water demand is determined as follows:

Case 1 : Project not connected to onsite or private offsite wastewater treatment facility



B_W = Total Building Wastewater

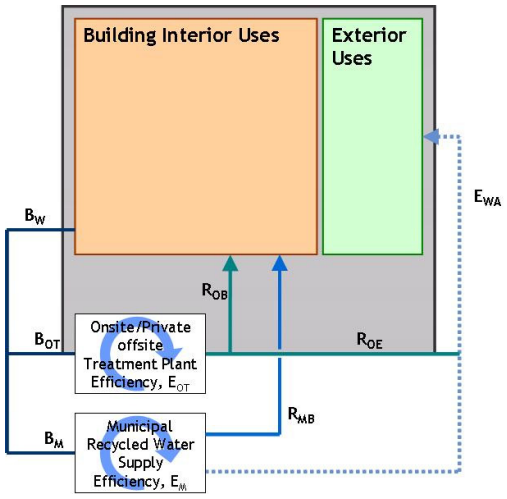
E_M = Municipal recycled water supply efficiency

R_{MB} = Volume of recycled water received from municipal supply that is supplied to the building

$$\text{Exterior Water Allowance, } E_{WA} = (B_W \times E_M) - R_{MB}$$

Case 2 : Project connected to onsite or private offsite wastewater treatment facility

- Exterior Water Allowance is based on the proportion of onsite/offsite recycled water used for exterior purposes and any remaining building wastewater sent for municipal treatment as follows:



B_W = Total Building Wastewater

B_{OT} = Volume of B_W sent to onsite/private offsite treatment

B_M = Volume of B_W sent to municipal system = B_W - B_{OT}

R_{MB} = Volume of recycled water received from municipal supply that is supplied to the building

E_M = Municipal recycled water supply efficiency

R_{OB} = Volume of onsite/private offsite recycled water supplied to building

E_{OT} = Onsite/private offsite wastewater treatment plant efficiency

R_{OE} = Volume of onsite/private offsite recycled water supplied to exterior uses

$$R_{OE} = B_{OT} \times E_{OT} - R_{OB}$$

$$\text{Exterior Water Allowance, } E_{WA} = R_{OE} + (B_M \times E_M) - R_{MB}$$

- E_{WA} must not be 'double counted' towards other uses such as heat rejection and/or water features. The design team must decide upon the most appropriate use of the Exterior Water Allowance in order to balance their building wastewater volume with their exterior water demand. The overall water balance must be documented in the Building Water Calculator.

Example Calculation: Plant Selection

A multi-residential building has a building footprint of 6,000 m^2 and is located within a 16,000m^2 plot. It has a 500m^2 sky garden located on the roof which contains 100m^2 of softscape requiring 6 $l/m^2/day$ and a 10m^2 water feature. At the base of the building there is softscape requiring 8$l/m^2/day$ which covers an area of 3,000m^2. Adjacent to the ground level softscape is a 150m^2 water feature.

Plot Area, A_P	16,000	m^2
Building Footprint, A_B	6,000	m^2
Softscape Area (grade level), A_S	3,000	m^2
Softscape Irrigation Demand (grade level), I_S	8	$l/m^2/day$
Water Feature Area (grade level), A_W	150	m^2
Roof Amenity Area, A_{RA}	500	m^2
Softscape Area (roof level), A_{RS}	100	m^2
Softscape Irrigation Demand (roof level), I_{RS}	6	$l/m^2/day$
Water Feature Area (roof level), A_{RW}	10	m^2
Total annual average irrigation demand of all external softscape areas, I_S	24,600	Liters / day

$$\text{Total Landscaped Area, } A_L = A_P - A_B - A_W + (A_{RA} - A_{RW})$$
$$= 16{,}000 - 6{,}000 - 150 + (500 - 10)$$
$$= 10{,}340 m^2$$

$$\text{Average Irrigation Demand} = \frac{I_S}{A_L}$$
$$= \frac{24{,}600}{10{,}340}$$
$$= 2.37 \text{ liters/m}^2\text{/day} = 2 \text{ Credit Points}$$

References

- Pearl Rating System Building Water Calculator

PW-2.2: Exterior Water Use Reduction: Heat Rejection

Intent

To reduce potable water use for heat rejection by promoting the use of recycled water and/or alternatives to water-based heat rejection.

Credit Requirements

General

Water-Based Heat Rejection

Demonstrate that the following percentage of the projects cooling tower/district cooling water make-up requirements can be served using the Exterior Water Allowance (as outlined in the Calculations and Methodology section):

- 2 Credit Points: > 25%
- 3 Credit Points: > 50%
- 4 Credit Points: > 75%
- 5 Credit Points: 100%

AND

Where cooling towers are installed onsite and recycled water is not immediately available, demonstrate that a recycled water mainline loop has been installed which allows for the future switch from potable to recycled water in onsite cooling towers when it becomes available. All pipes containing recycled water must be color coded in order to easily distinguish them from potable water pipes.

OR

No Water Used for Heat Rejection

- 8 Credit Points: Demonstrate that the project uses no water for heat rejection

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
8 (maximum)	**Design Rating**
2-5	Demonstrate that a percentage of the projects cooling tower/district cooling water make-up requirements can be served using the Exterior Water Allowance.
8	Demonstrate that no water is required for heat rejection.
8 (maximum)	**Construction Rating**
2-5	Demonstrate that a percentage of the projects cooling tower/district cooling water make-up requirements can be served using the Exterior Water Allowance.
8	Demonstrate that no water is required for heat rejection.

Credit Submission: Design Rating

Water-Based Heat Rejection

☐ Building Water Calculator confirming the percentage of the projects cooling tower/district cooling water make-up requirements that can be served using the Exterior Water Allowance; and

☐ A composite utility schematic illustrating routing of recycled water mainline and

laterals.

No Water Used for Heat Rejection

☐ Confirmation that no water is used for heat rejection.

Credit Submission: Construction Rating	**Water-Based Heat Rejection** ☐ Updated Building Water Calculator confirming the percentage of the projects cooling tower/district cooling water make-up requirements that can be served using the Exterior Water Allowance; ☐ As-built composite utility schematic illustrating routing of recycled water mainline and laterals; and ☐ Photographs of the installed cooling towers/district cooling plant, water recycling systems (where installed) and routing of recycled water mainline and laterals indicating their color code. **No Water Used for Heat Rejection** ☐ Confirmation that no water is used for heat rejection.
Calculations and Methodology	The projects cooling tower/district cooling water make-up requirements must be based on the proposed buildings cooling demand determined within RE-R1 Minimum Energy Performance / RE-1 Improved Energy Performance. The Exterior Water Allowance, E_{WA}, that is available to serve the projects exterior water demand is determined as per the Calculations and Methodology section of PW-2.1: Exterior Water Use Reduction: Landscaping E_{WA} must not be 'double counted' towards other uses such as irrigation and/or water features. The design team must decide upon the most appropriate use of the Exterior Water Allowance in order to balance their building wastewater volume with their exterior water demand. The overall water balance must be documented in the Building Water Calculator.
References	▪ Pearl Rating System Building Water Calculator

PW-2.3: Exterior Water Use Reduction: Water Features

Intent

Reduce potable water use in exterior water features by minimizing evaporative loss and through the use of recycled water.

Credit Requirements

General

2 Credit Points: Demonstrate that the water make-up requirements for all exterior water features can be served using the Exterior Water Allowance (as outlined in the calculations and methodology section); and

Where recycled water is not immediately available, demonstrate that a recycled water mainline loop has been installed which allows for the future switch from potable to recycled water for exterior water feature demands when it becomes available. All pipes containing recycled water must be color coded in order to easily distinguish them from potable water pipes.

1 Credit Points: Demonstrate that all external swimming pools are supplied with permanently installed retractable pool blankets.

Or

4 Credit Points: Demonstrate that there are no exterior water features or swimming pools.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREIDT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
2	Demonstrate that the water make-up requirements for all exterior water features can be served using the Exterior Water Allowance.
1	Demonstrate that all external swimming pools are provided with adequate pool blankets.
4	Demonstrate that there are no exterior water features or swimming pools.
4 (maximum)	**Construction Rating**
2	Demonstrate that the water make-up requirements for all exterior water features can be served using the Exterior Water Allowance.
1	Demonstrate that all external swimming pools are provided with adequate pool blankets.
4	Demonstrate that there are no exterior water features or swimming pools.

Credit Submission: Design Rating

- ☐ Site plans highlighting locations of all water features and swimming pools including their associated areas;
- ☐ Building Water Calculator confirming that the water make-up requirements for all exterior water features can be served using the Exterior Water Allowance;

	☐ A composite utility schematic illustrating routing of recycled water mainline and laterals; and ☐ Specification of proposed retractable pool blankets. OR ☐ Site plans confirming that there will be no exterior water features or swimming pools.
Credit Submission: Construction Rating	☐ As-built site plans highlighting locations of all water features and swimming pools including their associated areas; ☐ Updated Building Water Calculator confirming that the water make-up requirements for all exterior water features can be served using the Exterior Water Allowance; ☐ As-built composite utility schematic illustrating routing of recycled water mainline and laterals; ☐ Photographs illustrating routing of recycled water mainline and laterals indicating their color code, water recycling systems (where installed) and pool blankets. OR ☐ As-built site plans confirming that there are no exterior water features or swimming pools.
Calculations and Methodology	▪ Exterior water features: Include any open surface water associated with fountains, ponds etc (excluding swimming pools). ▪ The water loss from all external water features is determined using the Building Water Calculator and based on the total surface area of water features and catchment area of fountains; and the evaporation loss of surface water, E_L, as follows: $$\text{Total Water Feature Loss} = \sum (A_{WF} + F_L x A_{FC}) x E_L$$ A_{WF} = Water Feature Area A_{FC} = Fountain Catchment Area F_L = Fountain loss factor E_L = Evaporative Loss of surface water = 2,200 liters/m^2/yr The Exterior Water Allowance, E_{WA}, that is available to serve the project's exterior water demand is determined as per the Calculations and Methodology section of PW-2.1: Exterior Water Use Reduction: Landscaping E_{WA} must not be 'double counted' towards other uses such as irrigation and/or heat rejection. The design team must decide upon the most appropriate use of the Exterior Water Allowance in order to balance their building wastewater volume with their exterior water demand. The overall water balance must be documented in the Building Water Calculator.
References	▪ Pearl Rating System Building Water Calculator

PW-3: Water Monitoring & Leak Detection

Intent

To encourage the provision of metering facilities that allow the water consumption of the building to be recorded and monitored to allow future improvement and understanding of the use of water in buildings.

Credit Requirements

General

Monitoring

2 Credit Points: Demonstrate that easily accessible and clearly labeled water meters are provided and capable of monitoring the water consumption of, at a minimum, the following major uses (where present):

- Bathroom/Toilet Facilities;
- Kitchen/Catering Facilities;
- Swimming Pools (indoor); and
- Ablution Facilities.

Leak Detection

2 Credit Points: Demonstrate that a leak detection system has been installed that covers all main water distribution pipes within the project.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
2	Demonstrate that metering facilities that monitor the water consumption of major individual interior uses are installed.
2	Demonstrate that a leak detection system has been installed.
4 (maximum)	**Construction Rating**
2	Demonstrate that metering facilities that monitor the water consumption of major individual interior uses are installed.
2	Demonstrate that a leak detection system has been installed.

Credit Submission: Design Rating

Monitoring

- ☐ Design drawings showing locations of monitoring equipment;
- ☐ Narrative describing monitoring strategy relating to all major uses; and
- ☐ Extracts from specifications and MEP drawings clearly indicating the type, extent and locations of all metering, and central monitoring system

Leak Detection

- ☐ Design drawings and narrative showing the location of all equipment and describing the leak detection strategy. The narrative must address how the system deals with different leakage rates, the alarm mechanism, and how false alarms are avoided; and
- ☐ Extracts from specifications of leak detection systems.

Credit Submission: Construction Rating

Monitoring

- ☐ As-built drawings showing locations of monitoring equipment;
- ☐ Updated narrative describing monitoring strategy relating to all major uses;
- ☐ Manufacturer's information and as-built drawings clearly indicating the type, extent and locations of all metering, and central monitoring system;
- ☐ Photographic evidence confirming the installation of specified meters and central monitoring system; and
- ☐ Written commitment from the building owner to submit all exterior water monitoring data to Estidama (if requested).

Leak Detection

- ☐ As-Built drawings showing locations of leak detection equipment;
- ☐ Drawings and narrative showing the location of all equipment and describing the leak detection strategy. The narrative must address how the system deals with different leakage rates, the alarm mechanism, and how false alarms are avoided;
- ☐ Manufacturer's information of installed leak detection systems; and
- ☐ Photographic evidence confirming the installation of the leak detection system.

Calculations and Methodology

Monitoring

- All meters must have data logging capability and be connected to a central monitoring system so that information on the interior water consumption can be recorded. The monitoring system must have, at a minimum, the following capability:
  - Provide hourly, daily, weekly, monthly and annual water consumption for each major use;
  - Compare consumption to previous days, weeks, months and years for trend analysis;
  - Determine 'out-of-range' values to alert building operators to unusually high consumption; and
  - Record peak water consumption for each major use.
- The building owner must provide a written commitment to supply water monitoring data to Estidama (if requested). All reported information will be treated as confidential.

Leak Detection

- The leak detection system must be capable of:
  - Sounding an alarm when a leak is detected;
  - Identifying varying leakage rates; and
  - Being programmed to fit the projects water consumption requirements.

For buildings that include tenant fit-out areas not under developer control, Credit Points are only achieved where tenant guidelines prescribing the Monitoring and Leak Detection requirements are provided as part of IDP-R2 Tenant Fit-Out Design & Construction Guide.

References

None

PW-4: Stormwater Management

Intent

To minimize peak stormwater discharge and protect the stormwater drainage system and receiving water bodies from pollutant loading during and after storm events.

Credit Requirements

GENERAL

Quantity Control

- Demonstrate that the project has developed a stormwater management system that prioritizes infiltration, sustainable urban drainage systems, and utilizes structural solutions when necessary.
- 1 Credit Points: Demonstrate that the post-development peak runoff rate and quantity from the 2-year 24-hour design storm does not exceed the pre-development peak run-off rate and quantity through structural methods, or a combination of both structural and non-structural methods.
- 2 Credit Points: Demonstrate that the post-development peak runoff rate and quantity from the 2-year 24-hour design storm does not exceed the pre-development peak run-off rate and quantity through the use of non-structural methods only

Quality Control

- 1 Credit Point: The proposed stormwater management system is capable of collecting and treating a minimum of 90% of stormwater and that the treatment process is capable of achieving the following minimum standards for quality control:
  - 80% removal of Total Suspended Solids (TSS);
  - Minimum 95% removal of litter (gross pollutants, >1mm);
  - Minimum 90% removal of hydrocarbons; and
  - Use of petrol interceptors or suitable permeable paving for car parks of more than 4 bays

Operation & Maintenance Plan

- 1 Credit Point: Achieve a minimum of 1 credit point in either Quantity or Quality Control; and
- Demonstrate that an Operation & Maintenance Plan (OMP) is in place that shows how all systems will be maintained throughout the life of the development. The plan should include at a minimum:
  - Protocol for maintaining regular system checks and maintenance;
  - Methods for ensuring neighboring developments will not be adversely affected by the project's stormwater strategy; and
  - Strategies to prevent onsite erosion.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
1-2	Stormwater management system is designed to meet Quantity Control criteria as per Credit Requirements.
1	Stormwater management system is designed to meet Quality Control criteria as per Credit Requirements.
1	An OMP has been developed.
4 (Maximum)	**Construction Rating**
1-2	Stormwater management system components are constructed to meet Quantity Control criteria as per Credit Requirements.
1	Stormwater management system components are constructed to meet Quality Control criteria as per Credit Requirements.
1	An OMP has been updated.

Credit Submission: Design Rating

- ☐ Narrative describing the stormwater management system developed for the project including:
  - Drawings showing locations of components of the stormwater management system;
  - Civil engineering calculations describing and quantifying the stormwater management strategies, specifically addressing the pre-development and post-development peak runoff rate and quantity; and
  - Extracts from specifications and product data sheets describing the components specified, confirming that the system is capable of collecting 90% of stormwater and is able to treat to the required quality standards.
- ☐ OMP for ongoing site best management practices to uphold system integrity. The plan shall include:
  - An inspection schedule for the stormwater management system to assure its continued operation as designed;
  - The proposed person(s), organization, or entity responsible for the continued operation and maintenance of the stormwater management system;
  - Operating budgets and funding mechanism for the support of continued maintenance of the stormwater management system;
  - Methods for ensuring neighborhood developments will not be adversely affected by the project's stormwater strategy; and
  - Erosion plan to prevent excessive onsite erosion and to any receiving water courses.
- ☐ CV of qualified Civil Engineer

Credit Submission: Construction Rating

- ☐ As built drawings showing locations of the applied components of the stormwater management system;
- ☐ Updated civil engineering calculations describing and quantifying the stormwater management strategies, specifically addressing the pre-development and post-development peak runoff rate and quantity; and
- ☐ Manufacturers product data sheets for the purchased components, confirming that the system is capable of collecting 90% of stormwater and is able to treat to the required quality standards;

- ☐ Updated OMP; and
- ☐ Photographic evidence confirming the installation of the stormwater management strategies.

Calculations and Methodology

- For buildings within a Pearl Rated Community that has earned credit points under both Quantity and Quality Control for PW-2 Stormwater Management, the community wide stormwater system may be utilized to help earn this credit. In this case, plans must be provided showing how the building and community stormwater strategies are integrated. At least 50% of the difference between the post- and pre- development peak runoff rate and quantity from the 2-year 24-hour design storm must be contained and / or treated onsite (consistent with quantity and / or quality credit points pursued). The remainder must be sent to the community stormwater system.

- Non-structural stormwater management solutions include sustainable urban drainage systems (SUDS) such as ponds, vegetated swales, wetlands, etc.
- Structural stormwater management solutions include engineered structures such as tanks, pipes, concrete channels, etc.
- All water infiltrated through SUDS is considered to be 100% treated, achieving all the required quality control standards.
- Calculations must be signed off by a qualified civil engineer.

A qualified Civil Engineer is an individual with:

- A degree in a relevant subject, and
- A minimum of five years relevant work experience and a proven track record on working on similar projects in the region.

References

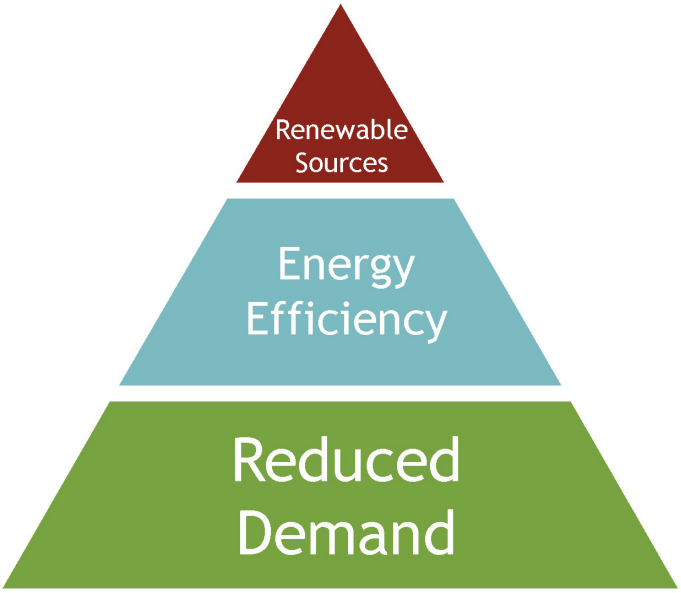
- Environment Agency Abu Dhabi, www.ead.gov.ae
- CSIRO Urban Stormwater Best Practice Environmental Management Guidelines (2006)

Abu Dhabi's ambitious growth targets translate into increased energy consumption. Energy conservation and portfolio diversification are imperative to sustain a competitive economy. Through the Pearl Rating System, Estidama seeks to target energy conservation through technological transitions in the building sector.

"The UAE has almost the highest rate of energy consumption per person in the world. If we continue at the current rate, the demand for energy will simply exceed the supply. At the same time, our consumption of energy adds to the worldwide problem of global warming. Clearly, we need to do something to prevent this."

— Heroes of the UAE

Techniques to conserve energy at the building design and construction stage can have significant impacts on reducing overall energy consumption during operation. The Resourceful Energy section requires an energy calculation and assessment process to be undertaken. This assessment will facilitate careful consideration of energy issues during the design of buildings, resulting in better informed decision making. Emphasis is on reducing the demand for energy through passive environmental design, appropriate selection of highly efficient mechanical and electrical equipment, and the facilitation of renewable energy installations.



CREDITS COVERED IN THIS SECTION

RE	Resourceful Energy					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
RE-R1	Minimum Energy Performance	R	R	R	R	R
RE-R2	Energy Monitoring & Reporting	R	R	R	R	R
RE-R3	Ozone Impacts of Refrigerants & Fire Suppression Systems	R	R	R	R	R
RE-1	Improved Energy Performance	15	15	15	15	15
RE-2	Cool Building Strategies	6	6	6	6	6
RE-3	Energy Efficient Appliances	3	3	3	3	3
RE-4	Vertical Transportation	3	3	3	3	3
RE-5	Peak Load Reduction	4	4	4	4	4
RE-6	Renewable Energy	9	9	9	9	9
RE-7	Global Warming Impacts of Refrigerants & Fire Suppression Systems	4	4	4	4	4
	TOTAL	**44**	**44**	**44**	**44**	**44**

RE-R1: Minimum Energy Performance

Intent

To create a decision-support tool to assist the project team in making informed decisions about the options, implications and benefits of various aspects of the building design in order to achieve a minimum level of energy efficiency.

Credit Requirements

General

Develop an energy model for the proposed building(s) using appropriate dynamic simulation modeling software and calculate the baseline building energy consumption according to the building performance rating method outlined in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007, using the minimum acceptable standards for building fabric, HVAC, service water heating, power, lighting and other equipment.

Demonstrate a minimum 12% performance improvement compared to the baseline building performance demonstrated by the energy simulation model as per the methodology outlined within Appendix G of Standard 90.1-2007.

Additional Requirement/Clarifications

None

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

☐ Energy Model Template summarizing the dynamic energy simulation, confirming that the minimum requirements of this credit will be achieved.

Credit Submission: Construction Rating

☐ Updated Energy Model Template summarizing the dynamic energy simulation, confirming that the minimum requirements of this credit have been achieved.

Calculations and Methodology

The method for determining reductions in energy consumption is outlined within the Performance Rating Method of ANSI/ASHRAE/IESNA Standard 90.1-2007 (Appendix G). Appendix G provides a methodology for rating the energy efficiency of building designs.

Compliance with the performance rating method requires that the mandatory provisions outlined in sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4 of Standard 90.1 – 2007 all be met.

Minimum acceptable standards for building fabric, HVAC, service water heating, power, lighting and other equipment for use within the baseline model must be set at either those given in Standard 90.1 – 2007 or local code, whichever is more stringent.

The building air leakage rate must be set at the more stringent of 3.64 l/s/m^2 at 75 Pa or local code, and be modelled identically in both the baseline and proposed building. If the project can demonstrate a requirement for improved air tightness performance is in place, this figure may be used in the proposed building design only if a full envelope air tightness test is to be carried out and the general contractor is under contract to achieve the required air leakage rate. The air tightness test must be carried out by a qualified and competent body (such as ATTMA member organisations or similar UKAS accredited organisations) and all test results and compliance certificates awarded to the project.

Unlike in Appendix G, performance improvements within the Pearl Rating System are based on reductions in annual energy consumption (kWh) rather than cost, thus all reference to energy rates within Appendix G must be ignored.

The proposed building's performance improvement is defined as:

$$\text{Percentage Improvement} = \frac{100 \times (\text{Baseline Building Performance (kWh/yr)} - \text{Proposed Buidling Performance (kWh/yr)})}{\text{Baseline Building Performance (kWh/yr)}}$$

Both the proposed building performance and the baseline building performance shall include all end-use load components:

- Lighting;
- Heating;
- Cooling;
- Heat rejection;
- Pumps;
- Fans;
- Service water heating; and
- Receptacle and process loads.

All tenant fit-out areas that are not under developer control must be modelled identically in both the baseline and proposed building unless tenant guidelines prescribing relied upon energy efficiency measures are provided as part of IDP-R2 Tenant Fit-Out Design & Construction Guide.

Where any form of mixed mode ventilation is used within areas of the building, the requirements of credit LBi-5.3: Thermal Comfort Modelling must be achieved for those areas in order to document energy savings attributed to mixed mode ventilation.

Performance Calculations

The proposed and baseline building performance must be calculated using the following:

- The same dynamic simulation modeling software (as per Appendix G of Standard 90.1-2007 and with approval from Estidama); and
- The same weather data.

Based on section B2. Major Climate Type Definitions within Standard 90.1-2007, climate zone 1b "Very Hot and Dry" will be assumed for projects within the Emirate of Abu Dhabi.

For components that cannot be adequately modelled by the simulation program, Estidama may approve an exceptional calculation method (as outlined within Appendix G of Standard 90.1-2007) which demonstrates energy savings through calculations performed by design teams, including theoretical and/or empirical information supporting the accuracy of the method.

Mixed-Use Developments: Where a building incorporates more than one occupancy type, for example part residential and part office, the methodology is as follows:

- Baseline HVAC systems are modelled as described within Standard 90.1 Appendix G section G3.1.1.
- Baseline building envelope parameters must be set at those required in Standard 90.1 and be based on occupancy type (residential, non-residential etc).
- The baseline and proposed building must be modelled as a single building including all requirements determined based on occupancy type.

Receptacle and Process Loads

Receptacle and process loads must be modelled identically in both the baseline and proposed building. These loads include all miscellaneous and plug loads within the building. Example loads that are included within receptacle and process consist of, but

are not limited to:

- Office equipment;
- Computers;
- Elevators and escalators;
- Kitchen equipment;
- Laundry equipment; and
- Water treatment.

District Cooling (DC)

- Buildings served via a DC network will need to obtain confirmation of the seasonal delivered coefficient of performance (COP) of the district system. This needs to take account of thermal losses within the network in both directions.
- For DC networks already in place, a seasonal delivered COP will need to be obtained from the district cooling operator based on actual data of the cooling plant and associated network over a 12 month period.
- For schemes which have not yet been built, or have been in operation for less than 12 months, confirmation on the proposed performance of the DC network over 12 months must be obtained from the DC developer/operator.
- If sufficient data cannot be provided on the DC network, a seasonal average COP of 4.5 must be assumed.
- The COP of the DC network must be used in the proposed building energy simulation.
- The DC plant will be assumed to be served via grid electricity unless evidence is provided to the contrary.

Renewable Energy

- Energy generated through onsite renewable technologies (those located within the site boundary) may be subtracted from the proposed building energy consumption, including where the energy produced is exported to the electrical grid.

References

- ASHRAE/ASHRAE/IESNA 90.1 – 2007: Energy Standard for Buildings Except Low-Rise Residential Buildings

RE-R2: Energy Monitoring & Reporting

Intent

To encourage the provision of metering facilities that allow the energy performance of the building to be recorded and monitored to allow future improvement and understanding of the use of energy in buildings.

Credit Requirements

General

Demonstrate that easily accessible and clearly labelled energy sub-meters are provided which enable a minimum of 90% of the estimated annual energy consumption of each fuel type (electricity, gas etc) to be monitored as outlined within the Calculations and Methodologies section.

In addition separate meters must be provided for all plant exceeding the sizes in the table below:

Plant Description	Load kW
Cooling installations comprising one or more units feeding a common distribution circuit	20
Motor control centres providing power to HVAC equipment	10
Final electrical distribution boards (power/lighting)	10

Additional Requirement/Clarifications

- Demonstrate that easily accessible and clearly labelled energy sub-meters are provided and capable of monitoring the energy consumption of all tenant areas (as outlined within the Calculations and Methodology section), and all metering requirements are documented within the tenant guidelines as part of IDP-R2 Tenant Fit-Out Design & Construction Guide.

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the requirements of the credit will be achieved;
- ☐ Energy system schematics illustrating the proposed metering strategy confirming that the required level of metering will be achieved; and
- ☐ Extracts from specifications and building services layout design drawings clearly indicating the type, extent and locations of all metering, and the central monitoring system.

Credit Submission: Construction Rating

- ☐ Updated brief narrative describing how the requirements of the credit have been achieved;
- ☐ Energy system schematics illustrating the metering strategy confirming that the required level of metering has been achieved;
- ☐ Manufacturer's data and as-built building services layout drawings clearly indicating the type, extent and locations of all metering, and central monitoring system;
- ☐ Photographic evidence confirming installation of specified meters and central monitoring system; and
- ☐ Written commitment from the owner to submit all energy monitoring data to Estidama (if requested).

Calculations and Methodology

- Based on the energy consumption of individual major end-uses (as outlined in the table below), develop a metering strategy that accounts for 90% of the total building

energy consumption by estimating the amount of energy passing through each meter. The largest loads should be considered in the first instance and repeated iterations performed until 90% achieved. Guidance on developing an appropriate metering strategy can be found within GIL 65: Metering Energy Use in New Non-Domestic Buildings and CIBSE TM39 2009: Building Energy Metering

- Landlord areas in all building types must meter energy consumption of all end-uses outlined in the table below.
- For office, retail and multi-residential buildings separated into landlord and tenant areas, each tenant area must also be sub-metered for each of the end-uses outlined in the table below.
- All onsite energy generating systems must be separately metered and their annual energy generation recorded.
- Building types that fall under the General category will follow either:
  - Non-Residential: tenant area metering requirements for office;
  - Residential (spaces used primarily for living and/or sleeping): tenant area metering requirements for multi-residential.
- Schools are assumed to be solely landlord controlled and therefore there are no additional requirements for tenant areas.
- The following table is divided into the metering requirements for landlord and tenant areas:

	Landlord Areas	Tenant Areas		
Building End-Use		Office	Retail	Multi-Resi
Cooling	✓	✓	✓	✓
Dehumidification	✓	✓	✓	
Service water heating	✓	✓	✓	✓
Motor Control Centres (fans)	✓	✓	✓	
Motor Control Centres (pumps)	✓	✓	✓	
Lighting	✓	✓	✓	✓*
Receptacle and process loads	✓	✓	✓	✓*
Other major energy consuming plant (swimming pools, kitchens, server room, lifts and escalators etc)	✓	✓	✓	

* Multi-Residential buildings: lighting and receptacle and process loads in tenant areas may be metered together.

- All sub-meters must have data logging capability and be connected to a central monitoring system so that information on the building's energy consumption can be recorded. The monitoring system must have, at a minimum, the following capability:
  - Provide hourly, daily, weekly, monthly and annual energy consumption for each end-use;
  - Compare consumption to previous days, weeks, months and years for trend analysis;
  - Determine 'out-of-range' values and alert building operators to unusually high consumption; and
  - Record peak energy consumption for each end-use.
- The building owner must provide a written commitment to supply energy monitoring

data to Estidama (if requested). All reported information will be treated as confidential.

References

- GIL 65: Metering Energy Use in New Non-Domestic Buildings
- CIBSE TM39 2009: Building Energy Metering

RE-R3: Ozone Impacts of Refrigerants & Fire Suppression Systems

Intent

To promote the selection of refrigerants and fire suppression systems that minimise impacts on the environment

Credit Requirements

GENERAL

Refrigerants

- Demonstrate that all refrigerants to be installed within the project site boundary have an ozone depletion potential (ODP) of zero

Fire Suppression Systems

- Demonstrate that all gaseous fire suppression systems to be installed within the project site boundary have an ozone depletion potential (ODP) of zero

This credit only refers to refrigeration systems contained within the site boundary; (i.e. district cooling systems which provide only chilled water to the site are not subject to the requirement of this credit)

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project meets the credit requirements; and
- ☐ Specification extracts for all proposed refrigerants and gaseous fire suppression systems confirming ODP of each refrigerant and gas is zero.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project meets the credit requirements; and
- ☐ Manufacturer's information for all installed refrigerants and gaseous fire suppression systems confirming ODP of each refrigerant and gas is zero.

Calculations and Methodology

- The ozone depletion potential (ODP) of various refrigerants is given below:

Chlorofluorocarbons	ODP	GWP	Common Building Applications
CFC-12	1.0	10,900	Refrigerators, chillers
Hydrochlorofluorocarbons			
HCFC-22	0.055	1,810	Air conditioning, chillers
HCFC-123	0.02	77	CFC-11 replacement
Hydrofluorocarbons			
HFC-134a	0	1,430	CFC-12 or HCFC-22 replacement
HFC-245fa	0	1,030	Insulation agent, centrifugal chillers
HFC-407c	0	1,700	HCFC-22 replacement
HFC-410a	0	1,900	Air conditioning

HFC-417a	0	1,950	HCFC-22 replacement
Natural Refrigerants			
Carbon Dioxide (CO_2)	0	1.0	
Ammonia (NH_3)	0	0	
Propane (C_3H_8)	0	3	
Isobutene	0	3	
Air	0	0	
Water	0	0	

References None

RE-1: Improved Energy Performance

Intent

To promote further reductions in the projects energy consumption and hence carbon emissions associated with building operation.

Credit Requirements

General

- 1-15 Credit Points: Using the same methodology outlined in RE-R1: Minimum Energy Performance, demonstrate further percentage reductions in the proposed building energy consumption beyond the baseline building consumption determined in RE-R1. Points are awarded as follows:

Points Achieved	Percentage Reduction
1	14%
2	16%
3	18%
4	20%
5	22.5%
6	25%
7	27.5%
8	30%
9	32.5%
10	35%
11	40%
12	45%
13	50%
14	55%
15	60%

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
15 (maximum)	**Design Rating**
1-15	Achieve further percentage reductions in the proposed building energy consumption compared to the baseline.
15 (maximum)	**Construction Rating**
1-15	Achieve further percentage reductions in the proposed building energy consumption compared to the baseline.

Credit Submission: Design Rating

☐ Energy Model Template summarizing the dynamic energy simulation and confirming the percentage reduction that will be achieved.

Credit Submission: Construction Rating

☐ Updated Energy Model Template summarizing the dynamic energy simulation and confirming the achieved percentage reduction.

Calculations and Methodology

- Determine the baseline building annual energy consumption as per RE-R1 Minimum Energy Performance.
- Through the addition of all energy conservation measures, determine the energy reductions of the proposed building and demonstrate a percentage improvement compared to the baseline.

$$\text{Percentage Improvement} = \frac{100 \times (\text{Baseline Building Performance(kW/yrh)} - \text{Proposed Buidling Performance(kWh/yr)})}{\text{Baseline Building Performance(kWh/yr)}}$$

References

- ASHRAE/ASHRAE/IESNA 90.1 – 2007: Energy Standard for Buildings Except Low-Rise Residential Buildings

RE-2: Cool Building Strategies

Intent

To determine the most effective solution to reducing a building's cooling demand by incorporating passive design strategies as a priority.

Credit Requirements

General

Demonstrate that passive design measures have been incorporated into the building design to reduce the external heat gain compared with the baseline building.

Reductions in the annual external heat gain must be analysed and presented according to the procedure outlined within the Calculations and Methodology section.

- 1-5 Credit Points: Points are awarded based on reductions in the annual external heat gain of the proposed building compared with the baseline as follows:

Points Achieved	Percentage Reduction
1	10%
2	20%
3	30%
4	40%
5	50%

An additional point is awarded for the use of high solar reflective roofing materials in order to help reduce the building external heat gain as well as the impact on the local microclimate.

- 1 Credit Point: Use of roofing materials with a Solar Reflectance Index (SRI) ≥ 78

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
6 (maximum)	**Design Rating**
1-5	Demonstrate percentage reductions in annual external heat gain attributed to passive design measures.
1	Demonstrate that roofing materials with a high SRI will be used.
6 (maximum)	**Construction Rating**
1-5	Demonstrate percentage reductions in annual external heat gain attributed to passive design measures.
1	Demonstrate that roofing materials with a high SRI have been used.

Credit Submission: Design Rating

- ☐ Narrative describing the passive design measures to be incorporated within the project;
- ☐ Graph and results table illustrating incremental reductions in the proposed building's annual external heat gain (kWh/m^2) as outlined within the Calculations and Methodology section;
- ☐ Drawings (section, plan and elevation) as necessary to fully describe all passive design measures integrated into the building design;

- ☐ Extracts from specifications relating to construction thermal performance parameters and building envelope air tightness specifications and air testing methodology (where applicable); and
- ☐ Roof drawings and specifications confirming all roof areas except those covered by mechanical plant, shading devices, renewable technologies and designated vegetated roofs use materials with a SRI ≥ 78.

Credit Submission: Construction Rating

- ☐ Updated narrative describing the passive design measures incorporated within the project;
- ☐ Graph and results table illustrating incremental reductions in the as-built building's annual external heat gain (kWh/m^2) as outlined within the calculations and methodology section;
- ☐ As-built drawings (section, plan and elevation) as necessary to fully describe all passive design measures integrated into the building design;
- ☐ Manufacturers information relating to construction thermal performance parameters and building envelope air tightness specifications and air testing results (where applicable); and
- ☐ As-built roof drawings and specifications confirming all areas except those covered by mechanical plant, shading devices, renewable technologies and designated vegetated roofs use materials with a SRI ≥ 78.

Calculations and Methodology

- Passive design measures are those which require no mechanical systems. This includes, but is not limited to, orientation, fixed shading devices, improvements to building fabric, air tightness etc.
- Reductions in external heat gain attributed to air tightness may only be included based on the testing requirements as per RE-R1 Minimum Energy Performance.
- External heat gain is defined as the sum of solar gain, external conduction gain and infiltration gain.
- Using the baseline building energy model developed within RE-R1 Minimum Energy Performance, extract the baseline annual external heat gain (solar gain + external conduction gain + infiltration gain) for each of the four baseline models (0, 90, 180, 270 degree rotations) and calculate the average baseline annual external heat gain.
- Introduce each of the following design measures to the baseline model incrementally and document the effect each measure has on the annual external heat gain:

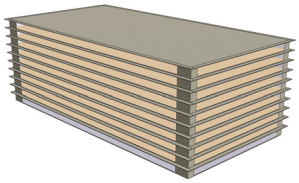
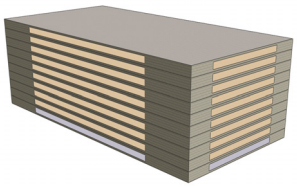
  1 Orientation
  2 Glazing ratio (both vertical fenestration and skylights)
  3 Glazing solar heat gain coefficients (SHGC)
  4 External shading
  5 Building air leakage rate
  6 Envelope conductive performance
  7 Any other passive design measure not covered within points 1-6 above

- The total reduction in annual external heat gain is given as:

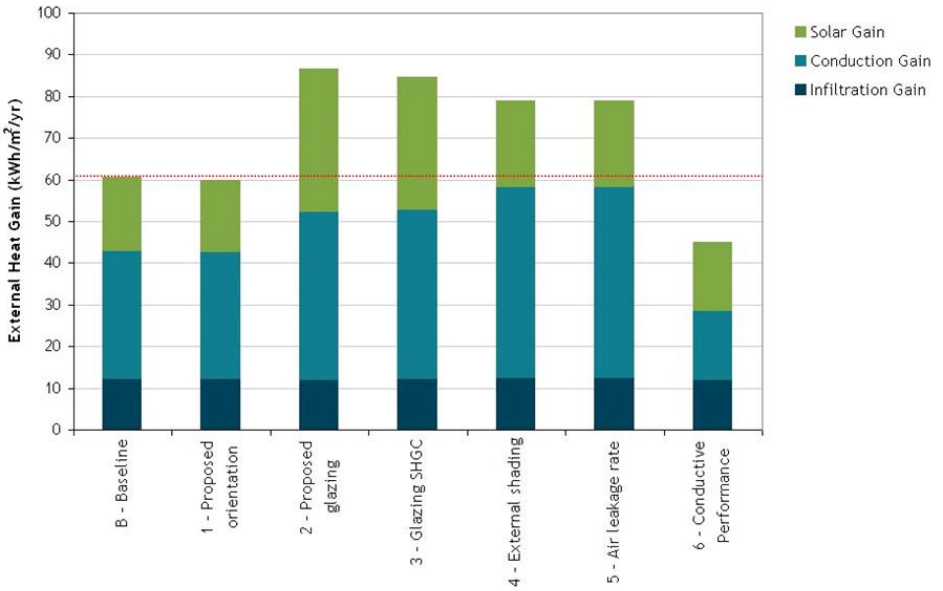
$$\text{Percentage Improvement} = \frac{100x\left(\text{Baseline Building External Heat Gain}\,(kWh/m^2) - \text{Proposed Buidling External Heat Gain}\,(kWh/m^2)\right)}{\text{Baseline Building External Heat Gain}\,(kWh/m^2)}$$

Calculation example:

The following example is based on a simple 10 storey building. The table below lists relevant building parameters assumed in the models as follows:

	Proposed building	Baseline building
Geometry		
Floor Area (m^2)	50,000	50,000
Floor-Floor Height (m)	3.4	3.4
Vertical Fenestration overall glazing ratio*	80%	40%
Vertical Fenestration SHGC	0.22	0.25
External Shading	1.5m overhangs	None
Air Leakage Rate ($l/s/m^2$)	3.64	3.64
U-Values (W/m^2K)		
Above-grade walls	0.35	0.705
Roof	0.25	0.36
Floors	0.25	1.986
Vertical Fenestration	2.2	6.81
Annual Solar Gain (kWh/m^2)	16.8	18.0
Annual External Conduction Gain (kWh/m^2)	16.8	30.6
Annual Infiltration Gain (kWh/m^2)	12.1	12.1
Annual External Heat Gain (KWh/m^2)	45.7	60.7
Total Percentage Reduction	24.7%	N/A
Credit Points Achieved	2	N/A

*Glazing Ratio – the ratio of the total area of glazing on a facade to the total façade area



		Annual External Heat Gain (kWh/m^2)	Percentage Change (%)
B	Baseline	60.7	-
1	Orientation	59.9	-1.4%
2	Glazing ratio	86.5	+42.6%
3	Glazing SHGC	84.6	+39.4%
4	External shading	79.1	+30.3%
5	Building air leakage rate	79.1	+30.3%
6	Envelope conductive performance	45.7	-24.7%

- In order to achieve an additional point for the use of roofing materials with a high SRI, the entire roof except those areas covered by mechanical plant, shading devices, renewable technologies and designated vegetated roofs must use materials with a SRI ≥ 78.
- Roof areas covered by external shading devices are calculated as the portion of roof area in shade measured at 12pm solar time on the summer solstice. The upper surface of those shading devices must also use materials with a SRI ≥ 78.
- Roofs are defined as the upper portion of the building envelope that are tilted at an angle of less than 60 degrees to the horizontal.
- Where a building contains no roof surfaces (excluding areas covered by mechanical plant, designated vegetated roofs and renewable technologies), the credit point is awarded automatically.
- The SRI of a material shall be calculated based on solar reflectance and emittance numbers as defined in the American Society of Testing and Materials Standard E1980-01. Alternatively manufacturer's evidence can be supplied where the testing is in accordance with the referenced standards below.

References

- ASTM E1980 - 01 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- ASTM E1918-06, Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

- ASTM C1549-09, Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
- ASTM E 408-71(2008), Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- ASTM C1371-04a, Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers

RE-3: Energy Efficient Appliances

Intent

To minimise the energy consumed by common building appliances.

Credit Requirements

General

3 Credit Points: Demonstrate that all landlord purchased and/or leased installed appliances achieve one of the following:

- Energy Star accredited
- A minimum A rating under the EU Energy Efficiency Labelling Scheme
- An appropriate level under a comparable rating scheme provided the appliance meets or exceeds equivalent level requirements under the Energy Star or EU Energy Efficiency Labelling Scheme

Additional Requirement/Clarifications

Provide guidelines for tenants (where applicable) outlining the benefits of energy efficient appliances, the sustainability goals that the building is aiming to achieve, how their purchases can contribute, and examples of the types of appliances the tenants may purchase.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
3 (maximum)	**Design Rating**
3	Demonstrate that all developer purchased and/or leased installed appliances shall be energy efficient, and that tenant guidelines outlining the benefits of energy efficient appliances will be produced.
3 (maximum)	**Construction Rating**
3	Demonstrate that all developer purchased and/or leased installed appliances are energy efficient, and that tenant guidelines outlining the benefits of energy efficient appliances have been produced.

Credit Submission: Design Rating

- ☐ Summary list of all appliances to be installed in the building, including quantity and energy efficiency certification;
- ☐ Extracts from specifications detailing appliance energy use and proof of certification by Energy Star program, EU Energy Efficiency Labeling Scheme or equivalent; and
- ☐ Draft tenant guidelines outlining the potential benefits of installing energy efficient appliances, along with examples of appliances which are appropriate for tenants to purchase.

Credit Submission: Construction Rating

- ☐ Updated summary list of all appliances installed in the building including quantity, manufacturer and model;
- ☐ Manufacturer information regarding appliance energy use and proof of certification by Energy Star program, EU Energy Efficiency Labeling Scheme or equivalent; and
- ☐ Tenant guidelines outlining the potential benefits of installing energy efficient appliances, along with examples of appliances which are appropriate for tenants to purchase.

Calculations and Methodology

Recognised appliance rating systems include but are not necessarily limited to:

- Energy Star
- EU Energy Efficiency Labelling Scheme
- If other labelling schemes are used, evidence describing how the appliances meet or exceed the equivalent requirements under the Energy Star or EU labelling scheme must be submitted and may be accepted after formal verification from Estidama.
- All landlord purchased and/or leased installed appliances included within the table below must achieve at least one of the energy efficient labels above.
- Schools are assumed to be solely landlord controlled and therefore there are no additional requirements for tenant areas.
- Based on the tenant occupancy type, tenant guidelines must cover all the appliances outlined in the table below.
- Where the occupancy type is general, tenant guidelines must cover all the appliances that are relevant to the building type.

	Landlord Areas	Tenant Areas		
Appliance		Office	Retail	Multi-Resi
Dishwashers	✓	✓	✓	✓
Refrigerators and freezers	✓	✓	✓	✓
Ovens	✓		✓	
Ice Machines	✓		✓	
Steam Cookers	✓		✓	
Fryers/Griddles	✓		✓	
Televisions	✓	✓	✓	✓
Washing Machines or washer/dryers	✓		✓	✓
Computers	✓	✓	✓	✓
Copiers and fax machines	✓	✓		
Digital duplicators	✓	✓		
Enterprise servers	✓	✓		
External power adapters	✓	✓	✓	
Monitors	✓	✓	✓	
Printers, scanners and all-in-ones	✓	✓		
Water coolers/heaters	✓	✓	✓	✓

References

None

RE-4: Vertical Transportation

Intent

To promote projects that specify and install energy efficient vertical movement and transportation systems

Credit Requirements

GENERAL

Easily Accessible Stairs

- 1 Credit Point: Demonstrate that there are easily accessible stairs to at least the first three floors (or to all floors if the building is less than three stories), and that the stairs are either visible from the main entrance or visible from the main building lifts. The stairs must have the following characteristics:
  - Achieve a minimum lighting level of 150 lux measured at the walking surfaces;
  - Open or visible on at least one side; and
  - All artificial lighting used within the stairs must be supplied with colour corrected lamps which provide a minimum Color Rendering Index (CRI) of 80.

Energy Efficient Lifts

- 1 Credit Point: Demonstrate that all lifts within the building are energy efficient as follows:
  - Offer 'idle/downtime' features allowing the lift to operate in a stand-by mode during off-peak periods;
  - Include a regenerative drive system (buildings over three stories only); and
  - Use LED lighting and LCD display features.

Energy Efficient Escalators/Travelators

- 1 Credit Point: Demonstrate that all escalators and travelators within the building are energy efficient as follows:
  - Offer an automated stop/start function linked to occupancy sensors to enable standby mode when there is no passenger demand; and
  - Use LED strip lighting.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

- Simple platform/wheelchair lifts and electronic ramps are not subject to the requirements of this credit.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
3 (maximum)	**Design Rating**
1	Demonstrate that easily accessible stairs shall be provided to at least the first three floors of the building.
1	Demonstrate that all lifts within the building shall be energy efficient.
1	Demonstrate that all escalators/ travelators within the building shall be energy efficient.
3 (maximum)	**Construction Rating**
1	Demonstrate that easily accessible stairs have been provided to at least the first three floors of the building.
1	Demonstrate that all lifts within the building are energy efficient.
1	Demonstrate that all escalators/travelators within the building are energy efficient.

Credit Submission: Design Rating

Easily Accessible Stairs

- ☐ Brief narrative indicating how the project will meet the credit requirements;
- ☐ Plan and elevation drawings detailing the staircase design and their location(s) within the building;
- ☐ Lighting calculations demonstrating that the minimum lux levels will be achieved on the stairs measured at the walking surfaces at any time; and
- ☐ Extracts from lighting specifications confirming that all light fittings within the stairs achieve the minimum color rendering index required.

Energy Efficient Lifts

- ☐ Brief narrative indicating how the project will meet the credit requirements; and
- ☐ Extracts from the lift specifications detailing the 'idle/downtime' features, regenerative drive system and confirmation that specified lighting is LED and any display features are LCD.

Energy Efficient Escalators and Travelators

- ☐ Brief narrative indicating how the project will meet the credit requirements; and
- ☐ Extracts from the escalator/travelator specifications detailing the automated stop/start system, occupancy sensors and confirmation that specified strip lighting is LED.

Credit Submission: Construction Rating

Easily Accessible Stairs

- ☐ Updated narrative including photographic evidence indicating how the project meets the credit requirements;
- ☐ As-built plan and elevation drawings detailing the staircase design and their location(s) within the building;
- ☐ Lighting measurements demonstrating that a minimum of 150 lux is achieved at the walking surfaces at any time; and
- ☐ Manufacturer's information confirming that all light fittings within the stairs achieve the minimum color rendering index required.

Energy Efficient Lifts

- ☐ Updated narrative including photographic evidence indicating how the project meets the credit requirements; and
- ☐ Manufacturer's information of the installed lift(s) detailing the 'idle/downtime' features, regenerative drive system and confirmation that installed lighting is LED

and any display features are LCD.

Energy Efficient Escalators and Travelators

- ☐ Updated narrative including photographic evidence indicating how the project meets the credit requirements; and
- ☐ Manufacturer's information of the installed escalator/travelator(s) detailing the automated stop/start system, occupancy sensors and confirmation that installed strip lighting is LED.

Calculations and Methodology	▪ Lighting calculations and measurements must be conducted without the influence of daylight
References	▪ SLL CIBSE Code for Lighting

RE-5: Peak Load Reduction

Intent

To reduce energy demand and consequent increased infrastructure requirements to cater for loads at peak use times through efficient building and services design and site-based renewable energy generation.

Credit Requirements

General

Demonstrate the following:

- 2 Credit Points: Peak electrical load is less than 80% greater than the project design annual average electrical load.
- 4 Credit Points: Peak electrical load is less than 60% greater than the project design annual average electrical load.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
2	Demonstrate peak electrical load shall be less than 80% above annual average electrical load.
4	Demonstrate peak electrical load shall be less than 60% above annual average electrical load.
4 (maximum)	**Construction Rating**
2	Demonstrate peak electrical load is less than 80% above annual average electrical load.
4	Demonstrate peak electrical load is less than 60% above annual average electrical load.

Credit Submission: Design Rating

- ☐ Graph from the dynamic energy simulation illustrating the annual electrical load profile of the proposed building, highlighting the peak and annual average electrical loads;
- ☐ Calculations confirming the percentage increase in peak electrical load compared to the annual average electrical load; and
- ☐ Narrative describing each of the major peak load reduction strategies, along with drawings, equipment data sheets/specifications as necessary to illustrate how and where the chosen measures are incorporated into the proposed building design.

Credit Submission: Construction Rating

- ☐ Graph from the dynamic energy simulation illustrating the annual electrical load profile of the as-built building, highlighting the peak and annual average electrical loads;
- ☐ Calculations confirming the percentage increase in peak electrical load compared to the annual average electrical load; and
- ☐ Updated narrative describing each of the major peak load reduction strategies, along with as-built drawings, equipment data sheets/specifications as necessary to illustrate how and where the chosen measures are incorporated into the as-built building design.

Calculations and Methodology

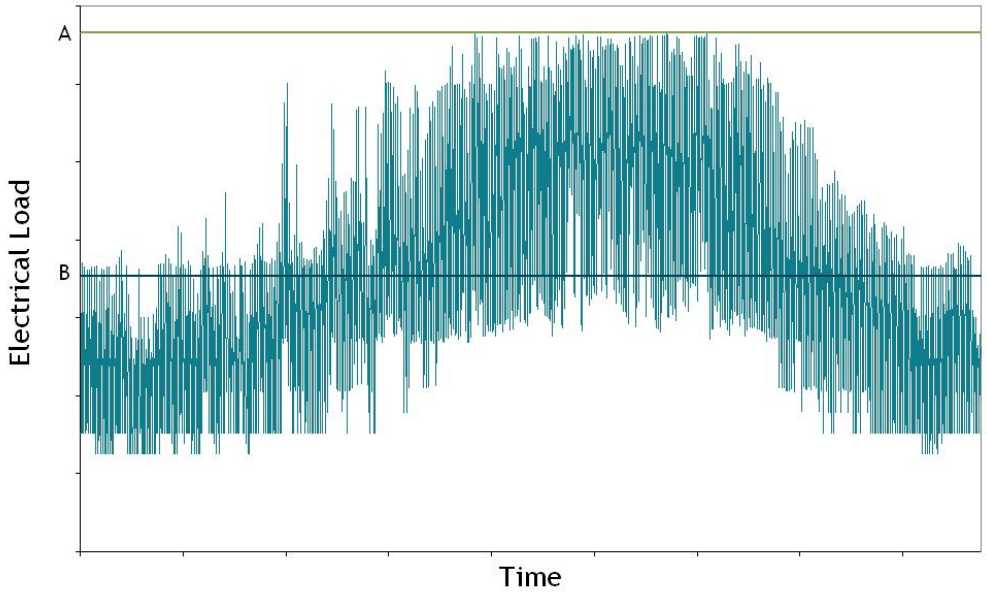
- The peak and annual average electrical load (MW) must be determined from the modeling results of the dynamic simulation undertaken as part of RE-R1 Minimum

Energy Performance / RE-1 Improved Energy Performance

- The electrical loads must include all energy conservation and peak load reduction measures (e.g. renewable technologies, energy storage systems etc)
- As per RE-R1, power generated through onsite renewable technologies may be subtracted from the project's electrical load.
- Points are awarded as follows:

2 Credit Points: Peak Electrical Load, A < 1.8 x Annual Average Electrical Load, B

4 Credit Points: Peak Electrical Load, A < 1.6 x Annual Average Electrical Load, B



References None

RE-6: Renewable Energy

Intent

To reward projects for the use of renewable technologies, therefore reducing the carbon emissions associated with building operation and the reliance on fossil fuel based power generation.

Credit Requirements

General

Demonstrate that a percentage of the developments total energy demand is supplied through renewable energy.

Onsite Systems:

- Demonstrate that an onsite renewable energy feasibility study has been undertaken, and that one or more appropriate technologies have been selected as a result of the study; and
- 1-8 Credit Points: Demonstrate that a percentage of the proposed buildings energy consumption is supplied through onsite renewable energy. Points are awarded as follows:

Points Achieved	Required Percentage
1	1%
2	3%
3	5%
4	7%
5	10%
6	13%
7	16%
8	20%

Offsite Systems:

- 1 Credit Point: Demonstrate that a minimum of 20% of the project's non-renewable energy use will be provided by offsite renewable generation through direct purchase and/or certified Renewable Energy Certificates (RECs), and that contracts are signed for a minimum of 2 years.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
9 (maximum)	**Design Rating**
1-8	Demonstrate that a percentage of the total energy consumption will be supplied by onsite renewable energy.
1	Demonstrate that 20% of the project's non-renewable energy use will be supplied by offsite renewable energy.
9 (maximum)	**Construction Rating**
1-8	Demonstrate that a percentage of the total energy consumption is supplied by onsite renewable energy.
1	Demonstrate that 20% of the project's non-renewable energy use is supplied by offsite renewable energy.

Credit Submission: Design Rating

Onsite Systems:

☐ Renewable energy feasibility study covering each of the technologies required as well as recommendations on the preferred technology/technologies; and

☐ Calculations of the annual energy generation capability of each proposed renewable energy technology, both in terms of annual energy produced as well as a

percentage of the proposed building annual energy consumption.

Offsite Systems:

- ☐ Calculations demonstrating the amount of renewable energy required to be purchased in order to achieve 20% of the project's non-renewable energy consumption from offsite renewable generation; and
- ☐ Narrative describing the proposed strategy (direct purchase/RECs) for achieving the credit requirements.

Credit Submission: Construction Rating

Onsite Systems:

- ☐ Photographic evidence confirming that the recommended renewable energy technology/technologies based on the design stage feasibility study has been incorporated into the project; and
- ☐ Updated summary report showing the annual energy generation capability of each installed renewable energy technology, both in terms of annual energy produced as well as a percentage of the proposed building annual energy consumption.

Offsite Systems:

- ☐ Direct Purchase
  - The name of the renewable energy provider;
  - Annual quantity of renewable energy purchases;
  - Renewable energy technology (e.g. solar photovoltaics);
  - Confirmation that the annual purchases are equal to 20% or more of the proposed building's annual non-renewable energy consumption; and
  - Copy of the contract verifying the annual purchase amount and length of contract.
- ☐ Renewable Energy Certificates (RECs)
  - Narrative describing the proposed purchase plan for RECs;
  - The annual quantity of purchases;
  - Renewable energy technology (e.g. solar photovoltaics);
  - Confirmation that the annual purchases are equal to 20% or more of the proposed building's annual non-renewable energy consumption;
  - Copy of the contract verifying the annual purchase amount and length of contract; and
  - Approved certification (e.g. Green-e certified).
- ☐ Combination of Direct Purchase and RECs
  - Documentation required above for both Direct Purchase and RECs; and
  - Narrative confirming that the combined annual purchase is equal to 20% or more of the proposed building's annual energy consumption.

Calculations and Methodology

Eligible renewable technologies include, but are not limited to:

- Wind energy systems;
- Solar energy, including solar electricity and solar thermal systems;
- Deep-heat geothermal systems, providing either electrical power or thermal energy (does not include ground source heat pumps);
- Wave/tidal/hydro electric energy systems;
- Landfill gas systems; and
- Organic/agricultural and animal waste to energy systems.

Any other form of renewable technology may be proposed and will be subject to approval from Estidama.

Onsite Systems:

Onsite systems are defined as renewable energy generated within the project site boundary.

The onsite renewable energy feasibility study must cover a minimum of three

renewable technologies and cover the following:

- Annual energy generated from each renewable technology;
- Percentage of total annual energy consumption supplied through onsite renewable technologies;
- Payback;
- Water use;
- Land use;
- Visual issues;
- Maintenance; and
- Where the renewable technology will be used (e.g. car park lighting systems).

The study must include a summary matrix detailing the relative merits of each renewable technology in reference to the above issues with the selected technology highlighted.

The percentage of energy supplied through onsite renewable technologies is determined by calculating the annual energy production of each onsite renewable technology, and dividing their sum by the annual energy consumption of the proposed building determined within RE-1 Improved Energy Performance.

$$\text{Percentage Onsite Renewable Energy} = \frac{100x \sum \text{Annual Energy Generated from Onsite Renewable Technologies (kWh)}}{\text{Proposed Building Energy Consumption (kWh)}}$$

Offsite Systems:

Offsite systems are defined as renewable energy generated outside of the project site boundary.

The percentage of the non-renewable energy consumption to be supplied through offsite renewable technologies is determined as follows:

$$\text{Non – Renewable Annual Energy Consumption (kWh)} = \text{Annual Building Energy Consumption (kWh)} - \sum \text{Annual Energy Generated from Onsite Renewable technologies (kWh)}$$

$$\text{Percentage Offite Renewable Energy} = \frac{100x \sum \text{Annual Energy Generated from Offsite Renewable Technologies (kWh)}}{\text{Non - Renewable Annual Energy Consumption (kWh)}}$$

All RECs are required to be certified to Green-e standard or equivalent

References

- Center for Resource Solutions, Green-e Product Certification Requirements http://www.green-e.org/

RE-7: Global Warming Impacts of Refrigerants & Fire Suppression Systems

Intent

To promote the selection of refrigerants and fire suppression systems that minimise impacts on the environment.

Credit Requirements

GENERAL

Refrigerants

- 1 Credit Point: Demonstrate that the weighted average of all refrigerants to be installed within the project has an equivalent Global Warming Potential (GWP) of 10 or less.

Refrigerant Leak Detection

- 1 Credit Point: Demonstrate that the project has installed a permanent refrigerant leak detection system.

Refrigerant Pump Down

- 1 Credit Point: Demonstrate that the project has installed an automatic refrigerant pump down system to a dedicated storage tank with isolation valves.

Fire Suppression Systems

- 1 Credit Point: Demonstrate that all gaseous fire suppression systems have a GWP of 1 or less.

Note:

- Where the total collective mass of refrigerant charge used in the project (including any charge associated with district cooling) is less than 5kg, 1 credit point for Refrigerants shall be awarded automatically.
- Where only individual units containing less than 5kg of refrigerant are used, Refrigerant Leak Detection and Refrigerant Pump Down systems are not required, and those credit points shall be awarded automatically.
- For projects served via district cooling (DC) systems, the points shall only be awarded if the DC system also complies with the requirements for Refrigerants, Refrigerant Leak Detection and Refrigerant Pump Down.
- Where no gaseous fire suppression systems are used in the project, the credit point for Fire Suppression Systems shall be awarded automatically.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
4 (maximum)	**Design Rating**
1	Demonstrate that the weighted average of all refrigerants shall have a GWP of 10 or less.
1	Demonstrate that a permanent refrigerant leak detection system shall be installed.
1	Demonstrate that an automatic refrigerant pump down system shall be installed.
1	Demonstrate that 100% of gaseous fire systems shall have a GWP of 1 or less.
4 (maximum)	**Construction Rating**
1	Demonstrate that the weighted average of all refrigerants has a GWP of 10 or less.
1	Demonstrate that a permanent refrigerant leak detection system has been installed.
1	Demonstrate that an automatic refrigerant pump down system has been installed.
1	Demonstrate that 100% of gaseous fire systems have a GWP of 1 or less.

Credit Submission: Design Rating

☐ Narrative and calculations (if applicable) describing how the project meets the credit requirements, and specific requirements as below:

Refrigerants

☐ Specification extracts for all proposed refrigerants confirming the GWP of each refrigerant.

Refrigerant Leak Detection

☐ System specifications for the leak detection system.

Refrigerant Pump Down

☐ Specification detailing the type and operation of the automatic refrigerant pump down system.

Fire Suppression Systems

☐ Extracts from specifications confirming the GWP of all proposed gaseous fire suppression systems.

Credit Submission: Construction Rating

☐ Updated narrative and calculations (if applicable) describing how the project meets the credit requirements, and specific requirements as below:

Refrigerants

☐ Manufacturer's information for all installed refrigerants confirming the GWP of each refrigerant.

Refrigerant Leak Detection

☐ Manufacturer's information for installed leak detection system; and

☐ Extract from IDP-R4 Basic Commissioning report verifying the individual Leak Detection system operates as intended.

Refrigerant Pump Down

☐ Manufacturer's information detailing the type and operation of the automatic refrigerant pump down system; and

☐ Extract from IDP-R4 Basic Commissioning report verifying the refrigerant pump down system operates as intended.

Fire Suppression Systems

☐ Manufacturer's information confirming the GWP of all installed gaseous fire suppression systems.

Calculations and Methodology

- The GWP weighted average of all refrigerants is calculated as follows:

$$\text{GWP Weighted Average} = \frac{R_1GWP_1 + R_2GWP_2 + \ldots\ldots\ldots + R_nGWP_n}{\sum R_1 + R_2 + \ldots. + R_n}$$

R = Charge (kg) of each refrigerant

GWP = Global Warming Potential of each refrigerant

- The Global Warming Potential (GWP) of various refrigerants (100 yr value) are given below:

Chlorofluorocarbons	ODP	GWP	Common Building Applications
CFC-12	1.0	10,900	Refrigerators, chillers
Hydrochlorofluorocarbons			
HCFC-22	0.055	1,810	Air conditioning, chillers
HCFC-123	0.02	77	CFC-11 replacement
Hydrofluorocarbons			
HFC-134a	0	1,430	CFC-12 or HCFC-22 replacement
HFC-245fa	0	1,030	Insulation agent, centrifugal chillers
HFC-407c	0	1,700	HCFC-22 replacement
HFC-410a	0	1,900	Air conditioning
HFC-417a	0	1,950	HCFC-22 replacement
Natural Refrigerants			
Carbon Dioxide (CO_2)	0	1.0	
Ammonia (NH_3)	0	0	
Propane (C_3H_8)	0	3	
Isobutene	0	3	
Air	0	0	
Water	0	0	

References

None

Credit Section
SM: Stewarding Materials

The act of using materials such as timber, concrete and asphalt generates a number of direct and indirect consequences, beginning with the way raw content is extracted through to how that material is prepared and installed. The consequences can be far-reaching including:

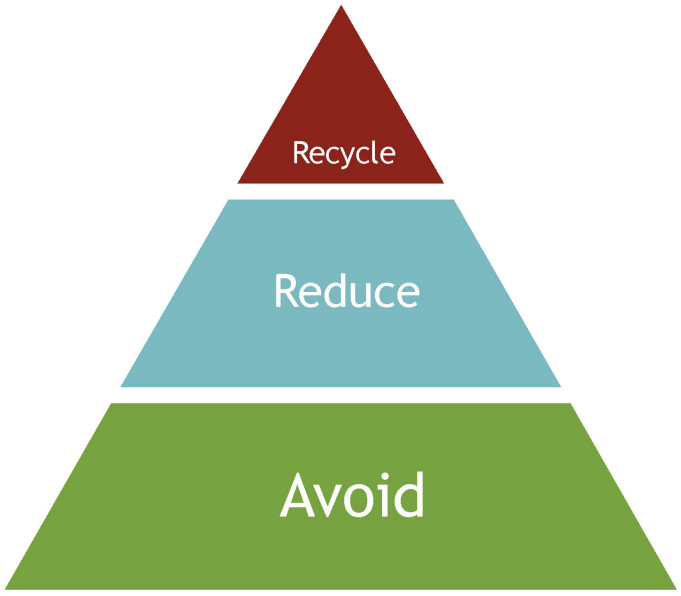
- The loss of biodiversity in a tropical rainforest half a world away;
- Consumption of energy required to ship materials to the UAE by boat, plane or truck;
- Substantial energy and water inputs required for the manufacturing process; and
- Impacts as the material ages, degrades and finally must be disposed of or recycled back into useful life.

In a sustainable development, the materials chosen, and the process by which associated waste is disposed, should be viewed as a complete cycle, not two disconnected processes. Transportation of waste uses large amounts of fossil fuel and decaying landfill trash generates methane, a major greenhouse gas.

"The fact that people produce waste cannot change. However, by changing our behavior and our attitudes to waste, we can tackle this problem in a way that meets the needs of the present without affecting future generations. Optimizing recycling and re-use, as well as limiting production, forms a core part of protecting the environment."

— The Center of Waste Management, Abu Dhabi

The Stewarding Materials section of the Pearl Rating System encourages design and development teams to consider this entire continuum – or 'whole-of-life' cycle- when selecting and specifying materials, with an overall objective to improve the social and environmental outcomes associated with their manufacture, transport, installation and disposal.



CREDITS COVERED IN THIS SECTION

SM	Stewarding Materials					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
SM-R1	Hazardous Materials Elimination	R	R	R	R	R
SM-R2	Basic Construction Waste Management	R	R	R	R	R
SM-R3	Basic Operational Waste Management	R	R	R	R	R
SM-1	Non-Polluting Materials	3	3	3	3	3
SM-2	Design for Materials Reduction	1	1	1	1	1
SM-3	Design for Flexibility & Adaptability	1	1	1	1	1
SM-4	Design for Disassembly	1	1	1	1	1
SM-5	Modular Flooring Systems	1	1	1	1	1
SM-6	Design for Durability	1	1	1	1	1
SM-7	Building Reuse	2	2	2	2	2
SM-8	Material Reuse	1	1	1	1	1
SM-9	Regional Materials	2	2	2	2	2
SM-10	Recycled Materials	6	6	6	6	6
SM-11	Rapidly Renewable Materials	1	1	1	1	1
SM-12	Reused or Certified Timber	2	2	2	2	2
SM-13	Improved Construction Waste Management	2	2	2	2	2
SM-14	Improved Operational Waste Management	2	2	2	2	2
SM-15	Organic Waste Management	2	2	2	2	2
	TOTAL	**28**	**28**	**28**	**28**	**28**

SM-R1: Hazardous Materials Elimination

Intent	To eliminate exposure of building occupants to asbestos and minimize toxic effects of chromated copper arsenate (CCA) treated timber on people and the environment.
Credit Requirements	**GENERAL** Demonstrate that no Asbestos Containing Materials (ACMs) are used within the development and that all ACMs have been removed from refurbished buildings. This Credit Requirement builds on *Cabinet Resolution No. 39 of 2006 Concerning Prohibiting Import, Production and Utilization of Asbestos Boards* and extends the prohibition to all ACMs. Demonstrate that where timber is specified to treat external structures where there is frequent and intimate contact, such as -but not limited to- shading devices, playground equipment and handrails that no chromated copper arsenate (CCA)-treated timber is used on the project. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ Extracts from specifications indicating that no ACMs or CCA-treated timber are to be used in the project as per the Credit Requirements. Where portions of the project are reused from an existing building: ☐ Results of a hazardous materials survey documenting the existence, if any, of ACMs in the building. It is recommended to follow internationally recognized standards such as *ASTM E 256-04 - Comprehensive Building Asbestos Surveys* or similar standards; and ☐ Where ACMs were found, Asbestos removal and disposal plan.
Credit Submission: Construction Rating	☐ Evidence of purchase indicating that no ACMs or CCA-treated timber were used in the project as per the Credit Requirements. Where portions of the project are reused from an existing building: ☐ Where ACMs were found, evidence of disposal at a hazardous waste facility.
Calculations and Methodology	None
References	▪ Cabinet Resolution No. 39 of 2006 Concerning Prohibiting Import, Production and Utilization of Asbestos Boards ▪ ASTM E 2356-04 - Comprehensive Building Asbestos Surveys

SM-R2: Basic Construction Waste Management

Intent	To reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.
Credit Requirements	**GENERAL** ▪ Demonstrate that the General contractor, working collaboratively with all sub-contractors and specialty contractors (e.g. demolition), developed a Construction and Demolition Waste Management Plan (CDWMP) prior to the start of construction and demolition activities. The CDWMP must identify the materials to be diverted from landfill and indicate whether the materials will be segregated on-site or commingled. If materials are planned for salvage, the plan must indicate their planned use. ▪ Demonstrate that the Contractor implemented monthly monitoring of the CDWMP, and achieved a minimum final recycling/salvage rate of 30% of construction and demolition waste (by weight or volume). This figure excludes all hazardous waste that must undergo specialized treatment. **ADDITIONAL REQUIREMENT/CLARIFICATIONS** None
Requirement Achievement	This is a requirement. There are no Credit Points awarded.
Credit Submission: Design Rating	☐ CDWMP conforming to the Credit Requirements; and ☐ Schedule of items to be recycled/salvaged, their source within the project, their total estimated weight or volume and the name and location of potential reclaim/recycling haulers.
Credit Submission: Construction Rating	☐ Calculations, supported with detailed receipts, summarizing final results of the CDWMP activities listing items recycled/salvaged, their source within the project, their total weight or volume, the name and location of the reclaim/recycling haulers, and markets for the recyclable materials.
Calculations and Methodology	Calculations can be done by weight or volume, but must be consistent throughout.
References	▪ Centre of Waste Management, Abu Dhabi: www.cwm.ae

SM-R3: Basic Operational Waste Management

Intent

To reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.

Credit Requirements

General

Demonstrate that an Operational Waste Strategy has been developed from the concept stage. As a minimum, the following must be addressed by the design and development team:

- Annual estimates of Operational waste;
- Summary review of existing and planned waste management infrastructure and programs available from the appropriate authority;
- Proposed options for diverting waste from landfills and incineration with a minimum targeted diversion rate of 40% by weight or volume of the total operational waste generated at full occupancy;
- Provision of adequately sized and accessible facilities and clearly labeled containers for the storage and collection of source-segregated waste as recommended by the Centre of Waste Management. At a minimum, allow for separation as follows:
    - Green container for recyclable plastics, glass and metals;
    - Blue container for recyclable paper and cardboard;
    - Black container for non recyclable and non compostable waste; and
    - An optional container may be provided for compostable organic waste;
- Distance to carry waste containers to the nearest collection point inside or outside the building may not exceed 30 m; and
- Adequate vehicular access for waste handling vehicles must also be ensured.

Additional Requirement/Clarifications

Multi-Residential Buildings
The minimum targeted diversion rate for Operational Waste is 30% by weight or volume of the total operational waste generated at full occupancy.

Requirement Achievement

This is a requirement. There are no Credit Points awarded.

Credit Submission: Design Rating

Operational Waste Strategy that includes:

- ☐ Narrative summarizing options researched and selected to meet the diversion targets. The strategy must address waste minimization, storage, collection, and treatment and links to private or municipal and regional infrastructure and programs;
- ☐ Calculations documenting projected waste quantities for the development during operation on an annual basis. Waste benchmarks may be obtained from the Centre of Waste Management, waste audits of similar buildings or literature research. References must be clearly listed;
- ☐ Drawing(s) indicating location of the storage/disposal facilities and vehicle access areas designed to ensure adequate space for maneuvering delivery and waste removal vehicles; and
- ☐ Waste transfer inventory outlining the intended receiver of waste. This should include information indicating that the carrier, recycling and disposal facilities are licensed.

Credit Submission: Construction

- ☐ Updated calculations documenting projected waste quantities for the development during operation on an annual basis;
- ☐ As-built drawing(s) and photographs indicating location of the storage/disposal

Rating	facilities and vehicle access areas designed to ensure adequate space for maneuvering delivery and waste removal vehicles; and ☐ Updated waste transfer inventory outlining the contracted receiver of waste. This should include information indicating that the carrier, recycling and disposal facilities are licensed.
Calculations and Methodology	▪ Calculations can be done by weight or volume but must be consistent throughout. ▪ Waste benchmarks may be obtained from the Centre of Waste Management, waste audits of similar buildings or literature research. References must be clearly listed.
References	▪ Centre of Waste Management, Abu Dhabi: www.cwm.ae

SM-1: Non-Polluting Materials

Intent

To promote the selection of materials that do not have long-term negative impacts on human health or pollute natural systems.

Credit Requirements

GENERAL

Demonstrate that the project has achieved the following:

Zero ODP, Low GWP Insulation

- 1 Credit Point: All thermal insulation materials used in the project have an Ozone Depleting Potential of zero (ODP = 0) and a low Global Warming Potential of less than five (GWP ≤5). Compliance is required for any blowing agent used to manufacture the insulation product or to spray it in place.

Chlorine Free Materials

- 1 Credit Point: Replace 'business as usual' use of chlorine-based materials including Polyvinyl Chloride (PVC), Chlorinated polyethylene (CPE), Chlorinated polyvinyl chloride (CPVC), Chlorosulfonated polyethylene (CSPE), and Polychloroprene with more sustainable alternatives for three or more of the following building product groups (The proportions required are indicated below):
  - Insulation (80% or more by surface area);
  - Waterproofing sheets and membranes (50% or more by surface area);
  - External cladding (90% or more by surface area);
  - Floor and wall coverings (90% or more by surface area);
  - Windows and door frames (90% or more by linear length);
  - Pipes (50% or more by linear length); and
  - Electrical Cables, cable sheathing and Conduits (50% or more by linear length).

Low Toxicity Materials

- **1 Credit Point:** Eliminate materials or building products or components containing elements or compounds with the following R-phrase attribution under EU Risk Phrases (R-Phrases) listed in Annex III of EU Directives 67/548/EEC:
  - R20 - Harmful by inhalation.
  - R21 - Harmful in contact with skin.
  - R22 - Harmful if swallowed.
  - R23 - Toxic by inhalation.
  - R24 - Toxic in contact with skin.
  - R25 - Toxic if swallowed.
  - R26 - Very toxic by inhalation.
  - R27 - Very toxic in contact with skin.
  - R28 - Very toxic if swallowed.
  - R29 - Contact with water liberates toxic gas.
  - R31 - Contact with acids liberates toxic gas.
  - R32 - Contact with acids liberates very toxic gas.
  - R33 - Danger of cumulative effects.
  - R36 - Irritating to eyes.
  - R37 - Irritating to respiratory system.
  - R38 - Irritating to skin.
  - R39 - Danger of very serious irreversible effects.
  - R41 - Risk of serious damage to eyes.
  - R42 - May cause sensitization by inhalation.
  - R43 - May cause sensitization by skin contact.
  - R45 - May cause cancer.

- R46 - May cause heritable genetic damage.
- R48 - Danger of serious damage to health by prolonged exposure.
- R49 - May cause cancer by inhalation.
- R50 - Very toxic to aquatic organisms.
- R51 - Toxic to aquatic organisms.
- R52 - Harmful to aquatic organisms.
- R53 - May cause long-term adverse effects in the aquatic environment.
- R54 - Toxic to flora.
- R55 - Toxic to fauna.
- R56 - Toxic to soil organisms.
- R57 - Toxic to bees.
- R58 - May cause long-term adverse effects in the environment.
- R59 - Dangerous for the ozone layer.
- R60 - May impair fertility.
- R61 - May cause harm to the unborn child.
- R62 - Possible risk of impaired fertility.
- R63 - Possible risk of harm to the unborn child.
- R64 - May cause harm to breastfed babies.
- R65 - Harmful: may cause lung damage if swallowed.

- In order to qualify for this credit, all building materials must not contain materials or compounds with over 1% of constituent materials with designated R-phrases in the above categories (minor exceptions permitted if it can be demonstrated that no alternatives are available).

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
3 (maximum)	**Design Rating**
1	Building meets the 'Zero ODP, Low GWP Insulation' Credit Requirements through design.
1	Building meets the 'Chlorine Free Materials' Credit Requirements through design.
1	Building meets the 'Low Toxicity Materials' Credit Requirements through design.
3 (maximum)	**Construction Rating**
1	Building meets the 'Zero ODP, Low GWP Insulation' Credit Requirements through construction.
1	Building meets the 'Chlorine Free Materials' Credit Requirements through construction.
1	Building meets the 'Low Toxicity Materials' Credit Requirements through construction..

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Credit Submission: Design Rating

Zero ODP, Low GWP Insulation

☐ Summary sheet listing all uses of insulation in the project; and

☐ For all listed products, extracts from specifications requiring materials manufactured without the use of ozone-depleting materials and with a global warming potential of less than 5.

Chlorine Free Materials

☐ Extracts from specifications requiring the use of chlorine free materials/products corresponding to the chosen initiatives; and

☐ Area/ length percentage calculations for each material product category.

Low Toxicity Materials

☐ Extracts from specifications highlighting that all materials in the project meet the Credit Requirements.

Credit Submission: Construction Rating	**Zero ODP, Low GWP Insulation** ☐ Updated summary sheet listing all uses of insulation in the project; and ☐ For all listed products, evidence of purchase of materials manufactured without the use of ozone-depleting materials and with a global warming potential of less than 5. **Chlorine Free Materials** ☐ Updated calculations describing how the Credit Requirements are met; and ☐ Evidence of purchase confirming the use of chlorine free materials/products. **Low Toxicity Materials** ☐ Confirmation that all materials comply with the EU Risk Phrases (R-Phrases) Directive 67/548/EEC , Annex III. This can be in the form of evidence of purchase or manufacturer information.
Calculations and Methodology	None
References	▪ EU Directive on Dangerous Substances 67/548/EEC : http://ec.europa.eu/environment/chemicals/dansub/consolidated_en.htm ▪ EU Directive 67/548/EEC Annex III : http://ec.europa.eu/environment/chemicals/dansub/pdfs/annex3_en.pdf

SM-2: Design for Materials Reduction

Intent

To reduce the overall amount of material used in the development of buildings.

Credit Requirements

General

Demonstrate that fewer materials are used in the final building design than in a typical building of the same type by achieving at least one of the following initiatives:

- At least 90% of the interior floor area does not include finishes (apart from sealant);
- At least 90% of the ceiling area does not have any ceiling systems (exposed ceilings only); or
- Use of dual function surfaces or materials such as:
  - Building Integrated Photovoltaics (BIPV) replacing traditional building envelope materials on at least 10% of the area of the building envelope (including roof);
  - Vegetated roofs on at least 50% of the area of roof. (Plant selection should favor native and drought-resistant species. This section of the roof must also be accessible to building users); or
  - Vegetated walls on at least 10% of the area of all interior partitions (Plant selection should favor native and drought-resistant species).

Additional Requirement/Clarifications

Office

Office buildings must achieve at least two of three initiatives from the list above.

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	General: Building is designed with at least one material reduction initiative. Offices only: At least two initiatives are required.
1 (maximum)	**Construction Rating**
1	General: Building is constructed with at least one material reduction initiative. Offices only: At least two initiatives are required.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project intends to meet the Credit Requirements, including any calculations; and
- ☐ Extracts from specifications requiring the proposed initiative(s).

Credit Submission: Construction Rating

- ☐ Updated brief narrative describing how the project intends to meet the Credit Requirements, including any calculations; and
- ☐ Calculations and photographs of the relevant features confirming the initiatives meet credit requirements.

Calculations and Methodology

Area calculations are required and must show a comparison between a traditional approach and current design using reduced amount of materials.

References

None

SM-3: Design for Flexibility & Adaptability

Intent

To lengthen the useful life of buildings through designs that are easily adaptable for other program uses.

Credit Requirements

General

Demonstrate the following:

- 90% of the building has regular rhythm to exposed facades (by area);
- Floor-to-floor heights of at least 3.6 meters;
- 90% of the windows are evenly distributed around exposed elevations (by area);
- 90% of interior, non-structural walls are demountable or movable (by area); and
- 90% of pipes, wiring and conduits are not permanently embedded in building materials (in length).

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Building is designed to meet Credit Requirements for flexibility and adaptability.
1 (maximum)	**Construction Rating**
1	Building is constructed to meet Credit Requirements for flexibility and adaptability.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project intends to meet the Credit Requirements, including any calculations;
- ☐ Building elevations clearly indicating how the building has regular rhythm to exposed facades, floor-to-floor heights and distribution of windows;
- ☐ Typical floor plan indicating the location of any load bearing walls and other interior walls as well as any connections for movable/demountable walls; and
- ☐ Drawings indicating plumbing and electrical services are not to be permanently embedded in building materials.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project intends to meet the Credit Requirements, including any calculations;
- ☐ Photographs clearly illustrating how the building has regular rhythm to exposed facade, floor-to-floor heights and distribution of windows;
- ☐ Photographs of movable/demountable walls; and
- ☐ As Built drawings illustrating how plumbing and electrical services have not been permanently embedded in building materials.

Calculations and Methodology

None

References

None

SM-4: Design for Disassembly

Intent

To facilitate the future deconstruction and reuse of buildings and their structural and envelope components.

Credit Requirements

GENERAL

Develop a Building Disassembly Plan highlighting the following:

- materials intended for recovery;
- materials connection requirements;
- system for marking and identifying recoverable elements prior to installation;
- best management practices for disassembly; and
- the disassembly sequence.

Demonstrate that 50% of the building structural skeleton, 75% of façade, or 90% of the roof is designed for disassembly (by surface area).

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Building is designed to meet Credit Requirements for design for disassembly.
1 (maximum)	**Construction Rating**
1	Building is constructed to meet Credit Requirements for design for disassembly.

Credit Submission: Design Rating

- ☐ Brief narrative describing how the project intends to meet the Credit Requirements, including any calculations; and
- ☐ Building Disassembly Plan conforming to Project and the Credit Requirements.

Credit Submission: Construction Rating

- ☐ Updated brief narrative describing how the project meets the Credit Requirements, including any calculations; and
- ☐ Photographs illustrating building elements designed for disassembly.

Calculations and Methodology

Calculations must indicate the total surface area of the building skeleton, façade and roofing systems, and the amount of this surface area that can be disassembled, both in square meters and as a percentage of the total surface area.

References

None

SM-5: Modular Flooring Systems

Intent

To minimize waste associated with replacement of flooring systems through the use of modular systems.

Credit Requirements

GENERAL

Demonstrate that at least 95% (by surface area) of finished floor areas use modular flooring products. To qualify, the proposed product must have one or more of the following environmental characteristics:

- Have a minimum of 30% post-consumer recycled content;
- Be fully or partly recyclable;
- be rapidly renewable; or
- be extracted, harvested or recovered and manufactured locally as per SM-9.

Projects where 95% or more of the floor areas are not finished automatically achieve the Credit.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	At least 95% (by surface area) of finished floor areas are specified with modular flooring products.
1 (maximum)	**Construction Rating**
1	Demonstrate that at least 95% (by surface area) of finished floor areas are constructed with modular flooring products.

Credit Submission: Design Rating

- ☐ Floor plans and floor finishes schedule describing all flooring systems used (excluding all non-finished floor areas such as plant rooms), their locations in the building, total area covered, and their environmental characteristic(s);
- ☐ Calculations demonstrating that the flooring systems used meet the Credit Requirements in aggregate; and
- ☐ Extracts from specifications showing that modular flooring systems meet the environmental characteristic(s) requirements.

Credit Submission: Construction Rating

- ☐ As-built floor plans and updated floor finishes schedule describing all flooring systems used (excluding all non-finished floor areas such as plant rooms), their locations in the building, total area covered, and their environmental characteristics;
- ☐ Updated calculations demonstrating that the flooring systems used meet the Credit Requirements in aggregate;
- ☐ Evidence of purchase and installation of these materials in the project in the form of invoices from suppliers and installers.

Calculations and Methodology

None

References

None

SM-6: Design for Durability

Intent

To promote a long life building by protecting its components from condensation, water ingress, improper drainage and protecting vulnerable areas of the building envelope and surroundings.

Credit Requirements

General

Develop and implement a Building Durability Plan (BDP) to optimize the integrity of the building envelope.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Building Design Rating**
1	Develop a Building Durability Plan.
1 (maximum)	**Building Construction Rating**
1	Implement the Building Durability Plan.

Credit Submission: Design Rating

- ☐ BDP conforming to the Credit Requirements; and
- ☐ Drawings and extracts from specifications and consultant briefs or scope demonstrating provision of the supporting measures described in the BDP.

Credit Submission: Construction Rating

- ☐ Report summarizing the implementation of the BDP within the building conforming with the Credit Requirements, including:
- ☐ Drawings and consultant reports demonstrating the implementation of measures described in the BDP; and
- ☐ If the items covered by the BDP are damaged or not operating as intended, rectification work undertaken to ensure the operation is restored to approved Design Rating functionality levels.

Calculations and Methodology

The Building Durability Plan must include the following:

- Estimated life span of key building features, including concrete walls, foundations and structural elements, flooring, ceilings, roofs, cladding, windows and glazing/curtain wall systems or installations;
- Where components or assemblies have a shorter service life than the life of the building, a plan for how these slower cycling materials will be specified to reduce life-cycle impacts (e.g. carbon and toxicity) and be maintained or replaced without damage to the longer cycling elements/materials; and
- Description of design measures to improve durability and long term service life such as:
  - Bollards in loading areas;
  - Condensate capture;
  - Drains/shower waterproofing and drainage gradients;
  - Façade waterproofing and leakage;
  - Insulation of ducts and durability of ceilings (particularly waterproofing);
  - Ease of maintenance; or
  - Access to façade and systems.

References

None

SM-7: Building Reuse

Intent

To encourage the reuse and improvement of existing building stock, reduce waste and other environmental impacts associated with new materials extraction, manufacturing, and transport.

Credit Requirements

General

Demonstrate that a portion of the building structural system, by surface area, is reused from an existing building. as follows:

- 1 Credit Point: At least 25% of the building structural system, by surface area, will be reused.
- 2 Credit Points: At least 50% of the building structural system, by surface area, will be reused.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	At least 25% of the building structural system, by surface area, will be reused.
2	At least 50% of the building structural system, by surface area, will be reused.
2 (maximum)	**Construction Rating**
1	At least 25% of the building structural system, by surface area, is reused.
2	At least 50% of the building structural system, by surface area, is reused.

Credit Submission: Design Rating

- ☐ Narrative describing how the project intends to meet the Credit Requirements, including calculations demonstrating the amount of surface area to be reused; and
- ☐ Plan drawings of the proposed building and demolition plan of the existing building demonstrating the amount of surface area to be reused.

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project meets the Credit Requirements, including calculations demonstrating the amount of surface area to be reused;
- ☐ As-built drawings of the new building and demolition drawings of the existing building demonstrating the amount of surface area reused; and
- ☐ Site photographs illustrating the reuse of the existing structural system.

Calculations and Methodology

$$\%\ \text{Building Reuse} = \frac{\text{Surf. area of portion of structural system reused}}{\text{Total surf. area of existing structural system}} \times 100$$

References

None

SM-8: Material Reuse

Intent

To promote the selection of previously used or salvaged materials in order to reduce demand on natural resources and reduce waste

Credit Requirements

GENERAL

Demonstrate that the total material cost of reused and salvaged materials represents 3% of the total material cost.

The following materials are *not* eligible for this credit:

- Materials addressed in all other credits under Stewarding Materials section except SM 9- Regional Materials;
- Materials constituting the reused portion of the building's structural system as per SM-7 Building Reuse compliance criteria; and
- Building components whose performance can influence the energy or water use are only eligible if an equivalent level of performance can be demonstrated in comparison to new components available in the current market.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	The cost of specified reused materials equal to at least 3% of the Total Material Cost.
1 (maximum)	**Construction Rating**
1	The cost of installed reused materials equal to 3% of the Total Material Cost.

Credit Submission: Design Rating

- ☐ Summary sheet listing all proposed reused materials meeting the Credit Requirements, their cost, the source or location of previous use, and intended new use;
- ☐ Calculations demonstrating that the total cost of the proposed reused materials meet the Credit Requirements; and
- ☐ Extracts from specifications requiring the use of the proposed materials.

Credit Submission: Construction Rating

- ☐ Updated summary sheet listing all proposed reused materials meeting the Credit Requirements, their cost, the source or location of previous use, and new use; and
- ☐ Updated calculations demonstrating that the total cost of the proposed reused materials meet the Credit Requirements.

Calculations and Methodology

$$\text{Percentage Material Reuse} = \frac{\text{Cost of the reused material}}{\text{Total Cost of Materials}} \times 100$$

Total Material Cost: exclude labor and equipment costs and include the following divisions from the Construction Specifications Institute (CSI) MasterFormat™ or equivalent: Division 03 Concrete, Division 04 Masonry, Division 05 Metals, Division 06 Wood, Plastics, and Composites, Division 07 Thermal and Moisture Protection, Division 08 Openings, Division 09 Finishes, Division 10 Specialties, Division 31 Earthwork, Division 32 Exterior Improvements. Division 12 may be included; however, associated costs must be carried throughout all Stewarding Materials credits.

References

None

SM-9: Regional Materials

Intent

To encourage the selection of building materials that have reduced transport impacts and promotes regional economies

Credit Requirements

GENERAL

Demonstrate that the transport distance traveled by materials, representing a proportion of the material cost, is not greater than 500 km from the furthest point of origin to the project site:

- 1 CREDIT POINT = cost of regional materials equivalent to 10% of *Total Material Cost*
- 2 CREDIT POINTS = cost of regional materials equivalent to 20% of *Total Material Cost*

Any materials sent by airfreight at any point during their transport do not qualify for this credit.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Cost of regional materials specified equal to 10% of Total Material Cost.
2	Cost of regional materials specified equal to 20% of Total Material Cost.
2 (maximum)	**Construction Rating**
1	Cost of regional materials installed equal to 10% of Total Material Cost.
2	Cost of regional materials installed equal to 20% of Total Material Cost.

Credit Submission: Design Rating

- ☐ Report listing all materials proposed to demonstrate compliance with the Credit Requirements, including:
  - Their cost;
  - location(s) of extraction/harvest/recovery/manufacture;
  - distance traveled and means of transport; and
  - calculations demonstrating the total amount of the qualifying materials as a percentage of the total material cost.
- ☐ For each nominated material, proof of manufacture detailing country of origin and port of entry, if applicable; and
- ☐ Extracts from specifications indicating the requirement for materials to meet this credit.

Credit Submission: Construction Rating

- ☐ Updated report listing all nominated materials demonstrating compliance with the Credit Requirements, including:
  - Final cost;
  - Location(s) of extract/harvest/recovery/manufacture; and
  - proof of manufacture detailing country of origin and port of entry, if applicable.
- ☐ For each nominated material, proof of manufacture detailing country of origin and port of entry, if applicable; and

	☐ Evidence of purchase and installation of these materials in the project in the form of invoices from suppliers and installers.
Calculations and Methodology	▪ The 'furthest point of origin' is the longest distance to the project site from (1) the point of extraction, harvest or recovery or (2) the point of manufacture. ▪ The distance traveled is calculated as ('Distance traveled by road or rail' + 0.1 x 'Distance traveled by sea') ▪ For composite materials, a weighted average by weight (mass) must be applied to the distance. This calculation is not necessary for materials where one major constituent represents at least 90% of the final material by weight. $\text{Percentage Regional Materials} = \frac{\text{Cost of the regional materials}}{\text{Total Cost of Materials}} \times 100$ ▪ Where materials or primary constituent elements are quarried, extracted, or harvested, the calculation begins at this point and includes the distance traveled to the manufacturing/processing facility. ▪ Where products are primarily comprised of recycled materials (i.e. 90% by weight or more), the calculation begins at the point of manufacture. ▪ Calculations to include distance to site but do not include returns. ▪ Total Material Cost: exclude labor and equipment costs and include the following divisions from the Construction Specifications Institute (CSI) MasterFormatTM or equivalent: Division 03 Concrete, Division 04 Masonry, Division 05 Metals, Division 06 Wood, Plastics, and Composites, Division 07 Thermal and Moisture Protection, Division 08 Openings, Division 09 Finishes, Division 10 Specialties, Division 31 Earthwork, Division 32 Exterior Improvements. It is optional to also include Division 12; however, associated costs have to be carried throughout all Stewarding Materials credits.
References	None

SM-10: Recycled Materials

Intent

To increase the demand for recycled materials to reduce the amount of waste going to disposal.

Credit Requirements

GENERAL

Demonstrate that recycled materials are used as follows. The credit points listed below are cumulative.

Recycled Steel

- 1 Credit Point: For Steel-framed Buildings, at least 50% of all structural steel (by weight) has a minimum of 25% post-consumer recycled content or is reused OR for Concrete-framed Buildings, at least 80% of all reinforcing or stressing steel (by weight) has a minimum of 90% post-consumer recycled content.

Cement Replacement

Demonstrate through either the use of supplementary cementing materials (SCMs) (including fly ash, ground granulated blast furnace slag (GGBFS) and silica fumes) or the increased use of aggregates or admixtures, that the project has reduced the overall amount of Portland cement used and associated embodied greenhouse gas emissions as per Table SM 10.1 below.

- 1 Credit Point: Concrete mixes with an embodied GHG as per table SM10.1, rows B1, C1 and D1
- 2 Credit Points: Concrete mixes with an embodied GHG as per table SM10.1, rows B2, C2 and D2

Table SM 10.1: Embodied Greenhouse Gas Emissions of Concrete

Row A	Strength Grade	25	30	35	40	45	50	55	60	Estidama Credits
	Type	Embodied GHG								
Row B1	Cast in place	162	192	218	240	259	277	292	307	1 Credit
Row B2	Cast in place	121	144	163	179	194	206	218	229	2 Credits
Row C1	Precast	176	209	236	260	281	300	317	332	1 Credit
Row C2	Precast	149	176	199	220	237	253	268	281	2 Credits
Row D1	Stressed	183	217	245	270	292	312	329	345	1 Credit
Row D2	Stressed	162	192	218	240	259	277	292	307	2 Credits

Recycled Aggregates

- 1 Credit Point: Demonstrate that at least 15% of all aggregates used on site (by volume), in structural and non-structural applications are recycled.
- 2 Credit Points: Demonstrate that only recycled aggregates and/or aggregates from industrial waste by-products are used as base, sub-base or backfill.

Other Materials

- 1 Credit Point: Demonstrate that any combination of materials with the following characteristics constitute at least 10% of the *Total Material Costs*:
  - minimum 30% post-consumer recycled content
  - minimum of 80% post-industrial content
  - 50% agricultural waste by-product

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
6 (Maximum)	**Design Rating**
1	Steel-framed: at least 50% of specified structural steel (by weight) has 25% post-consumer recycled content or is reused Concrete-framed: at least 80% of specified rebar or stressing steel has 90% post-consumer recycled content.
1	Specified concrete mix and reduction in cement use will achieve an embodied GHG of concrete as per table SM10.1, rows B1, C1 and D1.
2	Specified concrete mix and reduction in cement use will achieve an embodied GHG of concrete as per table SM10.1, rows B2, C2 and D2.
1	At least 15% of all specified aggregates to be used for structural or non-structural applications are recycled.
2	Only recycled aggregate is specified for use as base, sub-base or backfill.
1	Cost of specified recycled materials equal to at least 10% of Total Material Costs.
6 (Maximum)	**Construction Rating**
1	Steel-framed: at least 50% of installed structural steel (by weight) has 25% post-consumer recycled content or is reused Concrete-framed: at least 80% of installed rebar or stressing steel has 90% post-consumer recycled content.
1	Installed concrete mix and reduction in cement use will translate in embodied GHG of concrete as per table SM10.1, rows B1, C1 and D1.
2	Installed concrete mix and reduction in cement use will translate in embodied GHG of concrete as per table SM10.1, rows B2, C2 and D2.
1	At least 15% of all installed aggregates used for structural or non-structural applications are recycled.
2	Only recycled aggregate is used as base, sub-base or backfill.
1	Cost of installed recycled materials equal to at least 10% of Total Material Costs.

Credit Submission: Design Rating

- ☐ Narrative listing all materials proposed for compliance with the Credit Requirements;
- ☐ Calculations by weight (Recycled Steel), embodied GHG emissions (Cement Replacement, using the Estidama Concrete GHG calculator), volume (Recycled Aggregates) or cost (Other materials) demonstrating compliance with the Credit Requirements; and
- ☐ Extracts from specifications detailing the use of compliant nominated materials.

Credit Submission: Construction Rating

- ☐ Updated narrative listing all materials used to meet the Credit Requirements;
- ☐ Updated calculations by weight (Recycled Steel), embodied GHG emissions (Cement Replacement, using the *Estidama Concrete GHG calculator*), volume (Recycled Aggregates) or cost (Other materials) demonstrating compliance with the Credit Requirements;
- ☐ Proofs of manufacture for all nominated materials; and
- ☐ Proof of purchase for all nominated materials. For nominated 'Other Materials' the proof of purchase should indicate the material cost (excluding labor and equipment).

Calculations and Methodology

Recycled Steel

$$\text{Percentage Recycled Steel} = \frac{\text{Weight of recycled or reused structural steel}}{\text{Total weight of structural steel}} \times 100$$

Cement Replacement

- The embodied greenhouse gas emissions in concrete are calculated using the *Estidama Concrete GHG Calculator*.

Recycled Aggregates

$$\text{Percentage Recycled Aggregates} = \frac{\text{Volume of recycled aggregates}}{\text{Total volume of aggregates}} \times 100$$

Other Materials

$$\text{Percentage Recycled Materials} = \frac{\text{Cost of recycled-content materials}}{\text{Total Materials Cost}} \times 100$$

- Total Material Cost: exclude labor and equipment costs and include the following divisions from the Construction Specifications Institute (CSI) MasterFormat™ or equivalent: Division 03 Concrete, Division 04 Masonry, Division 05 Metals, Division 06 Wood, Plastics, and Composites, Division 07 Thermal and Moisture Protection, Division 08 Openings, Division 09 Finishes, Division 10 Specialties, Division 31 Earthwork, Division 32 Exterior Improvements. Division 12 may also be included; however, associated costs have to be carried throughout all Stewarding Materials credits.

References

- *Estidama Concrete Embodied GHG Calculator*

SM-11: Rapidly Renewable Materials

Intent

To increase the use of fast growing materials as an alternative to slow growing materials and finite resources.

Credit Requirements

GENERAL

Demonstrate that any combination of the following building components comprise a proportion of materials (by area) containing rapidly renewable content (a minimum of 50% of the material itself has to be rapidly renewable) according to the Requirement Achievement table below:

- joinery;
- walls and partitions;
- floors;
- ceilings; or
- roof.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	at least 75% (by area) of one or more specified building components are rapidly renewable; at least 35% (by area) of two or more specified building components are rapidly renewable; or at least 15% (by area) of four or more specified building components are rapidly renewable.
1 (maximum)	**Construction Rating**
1	at least 75% (by area) of one or more installed building components are rapidly renewable; at least 35% (by area) of two or more installed building components are rapidly renewable; or at least 15% (by area) of four or more installed building components are rapidly renewable.

Credit Submission: Design Rating

- ☐ Summary sheet listing all finishes materials and highlighting the proposed rapidly renewable materials that meet the Credit Requirements and their use in the project (i.e. materials used in joinery, walls and partitions, floors, ceilings, or roof);
- ☐ Calculations demonstrating that the total area of rapidly renewable materials meets relevant Credit Point requirement;
- ☐ Extracts from specifications requiring the use of rapidly renewable materials; and
- ☐ Drawings showing relevant area of proposed use.

Credit Submission: Construction Rating

- ☐ Updated summary sheet listing all finishes materials and highlighting the proposed rapidly renewable materials that meet the Credit Requirements and their use in the project (i.e. materials used in joinery, walls and partitions, floors, ceilings, or roof);
- ☐ Calculations demonstrating that the total area of rapidly renewable materials meets one relevant Credit Point requirement;
- ☐ For all rapidly renewable materials, a product cut sheet or letter from the manufacturer verifying the percentage of rapidly renewable content OR an independent third-party verification of the percentage of rapidly renewable content (e.g. Cradle to Cradle®, BRE Green Guide);

- ☐ As-built drawings showing relevant area of proposed use; and
- ☐ Evidence of purchase and installation of these rapidly renewable materials in the project in the form of invoices from suppliers and installers.

Calculations and Methodology

$$\% \text{ Rapidly Renewable Materials} = \frac{\text{Cost of rapidly renewable materials}}{\text{Total Materials Cost}} \times 100$$

- Total Material Cost: exclude labor and equipment costs and include the following divisions from the Construction Specifications Institute (CSI) MasterFormatTM or equivalent: Division 03 Concrete, Division 04 Masonry, Division 05 Metals, Division 06 Wood, Plastics, and Composites, Division 07 Thermal and Moisture Protection, Division 08 Openings, Division 09 Finishes, Division 10 Specialties, Division 31 Earthwork, Division 32 Exterior Improvements. Division 12 may be included however associated costs have to be carried throughout all Stewarding Materials credits.
- Rapidly Renewable Materials: are defined as biologically sourced materials with a growth cycle of less than 10 years, able to be sourced continuously in a sustainable manner without significant environmental disturbance or harm e.g. reeds, thatch, some bamboo (where sourced from plantations not remnant bamboo ecosystems) or agri-products grown specifically for the purpose e.g. coconut, hemp etc.

References

- BRE Environmental Profile www.greenbooklive.com
- Cradle to Cradle Certification www.c2ccertified.com

SM-12: Reused or Certified Timber

Intent

To encourage the use of timber sourced from legal and sustainable sources.

Credit Requirements

GENERAL

- Demonstrate that a proportion (by cost) of the timber and composite wood products used on the project, including temporary construction timber, is reused OR certified (with Chain of Custody Certification: CoC) under any one or any combination of the following certification schemes as per the Requirement Achievement table:
  - Forest Stewardship Council (FSC), or
  - Program for the Endorsement of Forest Certification scheme (PEFC) or the following national schemes endorsed by PEFC: the Canadian Standards Association, CSA, the Sustainable Forestry Initiative SFI and the Malaysian Timber Certification Scheme MTCS; And
- Demonstrate that all timber is legally sourced and not on the CITES (Convention on International Trade in Endangered Species) list of endangered species (Appendix I, II and III).

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	At least 50% (by cost) of the specified timber comply with the Credit Requirements.
2	At least 70% (by cost) of the specified timber comply with the Credit Requirements.
2 (maximum)	**Construction Rating**
1	At least 50% (by cost) of the installed timber comply with the Credit Requirements.
2	At least 70% (by cost) of the installed timber comply with the Credit Requirements.

Credit Submission: Design Rating

- ☐ List of specified timber products (including temporary construction timber) highlighting intended use, proposed certification schemes and/or if the timber product is reused; and
- ☐ Relevant extracts from specifications highlighting which timber product will come from certified sources (clearly indicating intended certification scheme) and/or be reused. The specification (or equivalent legally binding document) must also confirm that all timber and timber products will not include species on the CITES list of endangered species.

Credit Submission: Construction Rating

- ☐ Updated list of installed timber products (including temporary construction timber) highlighting certification schemes used and/or if the timber product was reused;
- ☐ Chain of custody (CoC) certificates associated with each timber product; and
- ☐ Evidence of purchase and installation of the certified timber products from suppliers and installers.

Calculations and Methodology

$$\text{Percentage Certified Timber} = \frac{\text{Cost of certified timber}}{\text{Total materials cost of timber products}} \times 100$$

References

- Forest Stewardship Council (FSC): www.pefc.org
- Program for the Endorsement of Forest Certification scheme (PEFC): www.fsc.org
- Canadian Standards Association (CSA): www.csa.ca
- Sustainable Forestry Initiative (SFI): www.sfiprogam.org
- Malaysian Timber Certification Scheme (MTCS): www.mtcc.com.my
- Convention on International Trade in Endangered Species (CITES) list of endangered species, Appendix I, II and III: http://www.cites.org/eng/app/index.shtml

SM-13: Improved Construction Waste Management

Intent

To further reduce the long-term environmental impacts associated with construction waste collection, transport and disposal.

Credit Requirements

General

- 1 Credit Point: Demonstrate that the Contractor implemented monthly monitoring of the CDWMP, and achieved a minimum final recycling/salvage rate of 50% of construction and demolition waste (by weight or volume). This figure excludes all hazardous waste that must undergo specialized treatment
- 2 Credit Points: Demonstrate that the Contractor implemented monthly monitoring of the CDWMP, and achieved a minimum final recycling/salvage rate of 70% of construction and demolition waste (by weight or volume). This figure excludes all hazardous waste that must undergo specialized treatment

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Demonstrate CDWMP aims for a minimum of 50% demolition and construction waste (by weight or volume) to be recycled / salvaged.
2	Demonstrate CDWMP aims for a minimum of 70% demolition and construction waste (by weight or volume) to be recycled / salvaged.
2 (maximum)	**Construction Rating**
1	Confirm a minimum of 50% of demolition and construction waste (by weight or volume) was recycled/salvaged.
2	Confirm a minimum of 70% of demolition and construction waste (by weight or volume) was recycled/salvaged.

Credit Submission: Design Rating

☐ CDWMP conforming to the Credit Requirements; and

☐ Schedule of items to be recycled/salvaged, their source within the project, their total estimated weight or volume and the name and location of potential reclaim/recycling haulers.

Credit Submission: Construction Rating

☐ Calculations supported with detailed receipts, summarizing final results of the CDWMP listing items recycled/salvaged, their source within the project, their total weight or volume, the name and location of the reclaim/recycling haulers, and markets for the recyclable materials.

Calculations and Methodology

Calculations can be done by weight or volume but must be consistent throughout.

References

- Centre of Waste Management, Abu Dhabi: www.cwm.ae

SM-14: Improved Operational Waste Management

Intent

To further reduce the long-term environmental impacts associated with operational waste collection, transport and disposal.

Credit Requirements

General

Develop and implement an Operational Waste Management Plan (OWMP) that includes measures for diverting waste from landfills and incineration to meet the following minimum targeted diversion rates:

- 1 Credit Point: a minimum targeted diversion rate of 60% by weight or volume of the total operational waste generated at full occupancy
- 2 Credit Points: a minimum targeted diversion rate of 80% by weight or volume of the total operational waste generated at full occupancy

These figures exclude all hazardous waste that must undergo specialized treatment.

Additional Requirement/Clarifications

Multi-Residential Buildings:

The diversion rate for Operational Waste are as follows:

- 1 Credit Point: a minimum targeted diversion rate of 50% by weight or volume of the total operational waste generated at full occupancy
- 2 Credit Points: a minimum targeted diversion rate of 70% by weight or volume of the total operational waste generated at full occupancy

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	General: An OWMP is developed for a minimum targeted diversion rate of 60% (by weight or volume. Multi-Residential: An OWMP is developed for a minimum targeted diversion rate of 50% (by weight or volume.
2	General: An OWMP is developed for a minimum targeted diversion rate of 80% (by weight or volume. Multi-Residential: An OWMP is developed for a minimum targeted diversion rate of 70% (by weight or volume.
2 (maximum)	**Construction Rating**
1	General: Waste management facilities have been installed to meet a minimum targeted diversion rate of 60% (by weight or volume) are built. Multi-Residential: Waste management facilities to meet a minimum targeted diversion rate of 50% (by weight or volume) are built.
2	General: Waste management facilities have been installed to meet a minimum targeted diversion rate of 80% (by weight or volume) are built. Multi-Residential: Waste management facilities to meet a minimum targeted diversion rate of 70% (by weight or volume) are built.

Credit Submission: Design Rating

☐ Operational Waste Management Plan that includes:

- Narrative summarizing options researched and chosen to meet the diversion targets. The strategy must address waste minimization, storage, collection, and treatment and links to private or municipal and regional infrastructure and programs;
- Calculations documenting projected waste quantities for the development during operation on an annual basis. Waste benchmarks may be obtained from

the Centre of Waste Management, waste audits of similar buildings or literature research. References must be clearly listed;

- Drawing(s) indicating location of storage/disposal facilities and vehicle access areas designed to ensure adequate space for maneuvering delivery and waste removal vehicles; and
- Waste transfer inventory outlining the intended receiver of waste, including confirmation that the carrier, recycling and disposal facilities are licensed.

Credit Submission: Construction Rating	☐ Updated calculations documenting projected waste quantities for the development during operation on an annual basis; ☐ As-built drawing(s) and photographs indicating location of the storage/disposal facilities and vehicle access areas designed to ensure adequate space for maneuvering delivery and waste removal vehicles; and ☐ Updated waste transfer inventory outlining the contracted receiver of waste. This should include confirmation that the carrier, recycling and disposal facilities are licensed.
Calculations and Methodology	Calculations can be done by weight or volume but must be consistent throughout.
References	▪ Centre of Waste Management, Abu Dhabi: www.cwm.ae

SM-15: Organic Waste Management

Intent

To encourage the recovery and reuse of organic waste from building operations including landscaping and food waste.

Credit Requirements

General

Demonstrate the provision of onsite location(s) for all project occupants dedicated to the collection and/or composting of organic waste generated onsite.

- 1 Credit Point: projects where only the collection and/or treatment of landscaping waste OR food waste is provided
- 2 Credit Points: projects where the collection and/or treatment of both landscaping and food waste is provided

Area must be suitably sized for the projected amount of waste to be collected and located within 50m of other waste and recycling storage areas, with ready access to adequate collection vehicle maneuvering area or onsite treatment facility.

Additional Requirement/Clarifications

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
1	Landscaping waste or food waste collection and/or treatment is proposed onsite.
2	Food and landscaping waste collection and/or treatment are proposed onsite.
2 (maximum)	**Building Construction Rating**
1	Landscaping waste or food waste collection and/or treatment is provided onsite.
2	Food and landscaping waste collection and/or treatment are provided onsite.

Credit Submission: Design Rating

- ☐ Narrative describing how the project intends to meet the Credit Requirements, including details on the size and location of the storage area and the estimated amount of waste to be generated; and
- ☐ Drawings clearly indicating the proposed location and size of waste collection area(s).

Credit Submission: Construction Rating

- ☐ Updated narrative describing how the project meets the Credit Requirements, including details on the size and location of the storage area and the amount of waste to be generated; and
- ☐ As Built drawings clearly indicating the location and size of waste collection area(s).

Calculations and Methodology

None

References

- Centre of Waste Management, Abu Dhabi: www.cwm.ae

Credit Section
IP: Innovating Practice

Innovative practice builds on the essential elements of Plan 2030 and the pillars of Estidama - environment, social, cultural and economic - to deliver developments that incorporate design outcomes that go beyond the established benchmarks and deliver genuinely innovative features. This requires a design process that embraces innovation and creativity whilst respecting and responding to the cultural identity of the region.

The Innovative Practice section is intended to encourage responsive design that achieves pioneering solutions which will enhance the development's success and contribute to sustainability in the UAE through;

- addressing the pillars of sustainability through innovative design solutions which are able to be replicated;
- providing for cost benefit and feasibility analysis; and
- developing designs that showcase cultural and regional practices, while contributing to the environmental performance of the development.

CREDITS COVERED IN THIS SECTION

IP	Innovating Practice					
Credit Code	Credit Title	General	Office	Retail	Multi-Residential	School
IP-1	Innovative Cultural & Regional Practice	1	1	1	1	1
IP-2	Innovating Practice	2	2	2	2	2
	TOTAL	2	2	2	2	2

IP-1: Innovative Cultural & Regional Practices

Intent

Develop designs that showcase cultural and regional practices, while contributing to the environmental performance of the building.

Credit Requirements

General

Develop a strategy for incorporating architectural and/or technical solutions that are inspired by cultural and regional precedents, and demonstrate their contribution to energy efficiency, water conservation or improved indoor or outdoor comfort.

Additional Requirement/Clarifications

None

Achieving Credit Points

CREDIT POINTS	REQUIREMENTS
1 (maximum)	**Design Rating**
1	Develop a design strategy for incorporating solutions that showcase cultural and regional practices
1 (maximum)	**Construction Rating**
1	Demonstrate that the proposed solutions are built as part of the development

Credit Submission: Design Rating

- ☐ Narrative describing the proposed strategy, documenting:
  - Precedents for the proposed solutions;
  - Numerical or physical performance modeling/testing describing the performance of the proposed initiative(s) within the project setting; and
  - Rationale of how the proposed solutions will be incorporated into the project.

Credit Submission: Construction Rating

- ☐ Updated narrative describing the nominated solutions; and
- ☐ Photographs illustrating the proposed built-in solutions.

Calculations and Methodology

None

References

None

IP-2: Innovating Practice

Intent

To reward design and construction practices that result in a significant positive impact in relation to any of the four pillars of Estidama.

Credit Requirements

GENERAL

Develop, document and implement an innovative design and/or construction solution that addresses one or more of the four pillars of Estidama.

AND

Develop a guideline document that enables the innovative solution to be repeated.

ADDITIONAL REQUIREMENT/CLARIFICATIONS

None

Awarding Credit Points

CREDIT POINTS	REQUIREMENTS
2 (maximum)	**Design Rating**
2	Innovative solution report.
2 (maximum)	**Construction Rating**
2	Implement the innovative solution, update the innovative solution report and produce guideline documentation.

Credit Submission: Design Rating

- ☐ Evidence of IDP related to the innovative design and / or construction solution engaging all relevant team members; and
- ☐ Innovative solution report.

Credit Submission: Construction Rating

- ☐ Updated innovative solution report; and
- ☐ Guideline Document.

Calculations and Methodology

The four pillars that make up the Estidama concept are :

- Environmental
- Cultural
- Social
- Economic

The innovative solution must be developed in conjunction with the IDP-R1 Integrated Development Strategy and be developed into a workable final solution.

An Innovative Solution Report must be prepared that demonstrates the process by which the final innovative solution has evolved from early concepts and addresses the following subjects where relevant:

- Detailed narrative of final design solution that must:
  - fully describe the design innovation so that it may be repeated;
  - be fully supported by concept proofs from studies, experiments or other research;
  - document key parameters relied upon in the context of the project; and
  - be fully supported by design drawings, photographs and specifications.

- Predicted impact in relation to the four pillars of Estidama: The final design solution should be contextualized in terms of tangible impacts against one or more of the four pillars;
- Feasibility studies: This must address documented design evolution decisions toward the final design solution and address any and all considerations that lead to the final solution;
- Cost Benefit Analysis: A detailed cost benefit analysis of the design measure(s) including, at a minimum, capital cost, operational and maintenance cost, cost as a percentage of total project cost and revenue where appropriate. The benefit analysis must include performance targets / levels attained or anticipated to be attained as a direct result of the measures;
- Risk: The risk analysis must detail the framework within which the design solution is intended to work and highlight any and all weaknesses that would impede performance. The analysis must anticipate the impact of such weaknesses on the performance of the design solution;
- Integration and Implementation: This section must clearly demonstrate how the design solution has been integrated with any and all related elements associated with the development as well as a detailed plan of how the design solution is implemented;
- Measurability: This section must address how the performance of the design solution will be measured in-use and include all metrics and associated technologies relied upon; and
- Maintainability and Durability: This section must address all maintenance and durability aspects related to the design solution.

Awarding innovative credit points are subject to Estidama approval.

References	None

Acronyms

ACM	Asbestos Containing Material
ADSSC	Abu Dhabi Sewerage Services Company
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
ATM	Automated Teller Machine
ATTMA	Air Tightness Testing & Measurement Association
BCIS	Building Cost Information Service
BDP	Building Durability Plan
BIPV	Building Integrated Photovoltaics
BLB	Building Log Book
BMS	Building Management System
BRE	Building Research Establishment
BS	British Standard
BSI	British Standards Institute
CCA	Chromated Copper Arsenate
CCR	California Code of Regulations
CCTV	Closed-circuit Television
CDWMP	Construction & Demolition Waste Management Plan
CEMP	Construction Environmental Management Plan
CFC	Chlorofluorocarbon
CFD	Computational Fluid Dynamics
CIBSE	Chartered Institution of Building Services Engineers
CIE	Commission Internationale de l'Eclairage
CITES	Convention on International Trade in Endangered Species
CLR	Contaminated Land Report
CNIA	Critical National Infrastructure Authority (Abu Dhabi)
CoC	Chain of Custody
COP	Coefficient of Performance
CPE	Chlorinated Polyethylene
CPVC	Chlorinated Polyvinyl Chloride
CRI	Color Rendering Index
CSA	Canadian Standards Association
CSI	Construction Specifications Institute
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSPE	Chlorosulfonated Polyethylene
CV	Curriculum Vitae
CWM	Center of Waste Management (Abu Dhabi)
DC	District Cooling
D&C	Design and Construction
DOT	Department of Transport (Abu Dhabi)
DSM	Dynamic Simulation Modeling
EAD	Environment Agency Abu Dhabi
EEC	European Economic Community
EHSMS	Environmental Health and Safety Management System
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency (US)
EU	European Union
FCU	Fan Coil Unit
FSC	Forest Stewardship Council

GFA	Gross Floor Area
GGBFS	Ground Granulated Blast Furnace Slag
GHG	Greenhouse Gas
GS	Green Seal
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HVAC	Heating, Ventilating and Air Conditioning
IAQ	Indoor Air Quality
IDP	Integrated Development Process
IECC	International Energy Conservation Code
IEQ	Indoor Environmental Quality
IESNA	Illuminating Engineering Society of North America
IP	Innovating Practice
ISAC	Integrated Situational Awareness Centre
ISO	International Standards Organization
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
KPI	Key Performance Indicator
LB	Livable Buildings
LCC	Life Cycle Cost
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MEP	Mechanical, Electrical and Plumbing
MERV	Minimum Efficiency Reporting Value
MSDS	Material Safety Data Sheet
MTCS	Malaysian Timber Certification Scheme
NGO	Non-Governmental Organization
ODP	Ozone Depletion Potential
OH	Occupant Handbook
OMM	Operation and Maintenance Manual
OMP	Operation and Maintenance Plan
PAD	Plan Abu Dhabi
PCP	Pentachlorophenol
PEFC	Program for the Endorsement of Forest Certification
PER	Preliminary Environmental Review
PMV	Predicted Mean Vote
PPD	Predicted Percentage Dissatisfied
PPM	Parts Per Million
PRS	Pearl Rating System
PV	Photovoltaic
PVC	Polyvinyl Chloride
PW	Precious Water
QP	Qualified Professional
R	R-value
RE	Resourceful Energy
REC	Renewable Energy Certificate
RFCI	Resilient Floor Covering Institute
RSB	Regulation & Supervision Bureau (Abu Dhabi)
RWE	Recycled Water Equivalent
SCM	Supplementary Cementing Material
SFI	Sustainable Forestry Initiative
SHGC	Solar Heat Gain Coefficient

SLL	Society of Light and Lighting
SM	Stewarding Materials
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SRI	Solar Reflectance Index
TVOC	Total Volatile Organic Compound
TSS	Total Suspended Solids
U	U-value
UAE	United Arab Emirates
UKAS	United Kingdom Accreditation Service
UPC	Abu Dhabi Urban Planning Council
VAV	Variable Air Volume
VOC	Volatile Organic Compound
WHO	World Health Organization

Units

ach	air changes per hour
°C	°Celsius
dB	decibel
g	gram
Hz	Hertz
J	Joule
K	Kelvin
kg	kilogram
km	kilometer
kW	kilowatt
kWh	kilowatt hour
l	liter
m	meter
Pa	Pascal
ppm	parts per million
s	second
W	Watt
yr	year

Glossary

The glossary for the Pearl Rating System is available on the Estidama website (www.upc.gov.ae).

Above-grade wall	A wall that is above the finish grade and not in contact with the ground.
Adaptive species	A plant species which has adapted to the local climate that is drought and/or saline tolerant.
Admixture	A material other than water, aggregates, lime, or cement, used as an ingredient of concrete or mortar, and added immediately before or during the mixing process.
Air leakage rate	The air flow rate required to pressurise a building to a stated pressure differential divided by the surface area of the building.
Air tightness	The resistance of the building envelope to inward or outward air leakage.
Aggregate	The particulate material used in construction including sand, gravel, crushed stone, slag, recycled concrete and geosynthetic aggregates.
Albedo	The amount of solar energy reflected by a surface.
American National Standards Institute (ANSI)	The non-profit organisation that coordinates and administers the U.S. voluntary national standards in both the private and public sectors.
American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)	The international organisation that establishes standards for the uniform testing and rating of heating, ventilation, air conditioning and refrigeration equipment. It also conducts related research, disseminates publications and provides continuing education to its members.
Area of probable impact	The extent of a physical area occupied by an environmental component that is likely to be impacted by at least one of the phases of the proposed project. The boundary of the area of probable impact is determined by measurements, previous studies, models or best professional judgment and may vary by environmental component. In simple terms the extent of the area outside of the project area that is likely to be directly or indirectly impacted by the proposed project.
Asbestos	A fibrous mineral formerly used for making incombustible or fireproof articles. The inhalation of asbestos fibres can cause serious illnesses, including malignant lung cancer, mesothelioma, asbestosis and gastro-intestinal cancer.
Audit	A systematic process of objectively obtaining and assessing evidence, including physical inspections and verification.
Ballast	An electrical device for starting and regulating fluorescent and discharge lamps.
Baseline building performance	The annual energy consumption of a baseline building design as defined in ANSI/ASHRAE/IESNA Standard 90.1-2007.
Below-grade wall	The portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.
Benchmark	A standard against which something can be measured or judged.
Blackwater	The wastewater from toilets, urinals, kitchen sinks and dishwashers.
Building envelope	The elements of a building that separate conditioned spaces from the exterior.
Building integrated photovoltaics	Photovoltaics that replace conventional building elements such as the roof, façade or skylights.

(BIPV)	
Building Log Book (BLB)	A simple document providing the building owner/manager with easily understood information on how the building should be operated, maintained and serviced. It also allows ongoing building performance and major alterations to be recorded.
Building Management System (BMS)	A computer based system with the capability to monitor, control and optimise the performance of building systems, controls and functions.
Business As Usual (BAU)	The practice of conducting business according to the status quo, with no attempt to assess new/additional needs, identify possibilities for improvement or implement change.
Candela	The base unit of luminous intensity i.e. the power emitted by a light source in a particular direction.
Carbon emissions	The release of carbon (or carbon dioxide) into the atmosphere.
Carrying capacity	The maximum number of organisms or amount of biomass that can be supported in a given area.
Car sharing	The shared use of a car by the driver and one or more passengers, usually for commuting.
Central monitoring system	A central point for the storage and monitoring of information.
Chromated Copper Arsenate (CCA)	A chemical wood preservative containing chromium, copper and arsenic.
Climate change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Clock time	The artificial time used in everyday life to standardise time measurements. It allows people in difference locations to use the same time or to easily convert time from one location to another. Clock time differs from Solar Time, also known as local solar time, which is the time according to the position of the sun in the sky relative to one specific location on the ground. In solar time, the sun is always due south in the northern hemisphere at exactly noon.
Coefficient of performance (COP) - cooling	The ratio of the net cooling energy exported from the system to the total electric power used by the system.
Co-generation	The generation of both electricity and useful heat. Also known as combined heat and power (CHP).
Color Rendering Index (CRI)	A scale of 0 to 100 of the ability of a light source to reproduce the colors of various objects in comparison with an ideal or natural light source. The higher the CRI, the closer the color reproduction is to that of the ideal/natural light source.
Commissioning	The process of ensuring that newly constructed/installed systems (HVAC, plumbing, electrical, fire/life safety, building security etc) operate as designed and meet the performance requirements of the building occupant.
Commissioning agent	An individual with responsibility for co-ordinating and monitoring the commissioning process.
Compensation	The measures taken to make up for the loss of, or permanent damage to, biological resources through the provision of replacement areas. Any replacement area should be similar to or, with appropriate management, have the ability to reproduce the ecological functions and conditions of those biological resources

	that have been lost or damaged.
Compost	A mixture of decomposed organic matter used to improve soil structure and provide nutrients.
Computational Fluid Dynamics (CFD)	A branch of fluid mechanics that uses numerical methods and algorithms to analyse and solve problems that involve fluid flows.
Condensate	The product of condensation.
Condensation	The change of a gas or vapor into a liquid, either by being cooled or being subjected to increased pressure. A common occurrence is the condensation of atmospheric moisture on a cold surface.
Conduction	The transfer of thermal energy through a material.
Connectivity	A measure of the functional availability of the habitats needed for a particular species to move through a given area.
Construction waste	The unwanted material generated during construction, including demolition waste.
Cutoff luminaire	A luminaire that controls the amount of uplight. Luminaires are classified as full cutoff, cutoff, semi-cutoff or non-cutoff according to the most recent adopted criteria of the Illuminating Engineering Society of North America (IESNA).
Desalinization	The removal of salt from water.
Development Review Process	The Urban Planning Council's process for reviewing development proposals.
Distribution system	The systems, components and mechanisms (such as ducts, pipes, and wires) conveying substances or energy from a source to the point of use. The distribution system includes such auxiliary equipment as fans, pumps and transformers and their respective control systems.
District cooling	The centralized production and distribution of cooling energy.
Dynamic Simulation Modeling (DSM)	The modeling of a building that simulates the energy inputs and outputs for different types of buildings over time.
Energy conservation measures	The modifications or installations to the building design in order to reduce energy consumption. Such measures include external shading, orientation, system efficiencies, on-site renewable technologies etc.
Energy rate	The cost of a unit of energy or power.
Environmental component	An attribute or constituent of the environment (i.e. air quality, marine waters, waste management, geology, seismicity, soil, groundwater, marine ecology, terrestrial ecology, noise, traffic, socio-economic) that may be impacted by the proposed project.
Environmental design	The process of addressing surrounding environmental parameters when devising plans, programmes, policies, buildings or products. Environmental design in the traditional sense develops physical environments to meet one or more aesthetic or day-to-day functional needs, or to create a specific sort of experience.
Environmental impact	The positive or negative impact that occurs to an environmental component as a result of the proposed project. This impact can be directly or indirectly caused by the project's different phases (i.e. construction, operation and decommissioning).
Environmental Impact Assessment (EIA)	The assessment of the possible impacts (both positive and negative) that a proposed development may have on the environment, covering natural, social and economic aspects.

Equinox	Either of the two times of the year when the sun crosses the plane of the earth's equator and day and night are of equal length.
Evapotranspiration	The transport of water into the atmosphere from surfaces, including soil and vegetation.
Façade	The exterior wall of a building exposed to public view or that wall viewed by persons not within the building. The portion of any exterior elevation of a building extending vertically from the grade to the top of a parapet wall or eave, and horizontally across the entire width of the building elevation.
Fan Coil Unit (FCU)	A unit that provides cooling and/or heating air as part of a comfort air conditioning system. An FCU uses heated or chilled water and supplies air via one or more electrically driven fans.
Fire suppression system	The system within a building that discharges inert gases or chemical agents to control/extinguish a fire.
Floor-to-floor height	The vertical distance measured from the finished floor of one storey to the finished floor of the above or below storey.
Formaldehyde	A simple, highly reactive hydrocarbon that is used as a fixative in the pathology laboratory, a fumigant, and in the manufacture of foam insulation, cosmetics, drugs, clothing and furniture. It is also a major toxic component of photochemical smog. Formaldehyde is a strong allergen.
Fossil fuel	A fuel manufactured from a hydrocarbon deposit such as petroleum, coal or natural gas derived from living matter of a previous geologic time.
General contractor	The contractor with the main responsibility for performing/supervising the construction of a project. The general contractor hires all the subcontractors and suppliers for the project.
Geothermal	The heating and/or cooling potential of the ground.
Glare	The result of excessive contrast between bright and dark areas in the field of view, causing discomfort or reducing the ability to discern detail.
Global Warming Potential (GWP)	An indicator that reflects the relative effect of a greenhouse gas in terms of climate change considering a fixed time period, such as 100 years (GWP100). The GWPs for different emissions can then be added together to give one single indicator that expresses the overall contribution to climate change of these emissions.
Graywater	The wastewater from uses such as showers, laundry, sinks, fire system tests and cooling tower drain-down water.
Green infrastructure	A strategically planned and managed network of wilderness, parks, greenways, conservation easements and working lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources and contributes to the health and quality of life for communities and people.
Greenfield	Previously undeveloped land in a city or rural area, currently used for agriculture, landscape design or left to nature.
Greenhouse gas (GHG)	A gas which absorb infrared radiation (heat) and contributes to the greenhouse effect (examples include water vapour, carbon dioxide, methane etc).
Gross Floor Area (GFA)	The sum of the floor areas of the spaces within a building, including basements, mezzanines and intermediate floors, and penthouses with an internal height of 2.3m or greater. It is measured from the exterior faces of the exterior walls or from the centreline of walls separating buildings. It excludes covered walkways, porches, pipe trenches, exterior terraces or steps, chimneys, roof overhangs and similar features.

Groundwater	The water that occurs below the surface of the earth where it occupies spaces in soils or geological strata.
Habitat	A place in which a particular plant or animal lives. Often used in the wider sense referring to major assemblages of plants and animals found together.
Habitat creation	The establishment of an ecosystem on land that did not previously support that ecosystem, or on severely altered sites.
Hazardous material/waste	A material that can cause harm to people, other living organisms or the environment.
Heat rejection	The removal of heat from a system, commonly water based.
Heating, Ventilation and Air Conditioning (HVAC) system	The equipment, distribution systems and terminals that provide heating, ventilating or air conditioning to a building or portion of a building.
High-frequency electronic ballast	A ballast that operates at a frequency greater than 20 kHz and typically around 30kHz.
Illuminance	The total luminous flux incident on a surface, per unit area.
Incandescent lamp	A lamp in which light is produced by a filament heated to incandescence by an electric current.
Indoor Environmental Quality (IEQ)	The quality of the internal environment in relation to airborne contaminants, thermal comfort, lighting, acoustics etc.
Infiltration - air	The uncontrolled leakage of air through cracks and gaps in any building element and around windows and doors of a building. Infiltration is caused by pressure differences across these elements due to wind, inside and outside temperature differences and imbalance between supply and exhaust air systems.
Infiltration - water	The downward movement of water through soil.
Infiltration rate - water	The rate of water entry into the soil expressed as a depth of water per unit of time (mm/hour).
Infrared radiation	The energy in the region of the electromagnetic radiation spectrum at wavelengths longer than those of visible light but shorter than those of radio waves.
Key Performance Indicator (KPI)	An indicator set in a key area to measure performance.
Landscaping	The planting, configuration and maintenance of trees, ground cover, shrubbery, decorative natural and structural features (walls, fences, hedges, trellises, fountains, sculptures), earth patterning and bedding materials, and other similar site improvements that serve an aesthetic or functional purpose.
Legionnaires disease	A respiratory disease caused by inhaling Legionella bacteria either in the form of contaminated water droplets (aerosols) or in droplet nuclei (after water has evaporated). Fatal in approximately 12% of reported cases.
Life Cycle Cost (LCC) analysis	An analysis of building impacts covering the consecutive and interlinked stages of a constructed building, from raw material acquisition to the final disposal.
Life span	The length of time an object, material or organism is expected to survive.
Light pollution	The adverse effect of artificial light, including sky glow, glare, light trespass, light clutter, decreased visibility at night and energy waste.

Living area	Any family room in a residential unit, such as a living room, dining room, majlis rooms, playroom, TV room, home theatre room, study, party rooms.
Load bearing wall	A wall that supports other elements of a building in addition to its own weight.
Lumen	A unit of luminous flux equal to the amount of light given out through a solid angle of one steradian by a point source of one candela intensity radiating uniformly in all directions.
Microclimate	The localised climate conditions within an urban area or neighbourhood.
Minimum landscaped area	The minimum area of landscaping as defined by development type and location within the Abu Dhabi Development Code.
Mitigation	The measures taken to avoid or reduce negative impacts.
Mixed mode ventilation	The combination of natural ventilation and mechanical ventilation and/or cooling to ventilate a space. In the context of this document and the UAE climate, this refers to changeover mixed mode design and operation. This implies a change of ventilation and cooling 'mode' from fully sealed in the hotter months, to one of natural ventilation through operable windows in cooler months.
Mixed-use development	A development that includes more than occupancy type - such as residential, commercial, industrial, public or semi-public - within the same building, project or site . The most common examples are a project with both commercial and residential uses, or commercial and industrial uses.
Nadir	The reference direction directly below a luminaire, or "straight down" (0 degree angle).
Native species	An indigenous species living naturally within a given area.
Non-renewable energy	The energy derived from a fossil fuel source.
Operation and Maintenance Manual (OMM)	A document containing instructions for the operation and maintenance of systems and components within a building.
Occupied area	Any internal space intended for sedentary occupancy.
Open area	The area of opening through which air exchange occurs between indoors and outdoors. It is not the same as the whole window area (glass and frame) and is typically much smaller and depends on the opening style of the window.
Operational waste	The waste produced as a result of operating/running a building e.g. office waste, landscaping waste, food waste.
Organic waste	The carbon-containing waste derived from animal and plant materials.
Outdoor/outside air	The air that is outside the building envelope or is taken from outside the building that has not been previously circulated through the building.
Ozone Depletion Potential (ODP)	The relative amount of degradation to the ozone layer a chemical compound can cause. The ODP of CFC-11 is 1 and the ODPs of other compounds are calculated relative to this.
Permeable paving	Paving designed to allow water to pass through its surface using porous asphalt or concrete or using interlocking concrete permeable pavers or open grid pavers.
Phase I habitat survey	A field survey technique which provides a relatively rapid method to record semi-natural and natural vegetation and other wildlife habitats, designed to cover large areas relatively rapidly.
Photovoltaics	Cells that produce a voltage when exposed to radiant energy (especially light).

	The main application is the conversion of solar radiation to usable energy.
Plan 2030	The plan which has been designed to help Abu Dhabi filter all planning decisions through environmental, social and economic development criteria. The full title is the Abu Dhabi 2030 Urban Structure Framework Plan.
Predicted Mean Vote (PMV)	A thermal scale from -3 (cold) to +3 (hot).
Predicted Percentage Dissatisfied (PPD)	The percentage of a hypothetical sample population who will be dissatisfied (uncomfortable) in a given environment. As the PMV moves away from neutral (PMV = 0) in either direction, the PPD increases.
Preliminary Environmental Review (PER)	A review to identify, at the earliest possible stage, the potential environmental consequences associated with a proposed development.
Previously developed land	Any land that is, or was, occupied by a permanent structure including the land up to the plot boundary of the permanent structure and any associated fixed surface infrastructure. It excludes any land occupied by agriculture or forestry and any parks or recreational grounds.
Priority habitats	The habitats identified in Abu Dhabi Emirate which are of exceptional value and are highly threatened, including Intertidal Mudflats, Mangroves, Vegetated Sandy Beaches, Marine (seagrass, coral), Wadis, Sand Sheets and Low Dunes, Interdunal Plains and High Dunes, Alluvial Plains and Jebels. Refer to Brown and Boer, 2004 for detailed habitat types.
Priority species	A protected species (flora or fauna) or species determined to be critically endangered, endangered, vulnerable or near threatened (as defined by the International Union for Conservation of Nature, IUCN and/or UAE Red Data list).
Projected shade	The shade projected onto a horizontal or vertical surface by another element including buildings or parts of buildings, shade devices or structures.
Project site area	The physical area within which activities of the proposed project will take place (the boundary of the project area is defined by the titled property boundary).
Proposed building performance	The annual energy consumption of a proposed building design, as defined in ANSI/ASHRAE/IESNA Standard 90.1-2007.
Public Open Space	Parks, plazas and similar open space areas that are reserved and dedicated for public access and use. This includes publicly accessible open space that is located on privately owned land.
Rapidly renewable material	A material or product made from plants that are typically harvested within a ten-year cycle or shorter.
Receptacle and process loads	All miscellaneous and plug loads within a building e.g. office equipment, kitchen equipment, elevators etc.
Recyclable material	Any raw or processed material than can be recycled.
Recycled water	The water discharged from a wastewater treatment system, treated to reduce the concentration of any substance or organism that may be detrimental to public health or the environment and made suitable for reuse.
Recycling	The processing of previously used materials to create new products.
Re-commissioning	The process through which buildings are commissioned at some time after their initial completion, occupancy and commissioning to ensure that building systems are still functioning as originally planned, constructed and delivered.
Refrigerant leak	A sensing system that detects refrigerant leaks. The system may be aspirated or

detection system	have multiple sensors linked to a central alarm unit or BMS.
Relative humidity	The amount of water vapor that exists in a gaseous mixture of air and water vapor, expressed as a percentage.
Remediation	In the context of contaminated land, remediation prevents contaminated land from harming the environment and restores the land to safe and usable conditions.
Renewable energy	The energy derived from a renewable source e.g. solar, wind, tidal.
Renewable Energy Certificate (REC)	A tradable energy commodity that represents proof that a unit of energy was generated from an eligible renewable source.
Residential unit	A single unit providing independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking and sanitation.
Restoration	The altering of an area in such a way as to re-establish an ecosystem's structure and function, usually bringing it back to its original (pre-disturbance) functioning.
Roof	The upper portion of the building envelope that is horizontal or tilted at an angle of less than 60° from horizontal.
Runoff	The water that is not absorbed by the soil or landscape to which it is applied and therefore flows from the area. For example, runoff may result from water that is applied at too great a rate (application rate exceeds infiltration rate) or where there is a severe slope.
Safety lighting	The lighting provided to enhance occupant safety, often used outside of daylight hours to provide sufficient light levels to enable safe use of areas such as main entrances, pathways, steps and car parks.
Salvage	To save discarded or damaged material for further use.
Security lighting	The lighting provided to deter intruders and protect property.
Service water heating	The heating of water for domestic or commercial purposes other than space heating and process requirements.
Setpoint	The point at which the desired temperature of the heated or cooled space is set.
Significant asset	An asset which is of significant importance (internationally, nationally, regionally and/or locally), including: ☐ Priority Habitats; ☐ Any other habitat identified as significant through a Development Review Process, the Coastal Development Guidelines, an Environmental Impact Assessment, a Preliminary Environmental Review or a Strategic Environmental Assessment; and ☐ Priority species.
Site boundary	The line that indicates the extent of the project/development site.
Smart meter	An advanced meter that identifies consumption in more detail than a conventional meter. Smart metering is designed to provide utility customers with information on a real time basis about their domestic energy consumption. This may include data on how much gas and electricity they are consuming, the cost and the impact of their consumption on greenhouse gas emissions.
Solar Heat Gain Coefficient (SHGC)	The ratio of the solar heat gain entering a space through a transparent/ translucent element to the incident solar radiation on the element. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted or convected into the space.
Solar radiation	The thermal energy from the sun, including the infrared, visible and ultraviolet wavelengths.

Solar Reflectance Index (SRI)	The measure of a material's ability to reflect solar heat on a scale of 0 to 100. A standard black material has an SRI of 0 and a standard white material has an SRI of 100.
Solar time	The time according to the position of the sun in the sky relative to one specific location on the ground. In solar time, the sun is always due south in Abu Dhabi at exactly noon. This means that someone a few miles east or west of you will realise a slightly different solar time than you, although clock time would be the same. Also known as local solar time.
Stormwater	The excess water created during precipitation events.
Street	A public or private right-of-way, other than a major or secondary highway or alley, whose function is to carry vehicular traffic or provide vehicular access to abutting property.
Sub-meter	A utility meter that allows for the monitoring of usage on a portion of a distribution system past a main meter.
Suitably qualified professional	An individual with: • a degree in a relevant subject; • a minimum of five years directly relevant work experience; and • a proven track record on working on similar projects in the region. The Environment Agency Abu Dhabi (www.ead.ae) holds a list of consultants carrying out a range of environmental services within the Emirate of Abu Dhabi. For other consultants, appropriate evidence must be submitted to demonstrate meeting the criteria above.
Summer solstice	The time at which the sun is at its northernmost point in the sky (southernmost point in the southern hemisphere), appearing at noon at its highest altitude above the horizon. It occurs on 21st June (22nd December in the southern hemisphere).
Supplementary Cementing Material (SCM)	A material that is added to concrete to make concrete mixtures more economical, reduce permeability, increase strength or influence other concrete properties. Typical examples are natural pozzolans, fly ash, ground granulated blast-furnace slag and silica fume.
Thermal zoning	The logical sub-divisions of building spaces based on anticipated thermal load and the need for occupant control. Consideration should be given to variations in thermal load at the perimeter of the building resulting from internal gains, façade orientation, passive shading, shading from adjacent buildings and façade design variations such as glazing percentage, glazing type and insulation thermal performance.
Thermostatic controller	An automatic control device used to maintain temperature at a fixed or adjustable setpoint.
Total Volatile Organic Compound (TVOC)	The total concentration of volatile organic compounds (see definition) in a given sample.
Trafficked walkway	A pedestrian walkway or any dedicated pedestrian route through courtyards inside the site boundary.
Transit station	A public transport station such as a railway station or metro station.
Transit stop	A dedicated public bus or tram stop.
U-value (thermal transmittance):	The heat transmission in unit time through a unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side. The units of U are W/m2K.

Valuable asset	A feature of ecological value, including healthy native trees or shrub.
Variable Air Volume (VAV) system	An HVAC system that controls the temperature within a space by varying the volumetric flow of heated or cooled supply air.
Vegetated roof	A roof that is partially or completely covered with plants and soil or a growing medium. Also known as a green roof.
Vegetated wall	A wall that is partially or completely covered with plants and a growing medium.
Visible light transmittance (VLT)	The percentage of visible light passing through a material relative to the total amount of light incident upon it.
Volatile Organic Compound (VOC)	An organic chemical which has a boiling point range below 250°C. Under normal conditions a VOC will significantly vaporize and enter the atmosphere. Many VOCs have significant health implications.
Walkway	A path/route intended for pedestrian use such as a concrete or asphalt surface or continuous blocks of pavers.
Wastewater	Water that has been adversely affected in quality by human activity. Wastewater is a source of potentially valuable resources including biosolids, nutrients and water.
Water feature	An artificial body of water such as a pool or fountain.
Water model	An analytical tool for understanding how much potable water is used in a building and to determine volumes of all demands and sources including potable and other potential sources of water, including graywater, recycled water and stormwater harvesting.
Window area	The total area of the window including the glazing, sash and frame. For doors where the glazed vision area is less than 50% of the door area, the window area is the glazed vision area. For all other doors, the window area is the door area.

Appendix A

Relationship Between Community, Building & Villa Rating Systems

The Pearl Rating Systems address common regionally relevant sustainability measures and challenges. The Community, Building and Villa Rating Systems have been developed concurrently to ensure a strong relationship between the three systems. As a result, work undertaken on a community scale will be also relevant to submissions when embarking on Building and Villa Ratings. The following table provides a summary of the commonality between the systems.

Community	Building	Villa
Integrated Development Process		
IDP-R1 Integrated Development Strategy	IDP-R1 Integrated Development Strategy	IDP-R1 Integrated Development Strategy
IDP-R3 Guest Worker Accommodation	IDP-R3 Guest Worker Accommodation	IDP-R2 Guest Worker Accommodation
IDP-R4 Community-Dedicated Infrastructure Basic Commissioning	IDP-R4 Basic Commissioning	IDP-R3 System & Envelope Performance Verification
IDP-1 Life Cycle Costing	IDP-1 Life Cycle Costing	IDP-1 Life Cycle Costing
IDP-2 Construction Environmental Management	IDP-2 Construction Environmental Management	IDP-2 Construction Environmental Management
IDP-3 Sustainability Awareness	IDP-5 Sustainability Communication	IDP-3 Sustainability Communication
Natural Systems		
NS-R1 Natural Systems Assessment	NS-R1 Natural Systems Assessment	NS-R1 Natural Systems Assessment & Protection
NS-R2 Natural Systems Protection	NS-R2 Natural Systems Protection	NS-R1 Natural Systems Assessment & Protection
NS-R3 Natural Systems Design & Management Strategy	NS-R3 Natural Systems Design & Management Strategy	NS-1 Landscape Design & Management Plan
NS-1 Reuse of Land	NS-1 Reuse of Land	
NS-2 Remediation of Contaminated Land	NS-2 Remediation of Contaminated Land	
NS-3 Ecological Enhancement	NS-3 Ecological Enhancement	NS-2 Landscape Enhancement
NS-4 Habitat Creation & Restoration	NS-4 Habitat Creation & Restoration	
Livable Communities, Livable Buildings and Livable Villas		
LC-R1 Plan 2030	LBo-R1 Plan 2030	
LC-R2 Urban Systems Assessment	LBo-R2 Urban Systems Assessment	LV-R1 Urban Systems Assessment
LC-R3 Provision of Amenities and Facilities	LBo-3 Accessible Community Facilities	LV-3 Community Facilities & Active Urban Environments

LC-R4 Outdoor Thermal Comfort Strategy	LBo-R3 Outdoor Thermal Comfort Strategy	LV-R2 Outdoor Thermal Comfort
LC-1 Transit Supportive Practices	LBo-6 Public Transport	LV-4 Public Transport
LC-4 Accessible Community Facilities	LBo-3 Accessible Community Facilities	LV-3 Community Facilities & Active Urban Environments
LC-7 Active Urban Environments	LBo-4 Active Urban Environments	LV-3 Community Facilities & Active Urban Environments
LC-8 Travel Plan	LBo-9 Travel Plan	
LC-9 Improved Outdoor Thermal Comfort	LBo-1 Improved Outdoor Thermal Comfort	
LC-11 Pearl Rated Buildings Within Communities	LBo-2 Pearl Rated Communities	LV-1 Pearl Rated Community
LC-12 Safe & Secure Community	LBi-10 Safe & Secure Environment	
Precious Water		
PW-R3 Water Monitoring & Leak Detection	PW-3 Water Monitoring & Leak Detection	PW-R2 Water Monitoring
PW-1.1 Community Water Use Reduction: Landscaping	PW-2.1 Exterior Water Use Reduction: Landscaping	PW-2.1 Exterior Water Use Reduction: Landscaping
PW-1.2 Community Water Use Reduction: Heat Rejection	PW-2.2 Exterior Water Use Reduction: Heat Rejection	
PW-1.3 Community Water Use Reduction: Water Features	PW-2.3 Exterior Water Use Reduction: Water Features	PW-2.2 Exterior Water Use Reduction: Water Features
PW-2 Stormwater Management	PW-4 Stormwater Management	PW-3 Stormwater Management
PW-3 Water Efficient Buildings	PW-R1 Minimum Interior Water Use Reduction	PW-R1 Minimum Interior Water Use Reduction
PW-3 Water Efficient Buildings	PW-1 Improved Interior Water Use Reduction	PW-1 Improved Interior Water Use Reduction
Resourceful Energy		
RE-R3 Energy Monitoring & Reporting	RE-R2 Energy Monitoring & Reporting	RE-R2 Energy Monitoring
RE-1 Community Strategies for Passive Cooling	RE-2 Cool Building Strategies	RE-2 Cool Building Strategies
RE-4.1 Renewable Energy: Onsite	RE-6 Renewable Energy	RE-3 Renewable Energy
RE-4.2 Renewable Energy: Offsite	RE-6 Renewable Energy	RE-3 Renewable Energy
RE-5 Energy Efficient Buildings	RE-R1 Minimum Energy Performance	RE-R1 Minimum Energy Performance
RE-5 Energy Efficient Buildings	RE-1 Improved Energy Performance	RE-1 Improved Energy Performance
Stewarding Materials		
SM-R1 CCA Treated Timber Elimination	SM-R1 Hazardous Materials Elimination	SM-R1 Hazardous Materials Elimination

SM-R2 Basic Construction Waste Management	SM-R2 Basic Construction Waste Management	SM-R2 Basic Construction Waste Management
SM-R3 Basic Operational Waste Management	SM-R3 Basic Operational Waste Management	
SM-2 Regional Materials	SM-9 Regional Materials	SM-4 Regional Materials
SM-3 Recycled Materials	SM-10 Recycled Materials	SM-5 Recycled Materials
SM-4 Reused or Certified Timber	SM-12 Reused or Certified Timber	SM-6 Reused or Certified Timber
SM-5 Improved Construction Waste Management	SM-13 Improved Construction Waste Management	SM-7 Improved Construction Waste Management
SM-6 Improved Operational Waste Management	SM-14 Improved Operational Waste Management	
SM-7 Organic Waste Management	SM-15 Organic Waste Management	
Innovating Practice		
IP-1 Showcase of Regional & Cultural Practices	IP-1 Innovative Cultural & Regional Practices	IP-1 Innovative Cultural & Regional Practices
IP-2 Innovating Practice	IP-2 Innovating Practice	IP-2 Innovating Practice

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Core Review Team

Estidama would like to appreciate and thank the contributions of many individuals who undertook reviews of the various drafts of the Pearl Rating System documents.