

GREEN BUILDING IMPLEMENTATION GUIDE

Building Institutional Capacity for Resilient Public Infrastructure in Pakistan



SUSTAINABLE
DESIGN



ENERGY
EFFICIENCY



WATER
CONSERVATION



RESOURCE
EFFICIENCY



HEALTHY
SPACES



BUILDING RESILIENT COMMUNITIES
FOR A SAFER, SUSTAINABLE TOMORROW



Document control

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This Guide is a companion to the notified Green Building Code of Pakistan 2023 and to the approved project design and specification. It does not replace the Code, the Building Code of Pakistan, a signed design, a decision of the Authority Having Jurisdiction, or the project-specific judgement of a competent professional. The intended result is a traceable compliance basis that records the applicability decision, adopted options and values, calculations, review decisions and the evidence supporting each compliance claim.

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Abbreviations

Term	Meaning
AHJ	Authority Having Jurisdiction
BCP-2021	Building Code of Pakistan 2021
BoD	Basis of Design
C&D	Construction and demolition
Cx	Commissioning
DISCO	Distribution company
ECBC-2023	Energy Conservation Building Code of Pakistan 2023
EIA	Environmental Impact Assessment
EPD	Environmental Product Declaration
FDD	Fault detection and diagnostics
FPT	Functional and performance testing
GBCP-2023	Green Building Code of Pakistan 2023
IEE	Initial Environmental Examination
IEQ / IAQ	Indoor environmental quality / indoor air quality
LCA	Life-cycle assessment
LPD	Lighting power density
M&V	Measurement and verification
NEECA	National Energy Efficiency and Conservation Authority
NEPRA	National Electric Power Regulatory Authority
NEQS	National Environmental Quality Standards
OPR	Owner's Project Requirements
PEC	Pakistan Engineering Council
PMD	Pakistan Meteorological Department
PPIB	Private Power and Infrastructure Board
PSQCA	Pakistan Standards and Quality Control Authority
PV	Photovoltaic
RWH	Rainwater harvesting
SHGC	Solar heat gain coefficient
SRI	Solar reflectance index
WWR	Window-to-wall ratio

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1 Purpose, Scope and Assurance Framework

The Green Building Code of Pakistan 2023 is a notified mandatory code. Throughout this Guide, "the Code" means that instrument, as notified through S.R.O. 1531(I)/2025 and S.R.O. 1532(I)/2025 dated 11 August 2025; where any other code or standard is meant, it is named in full. This Guide converts it into a delivery method: what to decide, in what order, on what evidence, and who accepts each decision. Meeting a numerical threshold is the floor. A building that meets every threshold and is unsafe, unmaintainable or undocumented has not achieved the outcome the Code exists to produce.

1.1 What this Guide does

Table 1.1 What this Guide does and how it does it

Function	How the Guide performs it
Establishes applicability	Chapter 2 determines which provisions apply to a project, which compliance route is selected, and which jurisdictional options the AHJ has recorded.
Resolves interpretation	Chapter 3 states a determination for each point at which the notified text is abbreviated, internally inconsistent or overtaken by later regulation, with the basis for the determination.
Sets the delivery method	Chapters 4 and 5 assign responsibility for every requirement and set the design sequence and the gates at which decisions are fixed.
Develops the technical domains	Chapters 6 to 12 work through site, water, energy, indoor environment, materials, construction and operation.
Covers existing buildings	Chapter 13 sets the retrofit sequence for buildings already in use.
Builds competence	Chapter 14 provides seven worked applications with the calculations set out in full.
Supports the authority	Chapters 15 and 16 give the AHJ the adoption, review and replication instruments.

Policy context. This Guide sits within Pakistan's national climate-policy framework. The National Adaptation Plan of Pakistan 2023 sets the national adaptation priorities, including resilient infrastructure and public services; the National Climate Change Policy 2021 provides the overarching policy direction; and Pakistan's Nationally Determined Contribution under the Paris Agreement records the national mitigation and adaptation commitments to which efficient, low-carbon public buildings contribute. The CD-CRI programme under which this Guide is produced is itself financed through the NAP Challenge Fund. These are policy instruments. They create no compliance obligation, form no part of the order of precedence in section 2.2, and are not cited as the basis of any requirement in this Guide. The binding basis is the notified Code and the instruments listed in Chapter 2.

The facilities this Guide is written for are predominantly low-rise public schools and basic health facilities. Figure 1.1 shows the measures this Guide governs as they appear on such a facility, and the same measures are traced through the worked applications in Chapter 14.



MEASURES SHOWN

- 1 Rooftop photovoltaics sized after load reduction.
- 2 Solar water heating for clinical and washing use.
- 3 Elevated storage with a secure, cleanable tank.
- 4 Screened waste storage with separated streams, away from the patient entrance.
- 5 Deep shaded waiting veranda at the entrance.
- 6 Accessible ramp and level entry at the main door.
- 7 Permeable grass-paver parking.
- 8 Covered inspection points to the buried rainwater tank.
- 9 Biodiverse native planting to the boundary.
- 10 Controlled vehicle and pedestrian entrance.

Figure 1.1 Green measures on a public health facility of the type this Guide serves

Source: prepared for this Guide by Dr. Qaisar Ali Associates, 2026. Base image is illustrative; it does not depict an identifiable existing building, site or person. Annotation and technical content by DQA.

1.2 Principles

Requirements interact. Meeting a threshold in one domain is necessary but not sufficient, and it is the interaction between requirements, rather than any single requirement, where projects most often fail.

The whole life-cycle counts. Performance is judged through design, construction, commissioning, operation, maintenance, modification and decommissioning, not at the point of handover alone.

Evidence drives action. Every claim states the requirement, the method, the input data, the calculation or test, the reviewer, the decision and the record retained.

Local adjustment runs through a recorded decision. A requirement is modified by an authorized jurisdictional decision, never by leaving out the parts that are difficult.

1.3 Assurance layers

Ten layers stand between design intent and a building that demonstrably performs, and each produces a controlled output. A project that cannot show the output has not completed the layer, irrespective of its drawings.

Table 1.2 Assurance layers and their controlled outputs

Layer	What is established	Controlled output
Legal baseline	The notified text, the AHJ adoption record, project scope, and the other laws that apply alongside the Code.	Legal and adoption file
Clause traceability	Every applicable clause, jurisdictional option, selected route and normative appendix.	Compliance register
Data quality	Source, date, spatial and temporal resolution, uncertainty and approval of every climate, site and utility input.	Project data register
Design verification	Signed calculations, models, drawings, schedules and recorded design reviews.	Basis of Design and calculation package
Product conformity	Declared performance, certification scope, traceability and installation limits.	Approved submittal register
Field verification	Inspections, hold points, tests, photographs and closure of nonconformances.	Inspection and test plan with records
Commissioning	Sequences, controls, system interactions, operator training and the systems manual.	Commissioning and functional test reports
Operational proof	Metered performance, benchmarks, occupant survey, maintenance and correction.	Measurement and improvement log
Independent review	Subject-matter review of high-risk, novel or contested technical issues.	Peer-review record
Controlled update	New law, standard editions, field lessons and approved revisions.	Standards watchlist and change log

1.4 Cross-cutting safeguards

Table 1.3 Cross-cutting safeguards for every green measure

Safeguard	Requirement for every green measure
Safety	Green roofs, photovoltaic arrays, water storage, shading and façade systems satisfy structural, wind, seismic, fire, electrical and access requirements before they are adopted for environmental performance.
Health	Water reuse, natural ventilation, low-emitting products and cleaning regimes protect water quality, air quality, infection control and vulnerable users.
Climate resilience	Flood, heat, drought, wind, landslide, deterioration and service continuity are assessed, and no measure creates a single point of failure.
Accessibility and inclusion	Routes, controls, information, sanitation and emergency procedures remain usable by people of different ages, abilities and genders.
Maintainability	Access, isolation, labeling, spares and safe cleaning are provided, and a competent operator exists. A green feature that cannot be maintained is a future defect.

Safeguard	Requirement for every green measure
Affordability and value	Whole-life cost, service life and avoided utility and maintenance risk are used, not first cost alone.

Accessibility. Where this Guide requires accessibility to be satisfied, the requirement is measured against the accessibility provisions of the Building Code of Pakistan 2021 and the accessibility and disability legislation applicable in the jurisdiction, together with any accessibility standard adopted by the Authority Having Jurisdiction or the client department. The instrument relied on, and the authority that enforces it, are recorded in the minimum applicability record.

1.5 Terms used for requirement strength

The terms below set how strongly a provision binds. They are used in the text, and the first four are also the labels carried by the boxed callouts throughout this Guide.

- **Requirement.** A mandatory provision of the Code, or a controlled condition without which a compliance claim cannot be made.
- **Caution.** A point at which a common error, an unsafe interface or a misreading of the Code carries consequences. The governing requirement is stated elsewhere; the box marks where projects get it wrong.
- **Key decision.** A choice that fixes later options and is expensive to reverse once the design is frozen. The box records what turns on the choice and when it has to be made.
- **Good practice.** A robust method or current benchmark. It does not replace the governing requirement.
- **Jurisdictional option.** A provision the AHJ may adopt, set a value for, or opt out of. The choice is recorded in the adoption schedule; silence is not a waiver.

Where a requirement comes from. Every mandatory statement in this Guide belongs to one of three classes, and the class governs the language used and the weight the statement carries.

- **Code requirement.** A provision of the notified Green Building Code of Pakistan 2023, or of another instrument adopted by the Authority Having Jurisdiction or applicable by law. Written with "shall" and identified to its source clause or Code chapter.
- **Adopted control.** A project, owner or AHJ control that is not statutory in itself but becomes binding once formally adopted, such as a selected compliance route, a jurisdictional option, or a contract or specification requirement. Written with "shall" only where the adoption basis is stated and recorded in the minimum applicability record or the jurisdictional-options schedule.
- **Guide method.** A delivery method, sequence or record format authored by this Guide. Written as good practice and not as a statutory requirement. A Guide method acquires binding force only by adoption as an adopted control, and this Guide does not assert that it has been adopted.

A Guide-authored method is not presented as a statutory requirement anywhere in this Guide unless its adoption basis is stated at the point of use.

2 Legal Basis, Scope and Compliance Route

Applicability is settled before design begins. A project that discovers at permit stage that a chapter applies, or that a jurisdictional option was not documented, pays for the omission in redesign.

2.1 Legal basis

The Green Building Code of Pakistan 2023 was approved by the Federal Cabinet vide Decision No. 486/Rule-19/2025/672 dated 28 July 2025 as Pakistan Engineering Council Bye-Laws, and notified by the Ministry of Science and Technology, Government of Pakistan, through Gazette Statutory Notifications S.R.O. 1531(I)/2025, amending the Conduct and Practice of Consulting Engineers Bye-Laws 1986, and S.R.O. 1532(I)/2025, amending the Construction and Operation of Engineering Works Bye-Laws 1987, both dated 11 August 2025. Both notifications are reproduced in the Statutory Notifications section of the PEC master copy of GBCP-2023 notified 11 August 2025. Because the Code is notified as PEC Bye-Laws, PEC is the professional authority over the registered consulting engineers and constructors who design and execute the work, distinct from the Authority Having Jurisdiction that approves the building. Rainwater-harvesting provisions were notified separately and have their own scope. The Code does not nullify federal, provincial or local law, and cannot be used to reduce a safety, health or environmental requirement imposed by another instrument. Adoption, interpretation and enforcement rest with the Authority Having Jurisdiction.

2.2 Order of precedence

- 1. Governing requirements.** The notified Code, applicable law, and the codes and standards adopted by the AHJ.
- 2. Recorded project decisions.** The AHJ schedule of jurisdictional options, approved alternatives, written interpretations, permit conditions and inspection decisions.
- 3. Referenced editions.** The editions cited by the governing Code, unless the AHJ has adopted or approved a later edition for the project.
- 4. Benchmarks.** Later national and international editions are compared for risk and good practice. They are not substituted for adopted requirements without a written decision.
- 5. Specific over general.** Where two applicable provisions conflict, the specific provision applies. Where the practical governing requirement remains unclear, obtain a written interpretation before design freeze.

2.3 Scope screen

The Code applies, under clause 101.3, broadly to the design, construction, addition, alteration, equipment, change of occupancy, relocation, replacement, demolition and removal of buildings and their sites. It lists exclusions for single-family dwellings, multi-family dwellings of three stories or fewer above grade, manufactured mobile or modular houses, and projects that use none of electricity, fossil fuels and water.

CAUTION

Screen rainwater harvesting separately. The separately notified rainwater provisions cover residential, non-residential and industrial applications, including existing buildings. A low-rise residential project can fall outside the main Code scope and still require a rainwater-harvesting assessment. Two applicability decisions are issued, not one.

2.4 Compliance architecture

- **Mandatory provisions.** All applicable mandatory provisions of the technical chapters apply, together with the whole of the construction and operation chapter.
- **Selected route.** Where the Code offers a prescriptive or a performance option, record the route and every condition attached to it before design freeze. Changing route after freeze re-opens the evidence base.
- **Jurisdictional options.** The adoption table allows the AHJ to opt out of listed provisions or set specified values. Where no opt-out has been recorded, the provision applies as written.
- **Normative appendices.** Normative appendices form part of the mandatory requirements. Informative appendices become mandatory only where specifically adopted.

2.5 Minimum applicability record

Table 2.1 Minimum applicability record

Record field	Minimum content
Project identity	Name, address, cadastral or site reference, owner, occupancy classification, floor area, height, project type and intended use.
Authority	Competent authority, adoption instrument, permit route, inspection regime and appeal route.
Scope determination	Code applies, is excluded, or applies in part, with the clause and the evidence.
Rainwater determination	Applicable category, intended end uses, potable or non-potable pathway, and the approving authority.
Compliance path	Mandatory provisions plus the prescriptive or performance selection for energy and materials, and any adopted appendix.
Jurisdictional-option schedule	Clause, adopted status or value, rationale, effective date, approver and source document.
Related requirements	Building Code of Pakistan 2021, fire safety, energy code, environmental approval, planning and master plan, utility and grid rules, water quality and local by-laws.
Interpretations sought	Each written request, the responsible person, the due date, and the decision required before the next gate.

2.6 Compliance pathway

The pathway in Figure 2.1 runs from the first scope question to verified operation. Each step releases the evidence the next one needs, so a step taken out of order is repeated later.

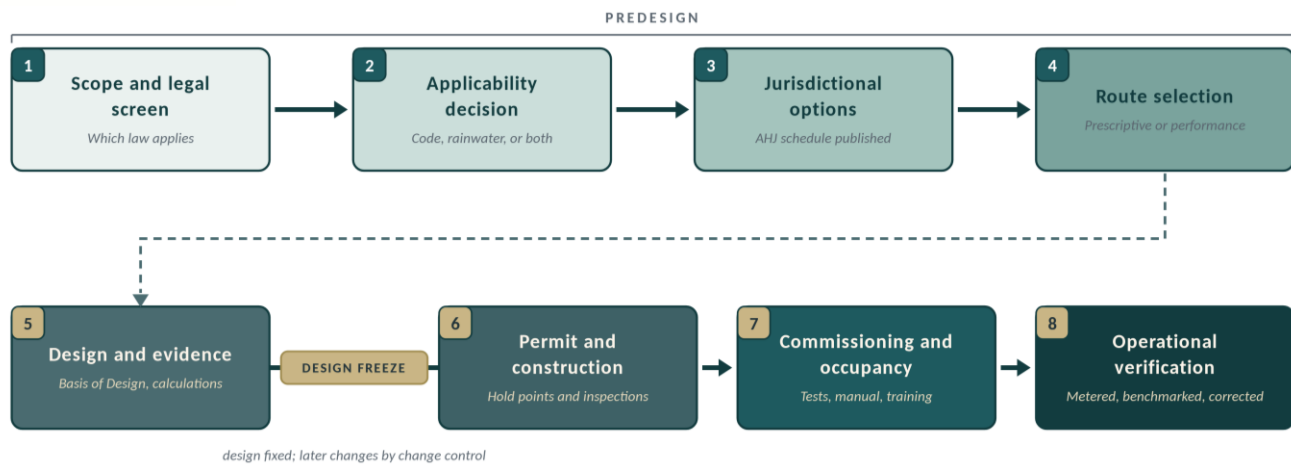


Figure 2.1 Compliance pathway from scope determination to operational verification

2.7 Jurisdictional-options schedule

The AHJ records a decision for every option the Code offers under clause 101.5.1 and Table 101.5.1. The format in Table 2.2 is the decision record; the complete list of options is taken from the Code's adoption table. Rows are shown to establish the required fields.

Table 2.2 Required fields of the jurisdictional-options schedule

Clause	Provision or value at issue	Decision recorded	Basis	Effective date
Heat-island mitigation, walls	Whether the wall-shading provision is adopted	Adopted / not adopted	AHJ rationale and source document	Date
Site waste diversion	The diversion percentage selected from the values the Code offers at clause 501.3.8.1	Value adopted	AHJ rationale and source document	Date
Dual water-supply plumbing	Whether dual supply is required	Adopted / not adopted	AHJ rationale and source document	Date
Orientation	Whether the orientation provision is adopted	Adopted / not adopted	AHJ rationale and source document	Date
Postconstruction flush-out or IAQ monitoring	Whether the provision is adopted	Adopted / not adopted	AHJ rationale and source document	Date

2.8 Authority Having Jurisdiction for public facilities

The Code makes the Authority Having Jurisdiction the agency responsible for enforcing it under clause 104.1 and gives that authority the power to approve under clause 105.1, but it does not name the agency. Adoption is provincial and departmental. For public schools and health facilities the enforcing authority is therefore identified from the approval route that actually governs the facility, and the result is recorded in the Authority row of the minimum applicability record.

The functions below are exercised by different bodies, and a project identifies the holder of each before design begins.

- Administrative approval of the scheme: the client department, being the provincial education department for schools and the provincial health department, or its delegated service delivery organisation, for health facilities.
- Scheme approval and funding: the provincial Planning and Development Department, through the applicable development working party, on the approved PC-I.
- Design, technical sanction and execution control: the Communication and Works or Works and Services Department, or the provincial infrastructure delivery agency where one is mandated for the facility type, under the delegation-of-powers rules in force.
- Building control where a municipal permit regime applies: the development authority or local council having jurisdiction over the area, under its building by-laws.
- Professional competence and code compliance of the design: the Pakistan Engineering Council, under the PEC Act 1976 and the Bye-Laws through which GBCP-2023 was notified.
- Environmental clearance: the provincial Environmental Protection Agency, under the environmental legislation applicable in the jurisdiction.

The department and agency names above are recorded for the specific province and facility type at the start of the project, against the notifications and delegation-of-powers rules then in force, because these vary between provinces and are revised from time to time.

REQUIREMENT

Where no conventional permit regime applies. A public building on government land may fall outside municipal building control, so that no building permit and no permit authority exist. The absence of a permit regime does not suspend the Code. In that case the substituted approval chain is: administrative approval by the client department; technical sanction by the works department; design certified against the adopted Code by a PEC-registered professional; adoption and recording of the jurisdictional-options schedule by the works department in place of an AHJ adoption table; and departmental acceptance and occupancy release in place of a certificate of occupancy. Each step is recorded in the Authority row of the minimum applicability record. Where a step has no identified holder, the gap is recorded as an open interpretation and not treated as a waived requirement.

Energy institutions. Energy conservation is administered nationally by the National Energy Efficiency and Conservation Authority, established under the NEECA Act 2016, which issued the Energy Conservation Building Code 2023. The provincial route runs through the provincial energy departments and the provincial energy efficiency and conservation agencies established under that Act. ECBC-2023 applies where it has been adopted by the Authority Having Jurisdiction or by the client department, and its adoption status is recorded in the minimum applicability record alongside the determination in section 3.2. This Guide states no energy-audit, energy-manager or periodic-plan obligation for existing buildings; any such duty arises only where an entity has been designated under the NEECA Act, and would be cited to that designation.

Environmental regime. Environmental requirements are governed by the Pakistan Environmental Protection Act 1997 and, following devolution, by the provincial environmental protection acts, and are enforced by the provincial Environmental Protection Agencies. Whether a project requires an Initial Environmental Examination, an Environmental Impact Assessment or neither is set by the schedules to the applicable provincial regulations and is threshold-based, so a small school block or

health facility may fall below the threshold for either. Applicability is established for the specific jurisdiction and project and recorded in the minimum applicability record; it is not assumed that every environmental instrument applies to every facility. Discharge and waste standards referred to in this Guide are those of the National Environmental Quality Standards as applied in the jurisdiction.

3 Code Interpretation Determinations

The notified Code contains points where the text is abbreviated, where two provisions give different values for the same subject, or where the regulatory landscape has moved since drafting. Each is stated below with the determination this Guide applies and the basis for it. These are determinations, not queries: a designer can act on each of them. Where a determination reserves a choice to the AHJ, the Guide states what applies until that choice is recorded.

3.1 Indoor environmental quality provisions

Table 3.1 Determinations on the indoor environmental quality provisions

Point	Determination and basis
The indoor environmental quality chapter is abbreviated in the notified text, while the adoption table and the construction and operation chapter refer to provisions of that chapter which do not appear in its body.	The referenced requirement stands. An abbreviated chapter body does not remove a requirement that the adoption table and the operation chapter both rely on. Apply the standards the Code explicitly references for ventilation, thermal comfort and acoustics, and apply the construction and operation chapter's indoor air-quality provisions in full, because they are self-contained. Obtain the AHJ's written interpretation where a permit decision turns on the abbreviated text, and record it in the interpretation register. No requirement is invented to fill the gap.
The chapter uses conditional wording in places within a mandatory chapter.	Treat the provision as mandatory where the adoption table lists it as a jurisdictional option, because only a mandatory provision requires an opt-out mechanism. Treat it as good practice only where the AHJ has recorded that reading. State the reading used in the compliance statement so that the reviewer can accept or correct it at permit stage rather than at inspection.

3.2 Energy provisions

Table 3.2 Determinations on the energy provisions

Point	Determination and basis
The energy performance route is referenced, and the appendix carrying the performance method is titled as normative, but the section that would establish the route in the chapter body carries no text.	The prescriptive route is the default. A performance route is only available once the AHJ has confirmed in writing that it will accept one, and has agreed the method and the acceptance criteria. If either is still open, compliance cannot be demonstrated, and any design built on that assumption is at risk of being redone. Teams that need the performance route should get that confirmation before design freeze.
The Code references the Building Code of Pakistan energy provisions of 2011, while the Energy Conservation Building Code of Pakistan was notified subsequently.	Where both instruments are adopted in the jurisdiction, apply the more stringent applicable provision for each parameter and document the comparison. Selecting the less demanding of two adopted instruments without a recorded precedence decision is not defensible. Where the AHJ has issued a precedence decision, that decision governs and is cited in the compliance statement.

Point	Determination and basis
The Code specifies a roof-based photovoltaic capacity requirement and, separately, an annual renewable-energy requirement under the prescriptive route.	Treat both as applicable and demonstrate both. Do not count the same generation twice: the capacity requirement is satisfied by installed capacity per unit of qualifying roof area, and the annual requirement by demonstrated annual energy. Where the installed array satisfies the capacity requirement but not the annual requirement, the shortfall is closed by load reduction, additional capacity or qualifying off-site procurement. Where the AHJ confirms that one requirement subsumes the other, apply that confirmation.
The prescriptive route sets two sets of annual renewable-energy values, a standard and an alternate approach, without stating in the chapter body which projects select which.	The standard values govern by default. The alternate values are available only where the AHJ has confirmed in writing that the project meets the condition the Code attaches to the alternate approach, and the confirmation is recorded before design freeze. A design sized against the alternate values without that confirmation carries the difference as risk.

3.3 Renewable-energy institutions and grid process

Table 3.3 Determinations on renewable-energy institutions and grid process

Point	Determination and basis
The Code narrative names the Alternative Energy Development Board (AEDB) of Pakistan as the certifying institution.	The functions of that Board were merged into the Private Power and Infrastructure Board in 2023. Use the current institution and its current certification process. An institutional name in a code narrative is descriptive; the function follows the institution that now holds it.
The Code narrative describes a grid-connection process that predates the current distributed-generation regulations.	Use the National Electric Power Regulatory Authority regulations and the distribution company procedures in force at the time of application. Grid connection is governed by the electricity regulator, not by the building code, and the building code narrative does not freeze the regulator's process.

3.4 Conflicting values and scope

Table 3.4 Determinations on conflicting values and scope

Point	Determination and basis
The site waste provision states one diversion percentage in the section text, while the adoption table offers the AHJ a choice among lower values.	Where the AHJ has recorded a value under the adoption table, that value governs, because the table exists precisely to let the jurisdiction set it. Where no value has been recorded, the section text applies. Record the applicable value in the applicability decision before the waste plan is written, since the plan's separation method and service-provider selection follow from it.
The Code's scope exclusions for low-rise residential buildings differ from the coverage of the separately notified rainwater provisions.	Issue two applicability decisions. Exclusion from the main Code does not exclude a project from the rainwater provisions, which were notified separately and carry their own scope. Treating one decision as covering both is the most common scope error on small residential projects.

Point	Determination and basis
Some internal cross-references and numbering in the notified text are inconsistent.	Verify every cross-reference against the controlling notified text before relying on it, and cite the provision by its subject as well as its number so that a numbering error does not defeat the reference. Where a cross-reference cannot be resolved, obtain the AHJ's written interpretation and record it.

3.5 Referenced standard editions and local data

Table 3.5 Determinations on standard editions and local data

Point	Determination and basis
Several standards cited by the Code have later editions.	The cited edition governs unless the AHJ adopts or approves a later one. Compare the later edition for changes that materially affect safety, performance, measurement or procurement, and record for each whether the project adopts it, proposes it as an alternative, or notes it only. Annex B carries the comparison.
Climate, flood, water-quality and product-conformity data sources, and the agencies competent to accept them, differ between jurisdictions.	The AHJ publishes the approved sources and the acceptance process in its jurisdiction annex. Until it does, the project uses Pakistan Meteorological Department data and the environmental and survey sources accepted by the AHJ for other statutory approvals, records the source, date, resolution and uncertainty of each dataset, and obtains written acceptance of the data basis before design freeze.

4 Responsibilities and Accountability

Requirements fall between organizations more often than they are refused. The purpose of this chapter is that no clause, test, decision or operational task has an ambiguous owner.

4.1 Who does what

Table 4.1 sets out what each party is responsible for and the evidence it produces. Figure 4.1 shows the interfaces between them, because it is at the handovers, rather than within any one role, that requirements are lost.

Table 4.1 Responsibilities and the evidence each party produces

Party	Core responsibility	Primary evidence
Authority Having Jurisdiction	Adopt and interpret requirements, set option values, review permits, inspect, decide alternatives, issue notices and retain public records.	Adoption and option schedule, permit comments, inspection decisions, occupancy decision
Owner	Define outcomes, budget and service life; appoint a competent team and an independent commissioning provider; retain records; operate the asset.	Owner's Project Requirements, appointments, approvals, systems manual, measurement plan
Architect and planner	Integrate site, form, orientation, daylight, accessibility, materials and user needs.	Site plan, drawings, area schedules, design decision records
Civil and landscape engineer	Flood and site due diligence, stormwater, landscape water, heat island, erosion and external works.	Hydrology, planting plan, erosion control plan, grading and drainage
Building services and energy team	Water balance, plumbing, ventilation and conditioning, energy, controls, metering, renewables and grid coordination.	Calculations, models, control sequences, schedules, single-line diagrams
Structural, fire and electrical specialists	Loads, anchorage, wind and seismic actions, fire separation, access, earthing and safe interfaces.	Signed designs, risk assessments, test and inspection plans
Contractor	Plan, procure, install, protect, test, document and correct the work.	Method statements, submittals, waste and air-quality logs, as-built records, test results
Commissioning provider	Independently plan and verify systems from the owner's requirements through post-occupancy completion.	Commissioning plan, design review, issue log, test scripts, reports, training verification
Facility manager and operators	Review maintainability, receive training, operate, meter, maintain, survey and improve.	Operations plan, logs, dashboards, corrective actions
Users and community representatives	State needs, accessibility, comfort, safety and operational realities, and participate in feedback.	Consultation record, user requirements, comfort survey and complaint log
Procurement and finance	Use performance specifications, conformity evidence and whole-life value.	Tender criteria, bid evaluation, cost plan, warranties

Party	Core responsibility	Primary evidence
Laboratories and approved agencies	Provide competent, traceable tests and certifications.	Accreditation scope, test reports, chain of custody

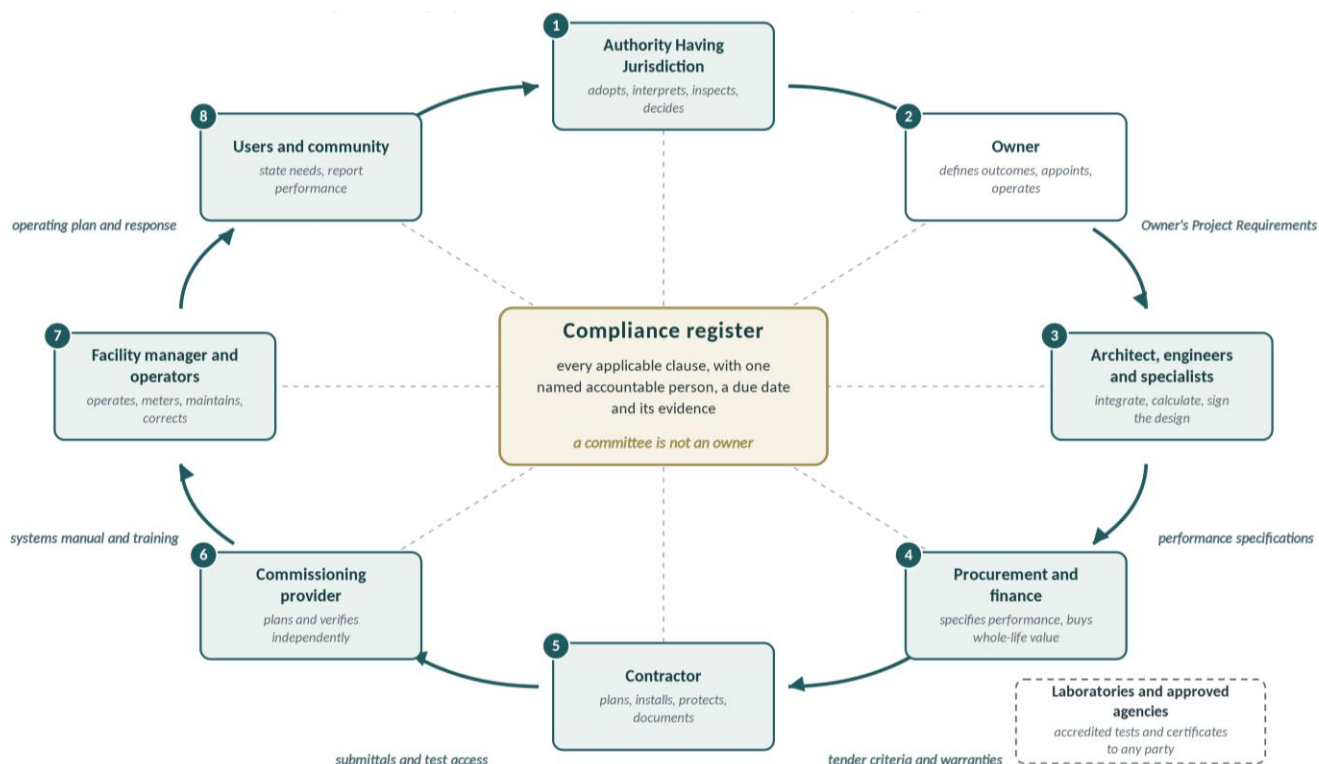


Figure 4.1 Project roles and accountability interfaces for Green Building Code implementation

4.2 Assigning each requirement

For each applicable clause, the register should name four things: who prepares or implements it; who signs it off and therefore owns the decision if it is challenged; which other disciplines or authorities have to be consulted before that sign-off; and who needs the result in order to do their own work. Collaboration across the team does not change this. Although many people contribute to a clause, one named person owns the decision, and that decision is dated.

4.3 Inclusive participation

Meaningful participation means involving the people who actually use, run and live with the building, not only its commissioners. In schools, health facilities and other public buildings, that means going beyond the obvious stakeholders to include women, people with disabilities, the maintenance and cleaning staff who keep the place working, security staff, and the front-line workers who deliver the service day to day.

- Hold consultations at accessible times and locations, with clear visuals and local-language explanation.
- Separate privacy-sensitive discussions where sanitation, safety or gender-based concerns would not be raised in a mixed group.

- Test controls, wayfinding, lighting, thermal comfort, water points and emergency access with representative users rather than with the design team.
- Keep a record showing what was heard, what was decided, the reason, and the follow-up. Attendance lists record who was present, not what changed.

4.4 Safeguarding, conduct, privacy and consent

This Guide requires information to be collected from occupants at several points, including comfort and satisfaction surveys during design, after occupancy and in operation. In public schools and health facilities those occupants are children and patients. The following applies to everyone who conducts a survey, gathers occupant information, or works in an occupied facility under this Guide.

- The applicable safeguarding policy and code of conduct apply to all survey and site personnel. There is no unsupervised one-to-one contact between survey or site personnel and a child or a patient.
- Participation is voluntary. The purpose of the collection is stated, the right to decline or to withdraw is stated, and consent is recorded before information is collected.
- Respondents under 18 are approached only through the institution, with the written permission of the head teacher or facility in-charge and with the respondent's own assent. No personal identifiers are collected and no photograph identifying a child is taken. Where the same information can be obtained from teachers, staff or observation, that route is used in preference.
- Patients are approached only through the facility in-charge and never during care. No health information is collected.
- Data minimization applies: no names or identifying details, reporting in aggregate, secure storage, and a stated retention and disposal point.
- A protected reporting channel is identified for safeguarding concerns, independent of the site team, with a named route, an obligation to report and no retaliation for reporting.

The consent and assent instrument used for occupant surveys under this Guide is issued as an annex to this Guide. Sections 11.2 and 12.3, and the occupied-works requirement in Chapter 13, are subject to this section.

5 Integrated Delivery and Progressive Assurance

Trade-offs are made before form, systems and budget are finalized. After that point every improvement is bought by removing something else.

5.1 Design sequence

1. Prepare the Owner's Project Requirements by stating the use, capacity, climate and hazard context, measurable performance criteria, cost and service-life assumptions, accessibility, training and documentation expectations, and the criteria by which success will be judged.
2. Form the cross-disciplinary team by including the authority liaison, owner, users, architect, engineers, cost and procurement, contractor input, the commissioning provider and facility operations.
3. Run a predesign workshop to review site constraints, passive opportunities, water and energy balances, material loops, user needs, maintenance capacity and risks together, in one room, before schemes exist.
4. Generate at least three schemes: a conventional baseline, a compliant integrated option, and an ambitious but maintainable option.
5. Score only viable schemes. A mandatory failure is a stop condition, not a low score. Score life-cycle value, resilience, accessibility and operation alongside the initial cost.
6. Document the Basis of Design. Explain how the selected solution meets each owner requirement and each code requirement, including calculations, sequences and product assumptions.
7. Re-score at each gate. Update after design development, tender, value engineering, major substitution and commissioning findings.

- 5.2** Transfer decisions to operation. The systems manual and operator training explain the intent, not only the equipment.

5.3 Progressive assurance gates

The gates are shown in Figure 5.1. A gate is passed when the named party has recorded the release against the evidence listed for it, and not before.

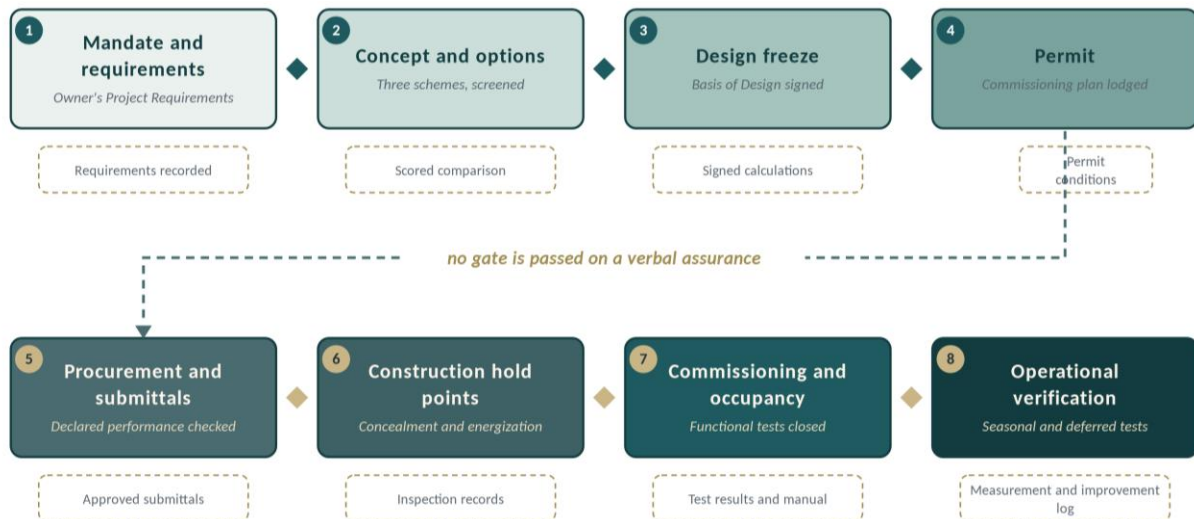


Figure 5.1 Progressive assurance gates from mandate to verified operation

5.4 Scheme comparison

Table 5.1 Scheme comparison criteria

Criterion	What the comparison must consider
Site and risk	Allowable site, flood and ecology buffers, access, heat island, stormwater, transport
Water	Landscape demand, fixtures, harvesting and reuse balance, quality, overflow, metering
Energy	Load avoidance, envelope, systems, controls, renewables, storage, metering
Indoor environment	Air, moisture, comfort, daylight, glare, acoustics, materials and user control
Materials	Quantity reduction, durability, recycled, local and biobased content, declarations, waste
Delivery	Constructability, commissioning access, evidence, available skills, schedule and risk
Whole-life value	First cost, utilities, maintenance, replacement, downtime and residual value
Resilience and inclusion	Hazards, backup modes, accessibility, user needs and safe failure

5.5 Controlling value engineering

Every value-engineering proposal carries a technical equivalence statement. Reject a change that reduces a mandatory outcome, shifts cost to operation without the operator's agreement, removes measurement or commissioning access, or relies on a product claim that has not been evidenced. The record in Table 5.2 is completed for every proposal.

Table 5.2 Value-engineering decision record

Decision field	What is recorded
Proposed change	The substitution or omission, described precisely enough to be priced and reviewed.
Reason and cost effect	Capital saving, and the effect on operating and replacement cost.

Decision field	What is recorded
Clauses and owner requirements affected	Every provision and performance criterion the change touches.
Performance evidence	Test data, certification or calculation demonstrating equivalence.
Safety, resilience and accessibility effect	Any change to structural, fire, electrical, hazard or access performance.
Operation and training effect	Change to maintenance burden, spares, operator skill or training content.
Commissioning effect	Tests added, removed or changed, and the effect on the test schedule.
Decision	Approved, rejected or approved with conditions; approver and date.

6 Site, Landscape and Stormwater

Site decisions are the least reversible decisions on a project. A site chosen without a flood, ecology and access screen commits every later decision to managing a problem that need not have existed. Figure 6.1 carries the measures of this chapter on a single site.



MEASURES SHOWN

- 1 Required separation from the watercourse, and from habitat and wetland areas, is measured and recorded.
- 2 Existing trees and native planting retained on the developed site.
- 3 Rooftop photovoltaics on the qualifying roof area.
- 4 Elevated storage serving harvested and supply water.
- 5 Raised plinth above the design flood elevation, with an accessible ramp.
- 6 Rain garden receiving roof and paved runoff.
- 7 Permeable paving to the play area reduces runoff and supports infiltration.
- 8 Paved area drains through a grated inlet into vegetated treatment before discharge.
- 9 Biodiverse native planting to the boundary, other than turfgrass.
- 10 Continuous pedestrian route from the gate to the veranda, kept clear.

Figure 6.1 Integrated site-planning measures for resilient and environmentally responsive development

Source: prepared for this Guide by Dr. Qaisar Ali Associates, 2026. Base image is illustrative; it does not depict an identifiable existing building, site or person. Annotation and technical content by DQA.

6.1 Site decision hierarchy

1. Prefer an existing building, brownfield or previously developed site where environmental risks can be safely managed.
2. For an undeveloped site, confirm planning approval and proximity criteria, and confirm that any agricultural, forest or park exception relied on is legitimately applicable.
3. Screen prohibited development areas before land purchase or concept approval, not after.
4. Preserve existing site features and native or adapted vegetation before designing new landscape.

5. Maintain or restore the predevelopment water balance, and avoid increasing erosion or damage to adjoining property.
6. Reduce hardscape heat, roof heat and unnecessary light spill.
7. Connect safe pedestrian, bicycle and motorcycle movement to public routes and transit.
8. Manage soil, rock and vegetation as resources rather than as disposal streams.

6.2 Predesign screen

Table 6.1 Predesign site screen

Source: requirements restated from GBCP-2023, Chapter 5 (Site Sustainability), clauses 501.3.1.2, 501.3.3.2, 501.3.4.1 and 501.3.4.2. Table structure and wording by DQA.

Screen	Requirement
Flood	Previously undeveloped land is generally required to sit at least 1.5 m above the 100-year flood elevation unless a permitted exception and engineered floodproofing apply. Construction within the flood limits of a river, natural stream or natural drainage channel is prohibited.
Habitat	Maintain the required separation from fish and wildlife habitat conservation areas unless a stated trail or habitat-enhancement exception applies.
Wetlands	Maintain the required separation from wetlands unless a stated trail, enhancement or restoration exception applies.
Master plan and access	Confirm physical access, environmental suitability and conformity with the approved master plan.
Contamination	For previously contaminated sites, establish the contamination status by an Initial Environmental Examination or an Environmental Impact Assessment, as the Code requires for site classification at clause 501.3.1.1(b), or by classification by a government agency, and ensure infiltration practices do not mobilize contaminants. Runoff from contaminated ground is treated to the total suspended solids limit of the National Environmental Quality Standards before discharge, as clause 501.3.4.5 requires.
Cultural and archaeological features	Identify and protect designated features through the site inventory and the applicable approvals.

CAUTION

Spatial data used as a design basis shall be obtained from an authoritative source. For each dataset, including flood maps, survey levels, meteorological data, environmental approvals and site observations, the date, scale, coordinate reference system, stated uncertainty and the authority's acceptance shall be documented. Data that does not carry this information, including imagery obtained from public mapping services, shall not be used as a design basis.

6.3 Landscape and biodiversity

- (a) Invasive species. Invasive plants shall be removed and lawfully disposed of, and shall not be replanted.
- (b) Vegetated area. Where the undeveloped-site trigger applies, not less than the required proportion of vegetated area shall be retained or provided.

- (c) Biodiverse planting. Not less than the required share of planting shall consist of native or adapted species other than turf, selected for the local climate, safety and maintenance capacity.
- (d) Water demand. Plant selection and hydrazones shall be coordinated with Chapter 7, and permanent potable irrigation shall be avoided wherever the planting permits.
- (e) Long-term survival. Soil volume, establishment period, plant protection, irrigation transition, replacement responsibility and maintenance access shall be specified. Planting shall not be accepted unless an establishment regime is specified.

6.4 Stormwater as a site system

Undeveloped sites are designed around the 95th-percentile 24-hour event or a demonstrated predevelopment water balance. Previously developed sites retain at least the specified 60th-percentile event unless the AHJ sets another value. The design also controls discharge duration, protects adjoining lots, and treats runoff from contaminated ground appropriately. Table 6.2 lists the methods available, and Figure 6.2 shows them working as one treatment train from capture through to controlled discharge.

Table 6.2 Stormwater methods and their design considerations

Method	Design considerations
Infiltration	Permeable paving, infiltration trenches, soakaways or basins, only where soil, groundwater and contamination conditions allow.
Evapotranspiration	Trees, vegetated swales, rain gardens, green roofs and soil-based systems.
Harvest and use	Rooftop or surface runoff captured for approved end uses, with water-quality and overflow control.
Detention and controlled discharge	Release of the design volume at the required rate and duration without moving erosion or flood risk off site.
Treatment train	Source control, sediment control, filtration, vegetation and final polishing matched to the pollutants present.

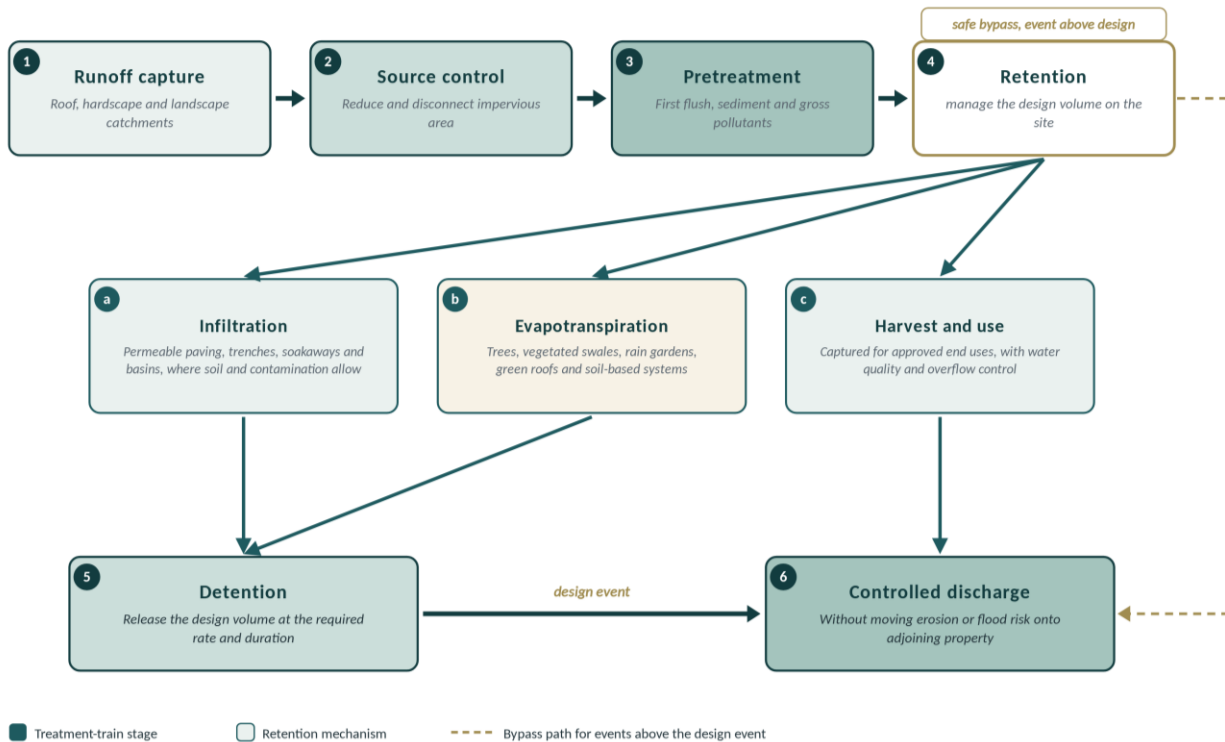


Figure 6.2 Integrated stormwater management from runoff capture to infiltration, reuse and controlled discharge

6.5 Heat island, lighting and movement

This clause sets the requirements for mitigating heat-island effect, controlling light and providing for pedestrian and non-motorized movement on the site. The following provisions shall be satisfied where the stated trigger or option applies.

- a. The required compliant share of hardscape shall be provided through shading, high-reflectance surfaces, permeable systems or covered parking.
- b. The roof reflectance or vegetated-roof requirement shall be applied to the calculated roof area after permitted exclusions, and not to the gross roof area.
- c. Where wall shading is adopted, east and west coverage shall be calculated at the specified times of day, and vegetation shall be kept clear of utilities and of the façade.
- d. A continuous, delineated pedestrian route of not less than the required width shall be provided from primary entrances to the public way or transit stop.
- e. Bicycle and motorcycle spaces shall be calculated from the occupant load and located securely, without obstructing accessible routes.
- f. Where the light-pollution option is adopted, the specified luminaire classification and lighting zones shall be used, and neighboring property and the night sky shall be protected.

6.6 Site evidence

This clause specifies the evidence to be submitted to demonstrate compliance with the requirements of this chapter. For each item listed in Table 6.3, the evidence shall establish the matter stated against it, and shall carry the source, date and acceptance information required under the respective clause.

Where a requirement in this chapter depends on a trigger or option, the corresponding evidence shall be provided only where that trigger or option applies.

Table 6.3 Site evidence and what each item establishes

Evidence item	Establishes
Survey and legal boundary plan	Site extent, levels and constraints
Authority and master-plan confirmation	That the use and access are permitted
Flood level and inundation evidence	The elevation datum for the flood screen
Habitat, wetland and cultural inventory	The separations and protections required
Existing vegetation and invasive-species plan	What is retained, removed and replaced
Hydrologic model and stormwater calculations	That the retention and discharge requirements are met
Landscape, soil and irrigation plan	Planting survival and the irrigation water source
Hardscape, roof and wall heat-island calculations	Compliance of each surface category
Exterior lighting photometrics and classification schedule	Light-spill control where the option applies
Pedestrian, bicycle and motorcycle plan	Safe movement and the required provision
Site waste management plan and receipts	Actual destinations of removed material

7 Water Efficiency and Rainwater Harvesting

Reduce demand first, match water quality to the use, recover appropriate sources, and prove performance through metering and maintenance. A harvesting system installed ahead of demand reduction is oversized on the day it is commissioned.

7.1 Water hierarchy

1. Eliminate unnecessary demand and leaks through layout, controls and user-centered design.
2. Use efficient fixtures, appliances, process equipment and hot-water distribution.
3. Use climate-appropriate planting and efficient irrigation, and restrict permanent potable irrigation.
4. Recover rainwater, condensate, greywater or other approved sources at a quality matched to the end use.
5. Submeter major sources and systems, diagnose abnormal use, and act on the diagnosis.
6. Maintain treatment, backflow protection, labeling, storage hygiene and safe overflow throughout the life of the system.

7.2 Fixture and fitting maxima

Water-consuming fixtures and fittings installed in the works shall not exceed the maximum flow or volume specified for their type in Table 7.1. Where a fixture is available in more than one rated flow, the rated value at the supply pressure specified shall be used to determine compliance. Where Table 7.1 refers to a permitted override or provision, the fixture shall comply with the conditions of that provision in the referenced clause.

Table 7.1 Fixture and fitting maxima

Source: values restated from GBCP-2023, clause 601.3.2.1 and Table 601.3.2.1. Table structure and wording by DQA.

Fixture or fitting	Maximum
Water closet, full flush	4.8 L per flush
Urinal	1.9 L per flush
Public lavatory faucet	1.9 L per minute
Public metering faucet	1.0 L per cycle
Residential bathroom faucet	5.7 L per minute
Residential kitchen faucet	6.8 L per minute, with the limited temporary override the Code permits
Residential showerhead, or simultaneous outlets in one stall	7.6 L per minute, subject to the Code's large-stall provision

7.3 Landscape water

- Use at least the required proportion of biodiverse native and rainfall-compatible planting.
- Limit the proportion of improved landscape irrigated with potable water, and supply the balance from approved alternate sources.

- Design hydrozones, backflow protection, master valve and flow sensing where required or adopted.
- Use weather or soil-responsive controls, or an approved rain or moisture shutoff, and post the station settings at the controller where the operator will see them.
- Avoid overspray onto buildings and hardscape, mismatched nozzles within a zone, and runoff on slopes.
- Disable or remove potable irrigation to rainfall-compatible planting after the establishment period, as the Code requires.

7.4 Rainwater design sequence

The steps below are worked in order. Figure 7.1 shows the system they produce, and the component each step fixes.

1. **Define approved end uses.** Separate potable and non-potable pathways, the water-quality requirement for each, and the authority that approves each. The water-quality requirement is that of the National Environmental Quality Standards for the relevant stream and any stricter requirement of the drinking-water or public-health standard adopted in the jurisdiction; the approving authority is the provincial Environmental Protection Agency for discharge and the client department or public-health authority for end uses within the facility.
2. **Establish climate data.** Use a rainfall series long enough to represent dry spells and seasonality, and record its source, period and station.
3. **Map catchments.** Record area, surface material, contamination risk, runoff coefficient, first-flush provision and access for cleaning.
4. **Build a time-step balance.** Compare usable yield with time-varying demand. An annual total cannot size storage because it conceals the dry season.
5. **Size treatment and storage.** Include losses, water age, turnover, dead storage, overflow, access, structural loads and disinfection where required.
6. **Design backup and isolation.** Prevent cross-connection and backflow, and label non-potable pipework and outlets so that a future contractor cannot connect them in error.
7. **Route overflows safely.** Integrate the overflow with the site stormwater design; do not create erosion or a neighbor's problem.
8. **Commission and maintain.** Test controls, level sensors, valves, water quality, pumps, alarms, bypass and cleaning procedures, and hand over the procedure with the system.

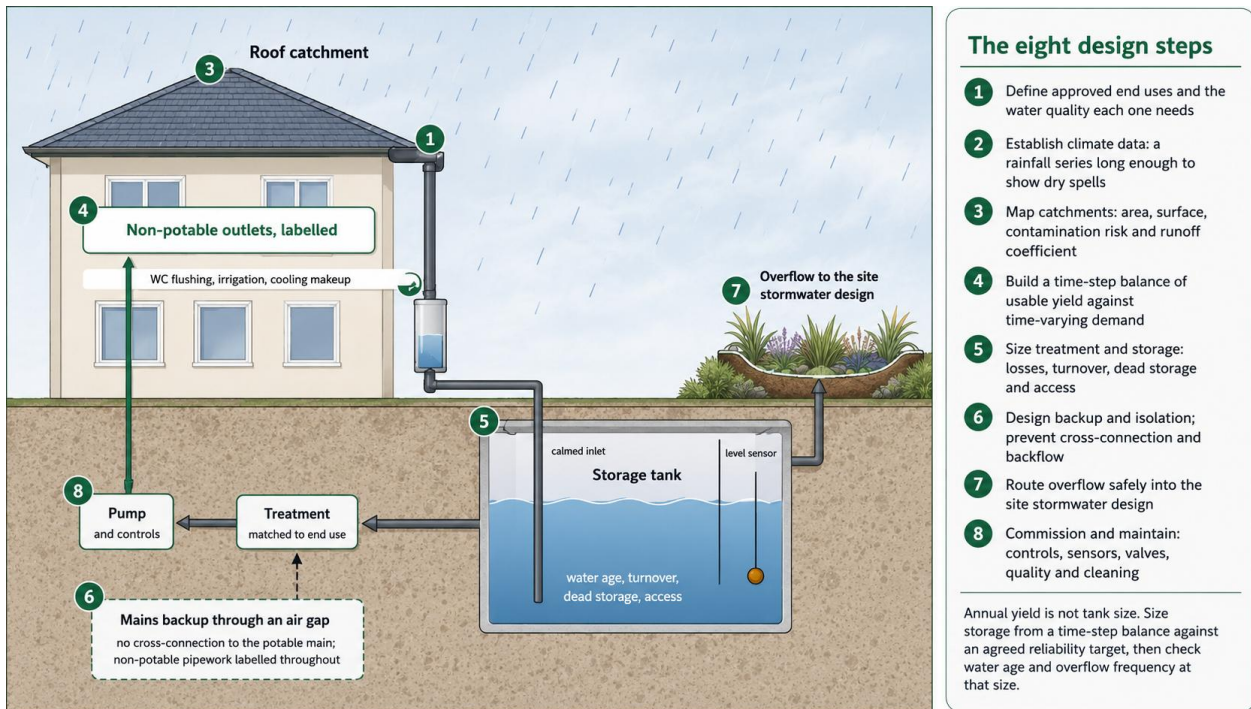


Figure 7.1 Typical rainwater-harvesting system from catchment and treatment to storage, reuse and overflow

KEY DECISION

Annual yield is not tank size. A roof that yields well over a thousand cubic meters a year can still fail to meet demand through a dry spell. Size storage from a time-step balance against an agreed reliability target, then check water age and overflow frequency at that size.

7.5 Cooling, hot water and process water

- Once-through cooling using potable water is prohibited.
- Control cooling-tower cycles of concentration, metering, conductivity and drift, and verify water chemistry against the materials in the circuit.
- Recover air-conditioning condensate where the climatic and capacity trigger applies.
- Limit hot-water pipe volume and developed length, and insulate and balance the system to reduce the water run to waste at each draw-off.
- Use efficient food-service, medical, laboratory and water-treatment equipment, and recover reject and backwash streams where it is safe to do so.
- Use demand-initiated softener regeneration and compliant reverse-osmosis shutoff, and keep regeneration waste out of any reclaimed-water collection.

7.6 Metering and operational proof

Meter potable, reclaimed and alternate sources and the major water-using subsystems where the Code's thresholds apply. Configure the reporting interval the Code requires, retain the data, and set alerts that feed the operational water-efficiency plan. The record in Table 7.2 is completed for each metered point.

Table 7.2 Water metering record for each metered point

Field	Content
Source or subsystem	Potable main, harvested or reclaimed main, cooling-tower makeup and blowdown, landscape irrigation, and large process or tenant supplies
Meter identity and location	Tag, position and accessibility for reading and replacement
Reading interval	The interval the Code requires for that category
Data owner	The named person who receives and reviews the data
Normal range and alarm	The expected range, the alarm threshold, and the benchmark used
Action owner	The named person who acts when the alarm triggers

8 Energy, Envelope, Renewables and Metering

Minimize loads, select efficient systems, provide the required renewable capacity, and prove performance through controls, metering and commissioning. Every step in that order is cheaper than the step after it.

8.1 Climate data and baseline

Use Pakistan Meteorological Department data or another source the AHJ approves. The Code gives a simplified two-zone description; project design uses location-specific temperature, humidity, solar, wind and rainfall data. Record the climate file, its period, its source and the design conditions used in the envelope, conditioning and renewable calculations. A design condition that cannot be traced to a dataset cannot be defended when the building underperforms.

8.2 Energy hierarchy

This clause establishes the order of priority in which energy measures shall be applied. Energy demand shall first be reduced through the higher-priority measures of Figure 8.1. These are load avoidance, passive envelope and form, efficient systems, and effective controls. These measures should be taken before on-site renewable generation is relied upon to meet the residual demand. Compliance shall be demonstrated through metering, commissioning and verified in-use performance, and not by design calculation alone.



Figure 8.1 Energy hierarchy from load avoidance to verified performance

8.3 Renewable energy and energy data

- **Roof-based photovoltaics.** The Code specifies on-site photovoltaic module capacity of 96.8 Wp per square meter of qualifying roof area, being the unshaded horizontal roof area remaining after the exclusions the Code permits, and subject to its solar conditions.
- **Product and structural conformity.** Verify module, inverter, cable and mounting certification, and verify wind and seismic loads, corrosion, fire and electrical safety, maintenance access and roof waterproofing before the array is fixed in the design.
- **Grid process.** Use the electricity regulator's current requirements and the distribution company's current procedures.
- **Main metering.** Provide remote-capable energy measurement for energy sources above the Code's thresholds.
- **Subsystem metering.** Meter conditioning, people-moving, lighting and process or plug categories above the thresholds, and communicate the data automatically.
- **Data.** Record hourly profiles, retain data for at least the required period, and produce reports an operator can act on.
- **Demand response and diagnostics.** Provide automated demand-response infrastructure where a program is available, and install fault detection and diagnostics where the size triggers apply.

8.4 Prescriptive renewable balance

The prescriptive route also sets an annual renewable-energy requirement by building type and gross floor area. Both this requirement and the roof-based capacity requirement are demonstrated, without counting the same generation twice. Table 8.1 carries two sets of values. The standard values govern by default; the alternate values are available only where the AHJ has confirmed in writing that the project meets the condition the Code attaches to the alternate approach, as determined in Chapter 3.

Table 8.1 Annual renewable-energy requirement by building type

Source: values restated from GBCP-2023, Chapter 7 (Energy Efficiency). Table structure and wording by DQA.

Building type	Standard approach, kWh per m ² per year	Alternate approach, kWh per m ² per year
Office	44	40
Retail	74	67
School	61	55
Healthcare and restaurant	126	113
Hotel	108	98
Apartment	68	62
Warehouse	26	23
All others	80	72

8.5 Envelope and passive design

- Keep total vertical fenestration below the Code threshold, and coordinate area, thermal transmittance, solar heat gain coefficient and visible transmittance as one decision rather than four.
- Apply the stated improvement to the referenced envelope thermal factors and to east, west and skylight solar heat gain where the option is adopted.
- Apply the orientation test to east and west fenestration, and document any permitted exception.
- Provide permanent projections to the required projection factors for the relevant climate zones and stories where adopted. Figure 8.2 shows how the factor is measured.
- Coordinate roof heat-island provisions with insulation, air barrier, moisture control, daylight and the structural and fire interfaces.
- Provide shading controls that occupants can reach and understand, and verify automatic devices through functional testing.

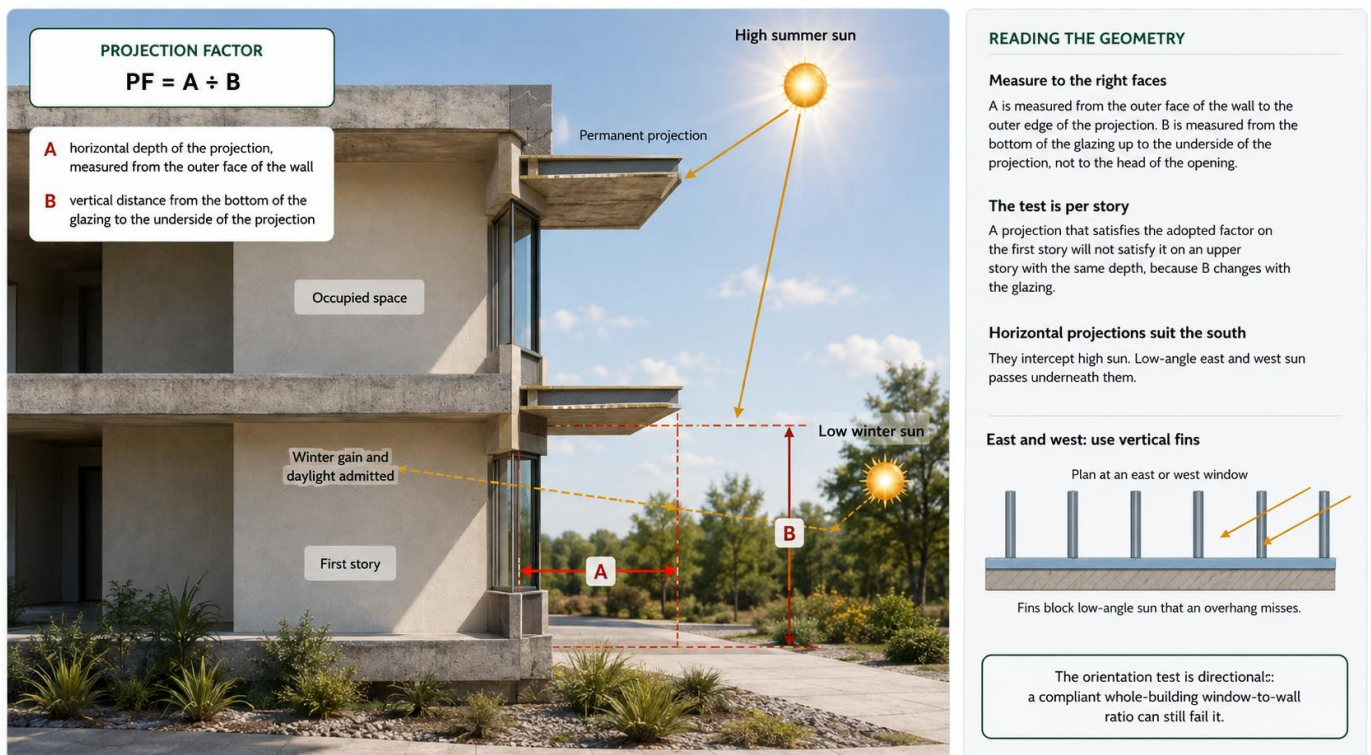


Figure 8.2 Integrated passive-envelope strategies and the geometry of the projection factor

8.6 Systems, lighting and equipment

- Use the controlling equipment-efficiency tables and their test procedures, and record the selected approach.
- Provide demand-controlled ventilation, economizers, zone control, fan efficiency and energy recovery where the triggers and adopted options apply.
- Limit kitchen exhaust and apply transfer air, demand ventilation or recovery as required.
- Apply the building-area and space-area lighting power densities, with automatic shutoff, daylight response and occupancy control.

- Apply guest-room control, efficient water heating, regenerative lifts and pump power limits where applicable.
- Commission sequences, sensors, setpoints, safeties, alarms and trend logs, including the interaction between passive and mechanical modes. Untested mode transitions are where mixed-mode buildings fail.

8.7 Energy model quality

This clause specifies the minimum information that shall be recorded for any energy model used to demonstrate compliance. For each model element listed in Table 8.2, the corresponding record shall be documented and retained and shall be sufficient for an independent reviewer to reproduce and verify the model's results. Where an element does not apply to the model's stated purpose, this shall be recorded with the reason.

Table 8.2 Energy model quality record

Model element	Minimum record
Purpose	Compliance route, option comparison, sizing, or measurement baseline
Weather	File, period, source, location and design conditions
Geometry	Areas, orientation, envelope construction and external shading
Schedules	Occupancy, lighting, equipment, ventilation, process and special uses
Systems	Efficiencies, controls, part-load behavior, ventilation and heat recovery
Renewables	Capacity, shading, losses, degradation, curtailment and attribute allocation
Quality assurance	Independent review, input checklist, calibration plan and version control
Outputs	Energy use intensity, peak demand, end-use split, renewable balance, unmet hours, sensitivity and the assumptions each result depends on

9 Indoor Environmental Quality

This chapter specifies the requirements for indoor environmental quality, covering ventilation and outdoor air, source control, moisture, thermal comfort, lighting and views, acoustics, user control and operational feedback. These requirements shall be satisfied together; compliance with one shall not be achieved by means that cause non-compliance with another.

9.1 Integrated strategy

This clause requires the indoor environmental quality layers of Table 9.1 to be addressed together as a single strategy. For each layer, the design and operating response listed shall be provided and demonstrated, and no response shall be adopted that satisfies one layer at the expense of another. Where a layer's response depends on operation, the responsibility and means for maintaining it in use shall be recorded.

Table 9.1 Indoor environmental quality layers

Layer	Design and operating response
Outdoor air and ventilation	Natural, mechanical or mixed-mode ventilation matched to climate, outdoor pollution, security and occupancy, with the airflow path, rates and controls demonstrated.
Source control	Smoking setback, vented kitchens and combustion appliances, low-emitting products, isolated contaminant sources, cleaning regime and entry control.
Moisture	Envelope and system moisture analysis, condensation control, drainage, material protection, humidity sensing and a defined response.
Thermal comfort	Appropriate temperature, air speed, radiant conditions and humidity, with adaptive opportunity and user control.
Lighting and views	Daylight without glare or overheating, quality electric lighting, control, visual comfort and access to views where required.
Acoustics	Background noise, sound isolation, reverberation and equipment or boundary noise appropriate to the use.
User control and inclusion	Controls reachable and understandable, with consideration of children, older people, persons with disabilities and different clothing and activity patterns.
Feedback	Complaint response, periodic survey and corrective action linked to trend data and maintenance.

9.2 Natural and mixed-mode ventilation

Figure 9.1 shows the air paths this clause requires to be demonstrated, and the point at which the building changes mode.

- Place openings to use the prevailing summer wind and cross-flow, and provide high and low openings where stack effect is intended.
- Demonstrate effective opening area, airflow path, room depth and obstructions. An operable window on a drawing is not a performance demonstration.

- Assess outdoor particulate matter, ozone, dust, noise, insects, humidity, security and driving rain before relying on natural ventilation for any part of the year.
- Condition natural-ventilation operation on outdoor air quality, and not only on the design assessment. Record the seasonal periods of concern, the outdoor-air-quality criterion at which openable ventilation is suspended, the monitoring source relied on, the alternative mode that applies, being filtration, mechanical supply, recirculation with filtration, or relocation of the activity, and the person who makes and records the decision. Where measured outdoor conditions make open-window ventilation unsuitable the building operates in its alternative mode; the design assumption does not override the measured condition.
- Provide safe user control and clear mode indication, and avoid simultaneous mechanical cooling and open windows unless that condition is intentionally controlled.
- Vent kitchens and combustion equipment outdoors, and prevent short-circuiting to air intakes and openable windows.
- For health facilities and other special occupancies, apply the ventilation and infection-control standard that governs that occupancy.



Mode changeover

Natural

Openings under user or automatic control, with outdoor conditions and outdoor air quality within the approved criteria.

Mixed

Mechanical assistance to one part of the building while another runs naturally. Interlocks prevent both at once.

Mechanical

Outdoor particulate matter, ozone, noise, humidity, driving rain or security rule natural ventilation out.

Test the transitions

Untested mode transitions are where mixed-mode buildings fail. Verify the interlocks by functional test, not by inspection of the drawing.

An operable window on a drawing is not a performance demonstration. Show the effective opening area, the airflow path and the room depth.

Figure 9.1 Natural and mixed-mode ventilation showing cross-flow, stack effect and controlled air paths

Source: prepared for this Guide by Dr. Qaisar Ali Associates, 2026. Base image is illustrative; it does not depict an identifiable existing building, site or person. Annotation and technical content by DQA.

9.3 Low-emitting materials and construction air quality

- Write performance-based volatile organic compound and formaldehyde limits into the specification and the submittal template, so that the requirement travels with the procurement.
- Protect ducts and absorptive materials from dust and moisture, and reject biologically contaminated materials rather than drying and installing them.
- Avoid using the permanent conditioning system during construction except for controlled startup and testing, and install clean filters before any such use.
- Sequence wet work ahead of absorptive finishes, and ventilate and cure products as their verified requirements specify.
- Complete flush-out or baseline air-quality monitoring where adopted or required, before occupancy, and retest any location that fails after the corrective action.
- Train cleaning and maintenance staff in the cleaning plan and in safe product use before handover, not after the first complaint.

9.4 Acceptance criteria record

Each parameter in Table 9.2 is recorded with its design criterion, the measurement method and instrument, the sampling locations, the reviewer and the result with any corrective action.

Table 9.2 Indoor environmental quality acceptance criteria record

Parameter	What the criterion must state
Outdoor airflow	Rate per person and per unit area, measurement method and acceptable tolerance
Carbon dioxide and occupancy control	Setpoint, sensor location, calibration and control response
Humidity and dew point	Range, sensing location, and the response when the range is exceeded
Particulate matter	Limit, averaging period, instrument and sampling location
Formaldehyde and volatile organic compounds	Limit, test method, sampling protocol and retest rule
Temperature and air speed	Range by season and activity, and the measurement height and location
Background sound and isolation	Limit by space type and the measurement method
Lighting and glare	Illuminance, uniformity, glare limit and the measurement condition

10 Materials, Circularity and Construction Waste

Reduce material demand and life-cycle impact, procure products whose performance is declared and verifiable, and keep construction resources out of disposal. The largest saving is the material never specified.

10.1 Material hierarchy

- Avoid unnecessary floor area, finish layers and oversizing.
- Retain and adapt existing structures and components where it is safe and feasible.
- Design for durability, repair, access, replacement and disassembly.
- Use salvaged, recycled, regional and responsibly sourced materials whose quality is verified.
- Use product-specific environmental information and whole-building assessment to compare choices.
- Source-separate or efficiently process waste, track destinations, and reject unsupported diversion claims.
- Plan end-of-life recovery and keep the records that make future reuse possible.

10.2 Waste controls

- Divert at least the required share of non-hazardous construction and demolition waste by weight, excluding soil and land-clearing debris from that calculation.
- Where the total-waste option is adopted, track total waste generated against the floor-area intensity limit, applying the stated exception where diversion is high enough.
- Prepare the waste plan before work starts, identifying expected streams, elements for deconstruction, the separation method, service providers, receiving facilities, tracking and reporting.
- Do not count alternative daily cover or waste-to-energy as diverted material where the Code excludes them.
- Maintain weighbridge tickets, receipts, photographs, transfer notes and facility diversion rates, and reconcile the mass balance before occupancy rather than at the final account.
- Provide operational areas for recyclables, reusable goods, lamps, electronics and batteries as applicable.

10.3 Prescriptive reduced-impact options

This clause sets out prescriptive options for demonstrating reduced material impact. A project following the prescriptive route shall satisfy the minimum requirement for at least two of the options listed in Table 10.1, and each option claimed shall be calculated by the method the Code specifies for that option. Costs shall be determined on a consistent basis across all options claimed, and the basis shall be recorded.

Table 10.1 Prescriptive reduced-impact options

Source: values restated from GBCP-2023, clauses 901.4.1.1 to 901.4.1.4. Table structure and wording by DQA.

Option	Minimum requirement
Recycled and salvaged content	At least 10 per cent of total material cost, using the Code's recycled-content calculation.
Regional materials	At least 10 per cent by cost sourced within the specified 400 km radius, applying the Code's transport rule where relevant.
Biobased products	At least 2 per cent by cost, with biobased content verified and chain of custody demonstrated for certified wood.
Declarations and certifications	Ten equivalent qualifying products, using industry-wide or product-specific environmental declarations, multi-attribute certification, or critically reviewed product assessment, weighted as the Code specifies.

10.4 Performance route

Where the performance route is selected, compare at least two building alternatives that both meet the owner's requirements, and demonstrate the required improvement across the specified impact categories including global warming potential. Use consistent boundaries, service life, quantities and a published impact method, obtain independent critical review, and submit the report to the AHJ. The comparison records the functional unit, service life, system boundary, structural, envelope and interior quantities, replacement cycles, whether operating energy is included, the impact method and database version, and the reviewer. Product approval

This clause specifies the checks that shall be completed before a product is approved for incorporation into the works. Each check in Table 10.2 shall be carried out and its outcome recorded, with the supporting evidence identified. A product shall not be incorporated until every applicable check is confirmed; where a check does not apply, this shall be recorded with the reason.

Table 10.2 Product approval checks

Check	What is confirmed
Specified performance and application	The declared performance matches the specification and the intended use
Certificate validity and scope, and the conformity scheme relied on. The national product-conformity route is certification by the Pakistan Standards and Quality Control Authority where the product category is covered; where it is not, the route is the conformity evidence accepted by the Authority Having Jurisdiction and published in its jurisdiction annex under section 3.5.	The certificate is current and covers the product as supplied
Identity consistency	Manufacturer, product and site records agree
Traceability	Batch or chain of custody where the claim depends on it

Check	What is confirmed
Health and emissions	Emission limits and chemical restrictions are met
Compatibility	Fire, structural, moisture and durability interfaces are satisfied
Installation and maintenance	Instructions, storage requirements and maintenance regime are available
End of life	Replacement, spares and disposal or recovery route are identified

11 Construction, Commissioning and Handover

Design intent survives construction only where it is protected by hold points, and it is demonstrated only by test. A building handed over without commissioning evidence has been handed over on the basis of hope.

11.1 Selecting the verification track

Projects with a gross floor area not greater than 1,000 m² follow the functional and performance testing process. Projects greater than 1,000 m² follow the full commissioning process. The individual system thresholds in Table 11.1 identify the systems requiring testing and planning in either case.

The functional and performance testing track. Most public schools and basic health facilities fall below the floor-area threshold, so the functional and performance testing track is the normal route for this programme. That track reduces the scope of the process. It does not reduce the obligations attaching to the systems actually installed.

- **Deliverables.** A short statement of the owner's requirements for the systems installed; verification that each system is installed as designed; written test scripts and recorded test results for each system reaching a threshold in Table 11.1; an issue log with each item closed out or carried with a named owner; a systems manual covering operation, settings and maintenance; and a record of operator training.
- **Who may act as the functional and performance testing provider.** An entity identified by the owner and competent for the systems concerned. Independence is not required on this track, but the provider is not the person who installed the system being tested. A works-department engineer not involved in the installation, the supervising consultant, or a PEC-registered professional engaged for the purpose may act in the role. The identity, competence and relationship to the installer are recorded.
- **Evidence accepted at handover.** The signed test results, the closed issue log, the systems manual and the training record, held in the compliance record and retrievable for inspection.
- **What does not change.** The system thresholds in Table 11.1 apply irrespective of building size, so a small facility with a system above a threshold tests that system. Any requirement of the Code, of the Authority Having Jurisdiction or of the contract applies in full on this track. Where an independent commissioning provider is required by the Code, by the AHJ or by the contract, this track is not available.

Table 11.1 System testing triggers

Source: thresholds restated from GBCP-2023, Chapter 10 (Construction and Plans for Operation). Table structure and wording by DQA.

System	Testing trigger
Cooling	Greater than 53 kW
Heating	Greater than 88 kW
Ventilation	Greater than 5,000 L/s

System	Testing trigger
Lighting systems	Greater than 5 kW
Domestic water heating	Greater than 15 kW
Water pumping and mixing	Greater than 4 kW
Irrigation	Greater than 4,000 L per day

REQUIREMENT

For full commissioning, the owner appoints an approved, independent commissioning provider before the construction documents are complete. The commissioning plan forms part of the permit submission, and the specification carries the construction-phase requirements. A provider appointed after tender inherits decisions that can no longer be influenced.

11.2 Commissioning deliverables

This clause specifies the deliverables required for the commissioning of the works. Each deliverable listed in Table 11.2 shall be produced to at least the minimum content stated against it, reviewed, and retained as part of the commissioning record. A deliverable shall not be treated as complete until its content is confirmed against that minimum, and final acceptance shall not be granted while any required deliverable is outstanding.

Table 11.2 Commissioning deliverables

Deliverable	Minimum content
Owner's Project Requirements	Outcomes, measurable criteria, use, service life, training and documentation expectations
Basis of Design	Concepts, calculations, decisions and product selections responding to those requirements
Commissioning plan	Team, systems, responsibilities, schedule, documentation, tests, sampling, issue process and post-occupancy tasks
Design review	Review of requirement coverage, access, sensors, sequences, testability and maintainability; this does not replace code or design review
Submittal review	Confirmation that products, controls and testing information remain consistent with the requirements and the Basis of Design
Installation verification	Location, access, labeling, cleanliness, calibration, safety and readiness
Test scripts and results	Normal, part-load, transition, alarm, failure, seasonal and interaction sequences
Issue log	Deficiency, owner, due date, retest and closure evidence
Interim and final reports	Results, unresolved and deferred items, training and the completion plan
Systems manual	Design intent, sequences, setpoints, schedules, interfaces, maintenance, troubleshooting, warranties and records
Training record	Audience, learning outcomes, materials, attendance, demonstration and competence check

Deliverable	Minimum content
Post-occupancy completion	Seasonal and deferred tests, trend review, operator support and final acceptance

11.3 Construction environmental controls

- Apply erosion and sedimentation control to all construction activity, using the more stringent of the requirement of the Authority Having Jurisdiction and the discharge limits of the National Environmental Quality Standards as applied in the jurisdiction, together with any condition attached to an environmental approval issued for the project.
- Operate the construction air-quality plan: protect ducts and absorptive materials, prevent moisture and biological growth, and control use of the permanent system.
- Limit construction-vehicle idling and post the requirement where drivers will see it.
- Protect occupied areas and notify neighboring building management where contaminants could enter their premises.
- Designate collection areas, track waste throughout construction, and submit the final report where requested.
- Protect installed meters, sensors, air and water systems, photovoltaic components and green-roof waterproofing from damage and contamination.
- Use nonconformance and corrective-action control with evidence of retest or reinspection.

11.4 Preoccupancy testing

- Plan independent whole-building airtightness testing or the approved alternative route, and keep the air barrier accessible until it has been inspected.
- Where adopted or required, perform postconstruction flush-out or baseline air-quality monitoring after finishes and before occupancy.
- Retest failed contaminants or locations after corrective ventilation or source removal.
- Complete radon testing and mitigation where required.
- Close life-safety, controls, balancing, water-quality, renewable and metering tests before occupancy, except for controlled seasonal and deferred items recorded with their dates.

11.5 Permit and occupancy hold points

This clause establishes mandatory hold points at which the works shall not proceed past the stage indicated until the required evidence has been provided and release has been granted by the party stated. For each hold point in Table 11.3, the evidence listed is the minimum required for release, and release shall be recorded and dated. Work carried out beyond a hold point before its release is granted shall not be accepted, and shall be subject to reopening, retesting or re-inspection at the responsible party's cost. Figure 11.1 places these hold points in the commissioning and verification sequence as a whole.

Table 11.3 Permit and occupancy hold points

Hold point	Evidence required before release	Released by
Before permit	Owner's requirements, commissioning appointment and plan, a testable design, the compliance route and the key calculations	AHJ and owner
Before concealment	Air and water barriers, insulation, ducts and pipework, sensors, anchors, drains, test points, photographs and inspection records	Inspector, design team, commissioning provider
Before energization	Approved submittals, safe installation, pre-functional checks, calibration and method statement	Contractor, specialist, commissioning provider
Before occupancy	Test results, issue closure, air-quality route completed, systems manual, training, as-built records and the interim report	AHJ and owner
After occupancy	Seasonal and deferred tests, final report, measurement baseline, occupant survey and corrective actions	Owner, commissioning provider, facility manager

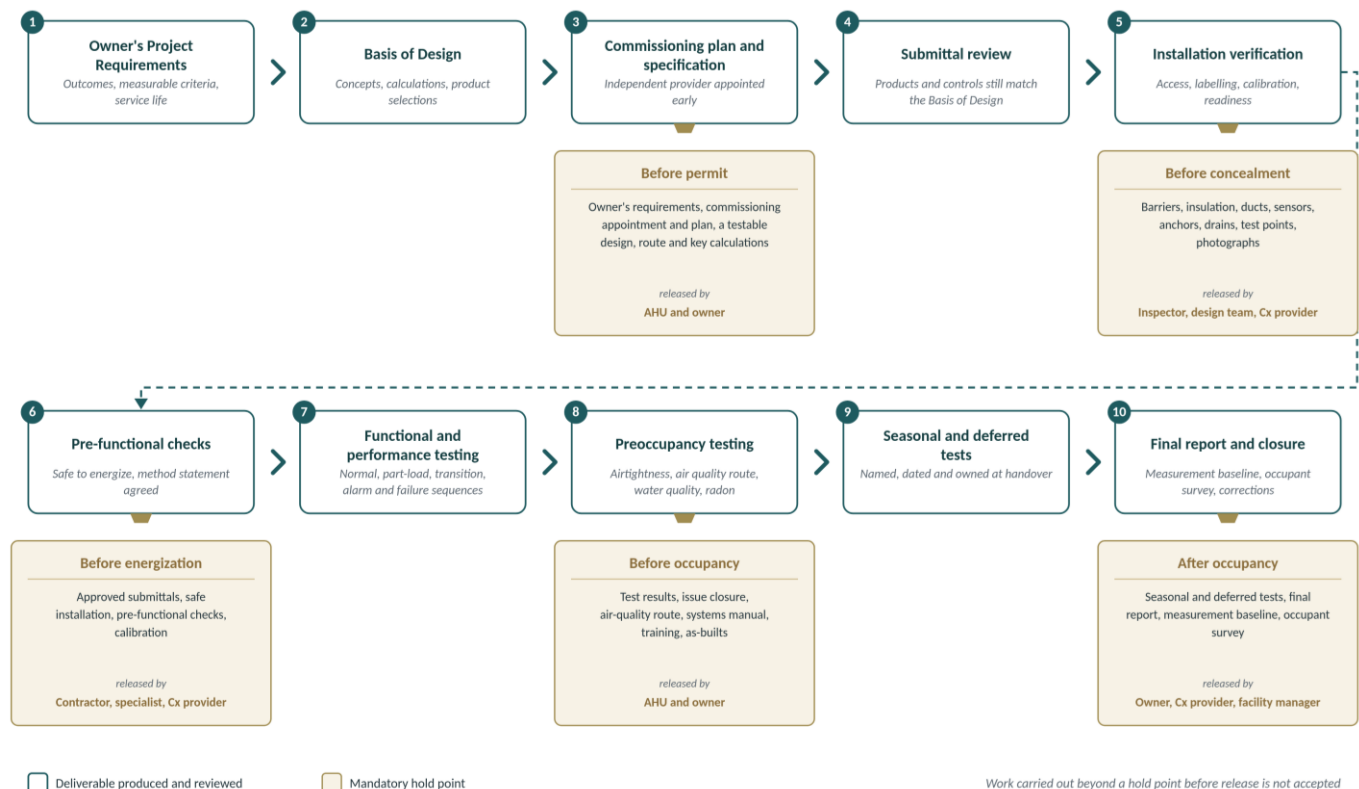


Figure 11.1 Commissioning and verification pathway from design requirements to post-occupancy closure

12 Operations, Measurement and Service Life

A building stays green only while somebody measures it, maintains it and acts on what the measurements show. Every requirement in the preceding chapters decays without this one.

12.1 Operational plan

An operational plan shall be prepared before occupancy and maintained for the service life of the building. The plan shall contain, as a minimum, the content stated for each part in Table 12.1, and shall identify the responsible person and the record to be retained for each part. The plan shall be reviewed and updated on a change of use, system or ownership, and shall not lapse on a change of building ownership.

Table 12.1 Operational plan content

Plan part	Minimum operational content
Site	Vegetation survival and replacement, roof cleaning, green-roof membrane inspection and irrigation transition
Water	Meter collection, leak and abnormal-use alarms, an initial assessment over the first 12 to 18 months, periodic reassessment and record retention
Energy	Hourly load profiles, monthly and annual use and peak, benchmarking, an initial assessment over the first 12 to 18 months, and a review at least every three years
Indoor environment	Ventilation operation, outdoor-air checks against the outdoor-air-quality criterion in section 9.2 and the recorded changeover to the alternative mode, filtration and air cleaning, humidity sensing, complaint response, and radon controls where required
Cleaning	Cleaning plan, approved products, staff training, storage and performance checks
Renewables	Attribute tracking and allocation, and the alternative supply plan if a supplier ceases to operate
Maintenance	Task frequencies, competent persons, access, calibration, records and corrective action for services and fire systems
Service life	Inspection, maintenance and replacement forecasts for structure, envelope, hardscape and site improvements
Transport	Shared-transport, bicycle and tenant communication measures where adopted

12.2 Data to action

Operational data collected under the plan shall be acted upon through the flowchart shown in Figure 12.1, with each stage completed in the shown sequence. Corrective action shall be assigned to a named owner with a date, its persistence verified before the deviation is closed, and the plan and training updated; reporting shall feed the next cycle, not conclude it.



Figure 12.1 The operational data-to-action loop

12.3 Minimum performance indicators

The indicators in Table 12.2 shall be monitored at not less than the stated frequency, recorded, and reviewed against the applicable baseline. A result outside the expected range shall be investigated and corrected through the flowchart given in Figure 12.1.

Table 12.2 Minimum performance indicators

Indicator	Review frequency
Electricity use intensity and peak demand	Monthly and annually
Photovoltaic generation and performance ratio	Daily and monthly
Water use intensity and night flow	Daily and monthly
Harvested yield, tank turnover and overflow events	Monthly and seasonally
Outdoor airflow and ventilation faults	Continuously, reviewed quarterly
Zone temperature and humidity	Continuously
Complaints and occupant satisfaction	Ongoing, with survey at 6 to 18 months and a three-year review

Indicator	Review frequency
Waste and recycling	Monthly and annually
Maintenance and calibration completion	Monthly

GOOD PRACTICE

Measure only what will be used. Every meter and sensor needs a data owner, a review frequency, a normal range, an alarm response and a retention rule. Data that nobody reviews is not verification, and it costs resources and money to collect.

12.4 Service-life plan

The Code classifies buildings as temporary, medium-life or long-life at clause 1001.10. Record the design service life of each major assembly with its inspection, maintenance and expected replacement requirements, and align the material assessment, warranties, spares strategy and life-cycle cost with that plan. The assemblies recorded are the roof and waterproofing, façade, windows and shading, photovoltaic modules with their inverters and mounting, harvesting tank with treatment and pumps, conditioning systems with controls and sensors, landscape and green roof, and hardscape and drainage. Each carries its design life, inspection and maintenance regime, expected replacement point, and the access and outage arrangements that the replacement will need.

CAUTION

Record the outage plan at design stage. A rooftop plant replacement that requires a crane over an occupied entrance, or a tank clean that has no second supply, becomes an operational crisis twenty years after the decision that caused it.

13 Existing-Building Retrofit Pathway

Existing buildings carry the larger share of the stock and the larger share of the opportunity. The sequence below spends the cheapest measures first, and establishes safety before efficiency.

13.1 Retrofit hierarchy

Retrofit measures shall be applied in the order of the levels in Table 13.1, from safety and legal status through to deep retrofit. A lower level shall not be undertaken before the higher levels have been assessed and, where applicable, completed, and any decision to omit a level shall be recorded with the reason. The safety and legal status level shall be satisfied before any other retrofit work proceeds. The sequence itself is a method of this Guide under section 1.5 and becomes binding on a project when it is adopted as a project control; the structural-safety gate below applies in either case, because it rests on the Building Code of Pakistan and on the duty of a competent professional. Figure 13.1 sets the same levels against capital cost, disruption and expected saving.

Table 13.1 Retrofit hierarchy

Level	Typical actions
Safety and legal status	Confirm lawful occupancy, structural, fire and electrical risk, hazardous materials, access and the permit route before any environmental work. Apply the structural-safety gate below before adopting any measure that changes structural demand.
Operational reset	Schedules, setpoints, maintenance, leak repair, control tuning, lighting adjustment, user behavior and a tariff and data review.
Low-disruption upgrades	Efficient lamps and controls, fixtures, aerators, insulation repair, shading, weather-sealing with ventilation verification, and meter upgrades.
System renewals	Efficient conditioning, pumps and hot water, heat recovery, demand control, harvesting and reuse, and electrical upgrades.
Envelope and site retrofit	Roof, wall and window upgrades, cool or green roofs, external shading, drainage, permeable areas and landscape.
Renewables and storage	Photovoltaics and storage after load reduction, with roof, structural, electrical, fire and access assessment and current grid approvals.
Deep retrofit or change of use	Integrated redesign, assessment of the requirements triggered, phasing, temporary services, full commissioning and updated occupancy approval.

REQUIREMENT

Structural-safety gate. Screen every proposed retrofit measure against the four triggers below. Where any trigger is met, the measure shall be reviewed by a competent structural engineer against the building's current structural assessment, and the reviewed outcome shall be recorded in the retrofit decision record before installation.

Added dead load. Rooftop photovoltaic arrays and their ballast or frames, vegetated or ballasted roof build-ups, water tanks, plant, or a replacement roof covering heavier than the one removed.

Altered load path. Removal or modification of walls, slabs, beams or columns, new openings, or new supporting frames.

Penetration of or attachment to structural elements. Anchors, brackets, service penetrations, and heavy façade, shading or louvre attachments.

Adverse or absent structural condition record. The building carries an adverse finding from a Structural Health Assessment, a rapid visual screening or an equivalent record, or no such record exists for a building to which the first three triggers apply.

Assessment route and proportionality. The assessment route is that of the Structural Health Assessment Manual and the Building Code of Pakistan 2021. Where no trigger is met, no structural review is required and a minor non-structural efficiency measure shall not be delayed on this ground. The screening decision is recorded either way.

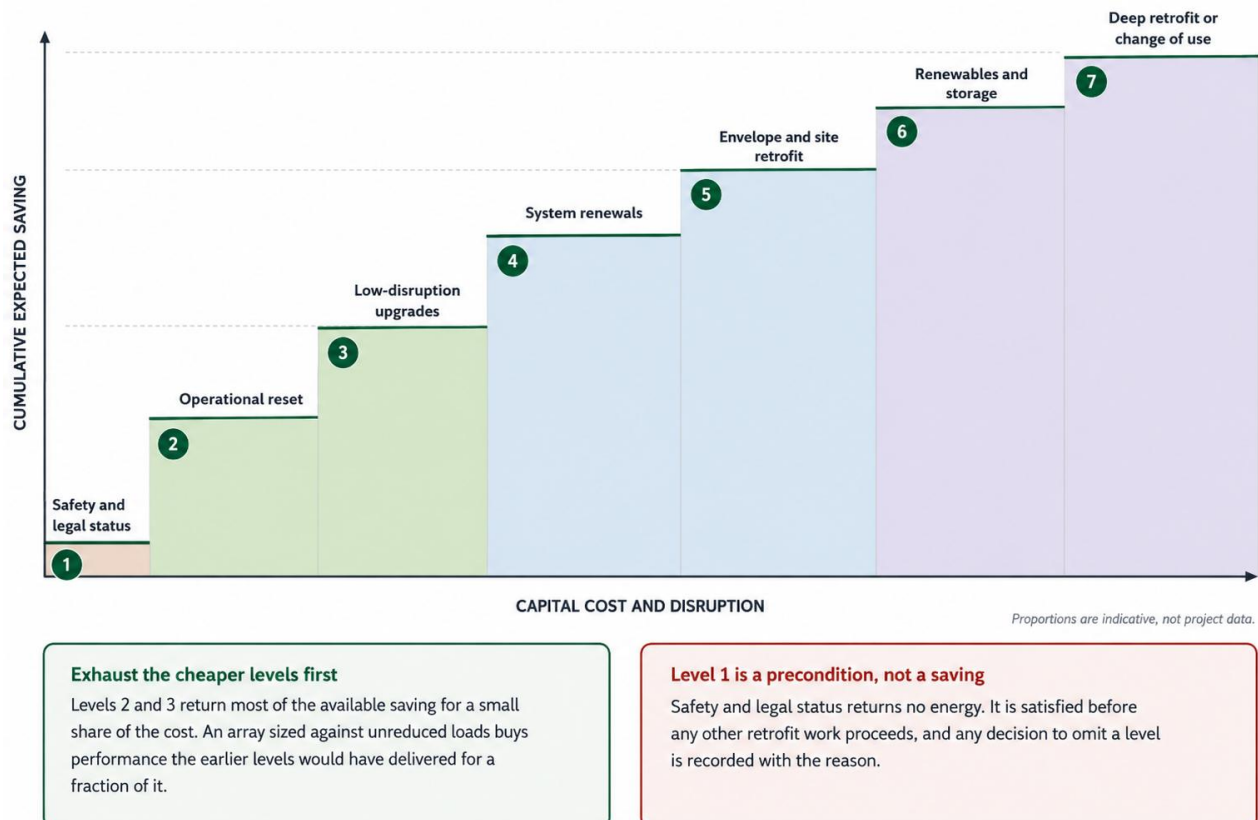


Figure 13.1 Existing-building retrofit hierarchy set against cost, disruption and expected saving

REQUIREMENT

Exhaust the cheaper levels before the expensive ones. A photovoltaic array sized against unreduced loads, or a plant replacement that precedes control tuning, buys performance that the earlier levels would have delivered for a fraction of the cost.

13.2 Baseline survey

A baseline survey shall be completed before retrofit measures are designed, establishing for each element in Table 13.2 the matters stated against it. The survey findings shall be documented, dated and retained, and shall record the source and reliability of each item. Where an element cannot be established, the limitation and its effect on the retrofit design shall be recorded.

Table 13.2 Retrofit baseline survey

Survey element	What is established
Use and occupancy	Hours, density, comfort complaints and vulnerable users
Legal position	Approvals, drawings, changes of use and outstanding notices
Risk	Structural, fire, electrical, water, façade, roof and hazardous-material condition
Consumption	12 to 36 months of energy and water bills and any available interval data
Equipment	Inventory, age, condition, controls, refrigerants and remaining life
Envelope	Condition, air-leakage pathways, moisture and thermal bridging
Environment	Ventilation rates, air quality, humidity, noise and lighting
Site	Drainage, flood exposure, heat island, landscape and mobility
Capacity	Maintenance capability, operator skills, spare parts and access constraints

13.3 Evaluating a package

Table 13.3 Criteria for evaluating a retrofit package

Criterion	Question the package must answer
Compliance	Which current requirements does the proposed work or change of occupancy trigger?
Safety	Does the measure add load, fire or electrical risk, moisture, or blocked access?
Saving	What is the verified baseline, the expected saving, and the uncertainty in it?
Health and comfort	What changes in ventilation, humidity, daylight, glare, noise and control?
Resilience	How does the measure behave during heat, flood, power outage or supply interruption?
Constructability	Can the work be phased safely around occupants and essential services?
Life cycle	What maintenance, replacement and disposal obligations follow?
Verification	Which meter reading, test or commissioning result will prove that it worked?

REQUIREMENT

Prepare an occupied-works plan covering dust and noise, protection of air intakes and windows, temporary ventilation, water and electrical isolation, accessibility, safeguarding, infection control where relevant, communication, and emergency procedures. Occupants do not leave because the efficiency work has started.

14 Worked Applications

The seven applications below work through the decisions this Guide describes, using one case and setting out every calculation in full. They are training material and screening aids. A result obtained here is not a permit calculation: project submissions use verified project data and signed calculations.

14.1 The case

Rounding. Calculations in the worked applications are carried at full precision and the results are shown to the precision stated at each step. Where a value is displayed rounded and a different, unrounded value is carried forward, that is stated at the point of use so a participant reproducing the step arrives at the printed result.

The case concerns a 6,000 m² office and public training center in Islamabad, on a previously developed site. The case is constructed so that some checks pass and others fail. Participants work in the roles the project would actually carry: owner, authority reviewer, architect, civil and landscape engineer, building services engineer, contractor, commissioning provider and facility manager. Each application ends with the assumptions made, the provisions engaged, the evidence a reviewer would require, the decision taken and the questions that need a written determination.

REQUIREMENT

Redesign before proposing an exception. When a result fails, the first response is to change the design. An exception is sought only after the design responses have been examined and recorded as unworkable.

14.1.1 Application 1 — Site, landscape and stormwater

Inputs. The AHJ has recorded the 95th-percentile 24-hour event as the retention basis for previously developed sites in this jurisdiction, as section 6.4 permits it to do. The site sits 2.0 m above the 100-year flood elevation, 75 m from a habitat conservation area and 50 m from a wetland. Hardscape is 3,000 m², of which 1,650 m² is shaded, high-reflectance or permeable. Improved landscape is 1,500 m², of which 1,000 m² is biodiverse native or adapted planting other than turf. The 95th-percentile 24-hour rainfall is 55 mm, the contributing area is 4,500 m² and the runoff coefficient is 0.85.

Site screens. The 1.5 m clearance in Table 6.1 applies to previously undeveloped land, so it is not triggered on this site; the 2.0 m clearance above the 100-year flood elevation is recorded as the design datum and carried into the evidence pack. The habitat and wetland separations are fixed by the Code at clause 501.3.1.2, subclauses (b) and (c), and are not a matter for jurisdictional determination: 50 m from a fish and wildlife habitat conservation area and 35 m from a wetland. The measured distances of 75 m and 50 m are therefore tested directly against those separations. Both pass, with 25 m and 15 m in hand respectively, and the screen is concluded within this exercise.

Compliant hardscape share.

$$1,650 / 3,000 = 0.550 = 55.0 \%$$

Biodiverse landscape share.

$$1,000 / 1,500 = 0.667 = 66.7 \%$$

Retention volume for the 95th-percentile event.

$$V = 0.055 \text{ m} \times 4,500 \text{ m}^2 \times 0.85 = 210.4 \text{ m}^3$$

Reading the results. Both surface shares pass. The retention volume is the design quantity the stormwater system must manage on the site, by infiltration, evapotranspiration, harvesting, detention or a combination.

Variation. Reduce the compliant hardscape to 1,050 m² and the biodiverse area to 750 m².

$$1,050 / 3,000 = 35.0 \% \quad \text{and} \quad 750 / 1,500 = 50.0 \%$$

Both shares now fall below the required proportions, and the retention volume is unchanged because the contributing area and coefficient have not changed. The design responses are shade over parking and pedestrian routes, permeable surfacing where the ground conditions allow it, conversion of turf to biodiverse planting, and rain gardens that serve the retention volume and the planting share at the same time.

Table 14.1 Application 1 record — site, landscape and stormwater

What to record	Content
Evidence	Survey levels and flood elevation source, habitat and wetland mapping with its date and scale, hardscape and landscape area take-offs, runoff coefficient basis, and the rainfall statistic with its station and record period
Determinations needed	Acceptance of the rainfall dataset. The habitat and wetland separations are mandatory Code provisions and are applied directly, so no determination is required for them. The retention basis is already recorded: the AHJ applies the 95th-percentile 24-hour event to previously developed sites
Questions for debrief	Which input carries the greatest uncertainty? Could infiltration mobilize contamination? Who maintains the rain gardens after handover, and with what budget? What fails safely in an event larger than the design event?

14.1.2 Application 2 — Water efficiency and rainwater harvesting

Inputs. Annual rainfall 1,000 mm; roof catchment 2,200 m²; runoff coefficient 0.85; non-potable demand 15 m³ per day; dry-spell target 10 days; owner's preferred tank 50 m³.

Annual roof yield.

$$Y = 1,000 \text{ mm} \times 2,200 \text{ m}^2 \times 0.85 = 1,870 \text{ m}^3 \text{ per year}$$

Annual non-potable demand.

$$D = 15 \text{ m}^3/\text{day} \times 365 \text{ days} = 5,475 \text{ m}^3 \text{ per year}$$

Share of demand the roof can meet.

$$1,870 / 5,475 = 0.342 = 34.2 \%$$

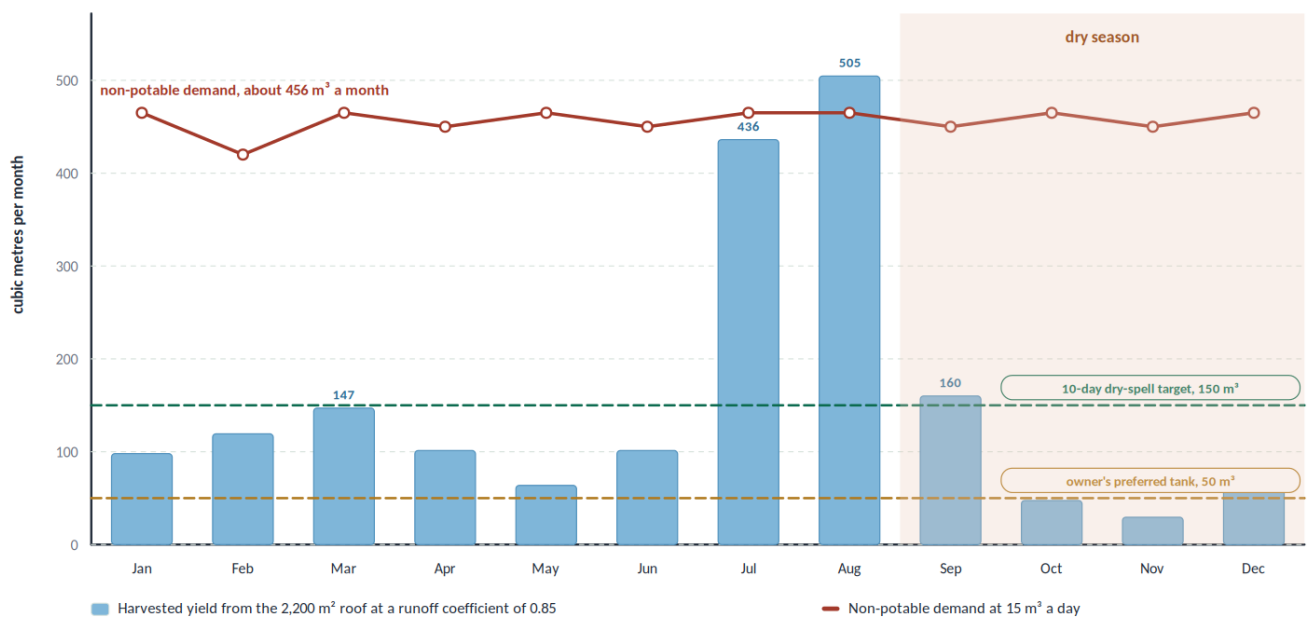
Storage for the dry-spell target.

$$S = 15 \text{ m}^3/\text{day} \times 10 \text{ days} = 150 \text{ m}^3$$

The owner's preferred tank, expressed as days of supply.

$$50 \text{ m}^3 / 15 \text{ m}^3/\text{day} = 3.3 \text{ days}$$

Reading the results. The roof cannot meet the whole non-potable demand at any tank size, so harvesting supplements the supply rather than replacing it. The 50 m³ tank carries 3.3 days against a 10-day target and is 100 m³ short of it. The correct sequence is to reduce the 15 m³ demand first, because every cubic meter removed from demand reduces both the yield gap and the storage target, then to size storage from a monthly or daily balance against an agreed reliability target rather than from the annual figures above. Figure 14.1 shows the monthly picture behind those annual figures.



The monthly distribution is illustrative, scaled to the 1,000 mm annual total used in Application 2, and is shown to make the seasonal point. Project work uses the station series with its record period, gaps and station identity recorded, and sizes storage from a time-step balance against an agreed reliability target.

What the chart shows

- Yield exceeds demand in one month of the year, August, and falls short in the other eleven.
- The annual total of 1,870 m³ meets 34.2 per cent of the 5,475 m³ annual demand, so harvesting supplements the supply rather than replacing it.
- Storage has to carry the system through the dry months, which is what sets the 150 m³ target, not the annual figure.
- The 50 m³ tank holds 3.3 days of demand against a 10-day target.

Figure 14.1 Monthly yield, demand and storage for the case building, showing why annual totals cannot size a tank

CAUTION

The annual yield of 1,870 m³ and the storage target of 150 m³ answer different questions. The first says how much water the roof produces across a year; the second says how much has to be held to survive a dry spell. A design that quotes the first as though it settled the second will run dry in the driest month, which is the month the system exists for.

Table 14.2 Application 2 record — water efficiency and rainwater harvesting

What to record	Content
Evidence	Rainfall series with station, period and gaps; roof area take-off and surface material; runoff and first-flush basis; the occupancy survey behind the demand figure; end-use and water-quality matrix
Controls to specify	Treatment train, cross-connection and backflow prevention, non-potable labeling, backup supply, overflow route, access for cleaning, and water-quality monitoring with a named owner
Questions for debrief	What happens in the driest month? How does water age affect quality at low turnover? Where does the overflow go in a large event? Who cleans the tank, how often, and what supplies the building while they do?

14.1.3 Application 3 — Energy, photovoltaics and metering

Inputs. Qualifying roof area 1,600 m²; capacity requirement 96.8 W_p per m²; 5.2 peak sun hours per day; performance ratio 0.78; office annual renewable requirement 44 kWh per m² per year over 6,000 m².

Required photovoltaic capacity.

$$P = 96.8 \text{ W}_p/\text{m}^2 \times 1,600 \text{ m}^2 = 154,880 \text{ W}_p = 154.88 \text{ kW}_p$$

Annual yield per installed kilowatt-peak.

$$5.2 \text{ h/day} \times 365 \text{ days} \times 0.78 = 1,480.4 \text{ kWh per kW}_p \text{ per year (shown rounded; the unrounded value is carried below)}$$

Estimated annual generation.

$$E = 154.88 \text{ kW}_p \times 1,480.4 = 229,291 \text{ kWh per year}$$

Annual renewable requirement.

$$R = 44 \text{ kWh/m}^2 \cdot \text{y} \times 6,000 \text{ m}^2 = 264,000 \text{ kWh per year}$$

Shortfall.

$$264,000 - 229,291 = 34,709 \text{ kWh per year, which is 13.1 \% of the requirement}$$

Reading the results. The capacity requirement is satisfied: the array is sized at the required watts per square meter of qualifying roof. The annual requirement is not. The two are separate tests and the first does not discharge the second.

Three responses, and what each costs.

Table 14.3 Responses to the renewable-energy shortfall

Response	Quantity	What it requires
Additional capacity	34,709 / 1,480.4 = 23.4 kWp more	At the same capacity density this needs roughly 242 m ² of further unshaded area. The roof is already committed, so the area comes from canopies, parking structures or another qualifying surface, each of which carries its own structural, wind, fire, electrical and access assessment.
Reduce the requirement	240,000 kWh, shortfall 10,709 kWh	Where the AHJ confirms that the alternate approach applies, the requirement is set at 40 kWh per m ² per year, so it falls to 240,000 kWh and the shortfall to 10,709 kWh. The alternate values are not available by default. Reducing demand is examined before capacity is added in every case, because section 8.2 places load avoidance above on-site generation.
Off-site procurement	34,709 kWh per year	Only where the AHJ accepts it, and subject to eligibility, contract duration, exclusive attribute allocation, delivery and record retention. The contract must outlast the building's obligation and survive a change of ownership.

KEY DECISION

The performance ratio of 0.78 and the 5.2 peak sun hours drive the generation estimate, and neither is a code value. Soiling in a dusty environment, module temperature, shading from later rooftop plant and degradation over the array's life all sit inside that ratio. Record the basis, and state the estimate as an estimate alongside the capacity figure, which is a requirement.

Table 14.4 Application 3 record — energy, photovoltaics and metering

What to record	Content
Evidence	Roof area take-off after permitted exclusions, shading study, module and inverter certification, structural and wind assessment, electrical single-line, fire and access provisions, and the grid-connection application under the current regulations
Metering	Main energy measurement above the threshold, subsystem metering for conditioning, people-moving, lighting and process loads, hourly profile retention, automated demand-response infrastructure where a program exists, and fault detection where the size trigger applies
Questions for debrief	Which figure is a requirement and which is an estimate? What survives a change of building ownership? What evidence will demonstrate performance after one year of operation?

14.1.4 Application 4 — Envelope, orientation, shading and lighting

Inputs. Gross above-grade wall area 2,600 m², of which the east elevation is 550 m² and the west elevation is 550 m²; total vertical fenestration 630 m², of which 160 m² faces east and 160 m² faces west. The remaining 310 m² of fenestration is on the north and south elevations. The orientation provision at clause 701.4.2.10 is a ratio between orientations rather than a proportion of wall area: under test (a), fenestration on each of the east and west shall not exceed one quarter of the combined north and south fenestration area; under the alternative test (b), the same comparison is made weighted by solar heat gain coefficient and divided by six. East and west mean orientations within 45 degrees of true east and true west. First-story shading projects 0.90 m over a 2.00 m drop from the

underside of the projection to the bottom of the glazing; upper-story shading projects 0.60 m over 2.40 m. The adopted first-story projection factor is 0.50. Installed lighting is 48.0 kW against an allowance of 44.4 kW.

Overall window-to-wall ratio.

$$630 / 2,600 = 0.242 = 24.2 \%$$

Orientation test, east and west each.

$$\text{permitted} = (A_N + A_S) / 4 = 310 / 4 = 77.5 \text{ m}^2 \text{ on each façade; } 160 - 77.5 = 82.5 \text{ m}^2 \text{ over the permitted area on each of the two façades, } 165 \text{ m}^2 \text{ in total}$$

Exceptions to the orientation provision. Clause 701.4.2.10 offers four exceptions, two of which bear on this case. Exception 4 permits east and west fenestration not exceeding 20 per cent of the gross wall area of each of those façades, provided the solar heat gain coefficient on those façades is no greater than 90 per cent of the criteria in clause 701.4.2.1; on a 550 m² elevation that is 110 m², against the 160 m² installed, which stands at 29.1 per cent. Exception 2 applies where permanent projections, existing buildings, permanent infrastructure or topography shade 75 per cent of the east and west fenestration at 9 a.m. and 3 p.m. on the summer solstice. Exception 3 covers alterations and additions with no increase in vertical fenestration area, and Exception 1 refers the case to the referenced envelope standard.

Projection factor, first story.

$$PF = 0.90 / 2.00 = 0.45 \text{ against an adopted } 0.50$$

Projection factor, upper stories.

$$PF = 0.60 / 2.40 = 0.25$$

The applicability decision records a projection factor for the first story only, so the upper-story result is recorded for comparison rather than tested. Where the AHJ adopts a value for upper stories, the same test applies to it. The geometry behind the calculation is set out in Figure 8.2.

Lighting power density.

$$\text{installed } 48,000 \text{ W} / 6,000 \text{ m}^2 = 8.0 \text{ W/m}^2$$

$$\text{allowance } 44,400 \text{ W} / 6,000 \text{ m}^2 = 7.4 \text{ W/m}^2$$

$$\text{excess} = 48.0 - 44.4 = 3.6 \text{ kW, which is } 8.1 \% \text{ above the allowance}$$

Reading the results. A comfortable overall ratio of 24.2 per cent conceals two envelope failures, and the lighting check adds a third. The orientation test is a directional test, and a design can satisfy the whole-building ratio while concentrating glass on the two orientations that admit low-angle sun. The first-story projection is 0.10 m short of the depth needed for the adopted factor, and the installed lighting sits 8.1 per cent above the allowance.

Design responses.

- Bring the east and west elevations within clause 701.4.2.10 by one of four routes, in ascending order of difficulty. Shade 75 per cent of the east and west fenestration at 9 a.m. and 3 p.m. on the summer solstice using permanent projections, which suits a deep veranda and engages Exception 2. Reduce east and west fenestration to 110 m² on each façade, being 20 per cent of the gross wall area of that elevation, and specify a solar heat gain coefficient at or below 90 per cent of the criteria, which engages Exception 4. Move 82.5 m² of glazing from each of the east and west elevations to the north and south, satisfying test (a) directly. Or satisfy test (b) by specifying east and west glazing with a solar heat gain coefficient not greater than about one-third of the climate-zone criterion. Raising north and south fenestration to 640 m² would also satisfy test (a), but at a window-to-wall ratio the envelope provisions are unlikely to accept.
- Extend the first-story projection from 0.90 m to 1.00 m, which gives $1.00 / 2.00 = 0.50$ exactly. Check the increased depth against wind loading, cleaning access, fire spread between stories and the effect on daylight at the back of the room.
- Improve east and west solar heat gain coefficient, or add fixed vertical fins, which suit low-angle east and west sun better than horizontal projections.
- Reduce installed lighting by at least 3.6 kW through luminaire efficacy, layout and task lighting, while maintaining task illuminance, emergency lighting and uniformity.
- Specify daylight-responsive and occupancy control, and test both through functional testing rather than accepting the commissioning of the luminaire alone.

Table 14.5 Application 4 record — envelope, orientation, shading and lighting

What to record	Content
Evidence	Elevation take-offs by orientation, glazing schedule with thermal and solar properties, shading geometry and its projection-factor calculation, lighting schedule and control narrative, daylight and glare assessment
Testing	Shading device operation, daylight response, occupancy control, and envelope inspection before the air and water barriers are concealed
Questions for debrief	Why can a low overall ratio still fail the orientation test? Does deeper shading block daylight or maintenance access? Which controls will occupants actually understand? How will the envelope be verified before it is covered?

14.1.5 Application 5 — Materials and construction waste

Inputs. Total non-hazardous construction and demolition waste 420,000 kg, of which 150,000 kg is diverted, over 6,000 m² of new floor area. Total material cost PKR 100 million, comprising recycled and salvaged content PKR 11 million, regional materials PKR 12 million and biobased products PKR 1.5 million, with ten equivalent qualifying declarations.

Diversion rate.

$$150,000 / 420,000 = 0.357 = 35.7 \%$$

Waste intensity.

$$420,000 \text{ kg} / 6,000 \text{ m}^2 = 70 \text{ kg/m}^2$$

The total-waste test. Where the jurisdiction adopts clause 901.3.1.2, the total construction waste generated before the final certificate of occupancy shall not exceed 100 kg per m² of new building floor area, counting all waste whether diverted, landfilled, incinerated or otherwise disposed of. Excavated soil, land-clearing debris and demolition debris are excluded from this calculation, so the intensity is tested on the construction waste stream alone; the figure below is shown on the combined stream given in the inputs and is therefore an upper bound, since separating out the demolition component can only reduce it. The exception to clause 901.3.1.2 removes the limit altogether where diversion under clause 901.3.1.1 reaches 50 per cent.

$$70 \text{ kg/m}^2 \text{ against a limit of } 100 \text{ kg/m}^2 \text{ — passes}$$

At 35.7 per cent the project does not reach the 50 per cent threshold that would remove the intensity limit. Reaching it would require 210,000 kg diverted, which is 60,000 kg more than achieved. That is a decision about whether to earn the exception, not a shortfall against a requirement: the project already satisfies both clause 901.3.1.1 and clause 901.3.1.2 as they stand.

Reduced-impact options, by cost share. Clause 901.4.1 requires any two of clauses 901.4.1.1 to 901.4.1.4.

$$\text{recycled and salvaged: } 11 / 100 = 11.0 \% \text{ against } 10 \% \text{ — passes}$$

$$\text{regional: } 12 / 100 = 12.0 \% \text{ against } 10 \% \text{ — passes}$$

$$\text{biobased: } 1.5 / 100 = 1.5 \% \text{ against } 2 \% \text{ — fails}$$

$$\text{declarations: } 10 \text{ qualifying products — passes}$$

Reading the results. Three of the four options pass, and the prescriptive route requires two, so the claim is made on recycled and salvaged content together with regional materials, both of which have a margin over the threshold. Biobased content fails at 1.5 per cent against 2 per cent. Declarations pass, but at exactly ten qualifying products there is no margin, and one product disqualified at submittal stage would fail the option, which is why the claim does not rest on it.

The diversion result. The diversion requirement for construction and demolition waste is set by clause 901.3.1.1, which requires a minimum of 25 per cent of non-hazardous construction, demolition or deconstruction waste to be diverted from disposal in landfills and incinerators through reuse, recycling, repurposing or composting, calculated by weight throughout the construction process. Excavated soil and land-clearing debris are excluded from the calculation, and alternative daily cover and waste-to-energy incineration do not count as diverted material. A rate of 35.7 per cent therefore passes, with 10.7 percentage points of margin. This provision is distinct from clause 501.3.8.1, which governs excavated soil, rock and land-clearing debris arising on the building site and carries its own, separate diversion percentage; the two are not interchangeable and are not added together.

$$\text{required} = 0.25 \times 420,000 = 105,000 \text{ kg; diverted } 150,000 \text{ kg — passes by } 45,000 \text{ kg}$$

CAUTION

The 11 per cent and 12 per cent cost shares are calculated on the contract material cost. Substitutions and final installed quantities move them. Reconcile both claims against final invoices and delivered quantities before the compliance statement is signed, not at the design stage where the figures originate.

Table 14.6 Application 5 record — materials and construction waste

What to record	Content
Evidence	Waste plan prepared before work started, weighbridge tickets and transfer notes, receiving facility diversion rates, product declarations and certificates with their scope, and the cost basis used for each claimed option
Improvement	One quantity-reduction or design-for-disassembly measure, quantified, because avoided material outperforms diverted material on every count
Questions for debrief	Which evidence in this pack would not survive scrutiny? Which product claim is most exposed to substitution? Could regional sourcing reduce durability? How does service life change the material choice?

14.1.6 Application 6 — Commissioning readiness

Inputs. The 6,000 m² project, with every listed system above its testing trigger. The owner's project requirements have not been approved, seasonal testing has not been priced, and sensor access does not appear on the drawings.

Verification track.

6,000 m² > 1,000 m² implies full commissioning, not functional and performance testing alone

Classifying the three gaps. They are not equivalent, and treating them as one list of outstanding items conceals that.

Table 14.7 Classifying commissioning readiness gaps

Gap	Effect	Action
Owner's requirements not approved	Blocks the permit submission, because the commissioning plan forms part of it and the plan cannot be written against requirements that do not exist. It also removes the standard against which every later test would be judged.	Approve the requirements before the permit application. This is the item on the critical path.
Sensor access absent from drawings	Cheap to correct now and expensive after ceilings close. Access omitted at design stage becomes either a permanent gap in verification or a demolition cost.	Add access provisions to the drawings at the current stage, and add access to the commissioning design review checklist.
Seasonal testing not priced	A commercial gap, not a technical one. It will surface as a dispute during the season when the test is due, by which time the contract is fixed.	Price it into the contract now, with the test dates, the responsible party and the acceptance criteria stated.

Preoccupancy evidence. Test results with the issue log closed, the air-quality route completed, the systems manual issued, operator training delivered and demonstrated, as-built records, and the interim commissioning report with any deferred test named together with its date and its responsible party.

Table 14.8 Application 6 record — commissioning readiness

What to record	Content
Ownership	A named owner and a date for the owner's requirements, the commissioning plan, access provisions, control sequences and test scripts
Training	Audience, learning outcomes, materials, attendance, demonstration and the competence check that shows operators can run the building rather than describe it
Questions for debrief	What can still be corrected on drawings today? Which defects become expensive once ceilings close? How will operators demonstrate competence rather than attendance? Which written determination is needed before the permit application?

14.1.7 Application 7 — Integrated comparison and closeout

Inputs. Three schemes and the findings of the six applications above. Scheme A places an atrium on the west with increased west glazing. Scheme B adopts a compact form with shaded east and west façades. Scheme C is developed by the participants.

Screening before scoring. Scheme A carries forward the orientation result of Application 4 and increases the west fenestration further. That is a mandatory failure, and a mandatory failure is a stop condition. Scheme A is removed from the comparison, whatever it scores on daylight, amenity or cost, unless it is redesigned to resolve the failure and re-entered.

REQUIREMENT

Screen for mandatory failures first, then score what survives. A scoring exercise run across all three schemes would rank Scheme A on its strengths and average away the failure that disqualifies it. This is the single most common way a compliant-looking comparison produces a non-compliant building.

Scoring the survivors. Compare the remaining schemes on site and risk, water, energy, indoor environment, materials, delivery and commissioning, whole-life value, and resilience and inclusion. Every score carries a written justification and names the evidence behind it. Record the provisions affected by the selected scheme, and update the compliance register with status, owner and due date for each.

Closeout. The output of this application is a decision record naming the selected scheme, its trade-offs, the evidence supporting each, the five highest risks, the determinations still needed in writing from the AHJ, and a 30-day action plan in which each participant names one thing they will change in their own work.

Table 14.9 Application 7 record — integrated comparison and closeout

What to record	Content
Decision record	Scheme selected, the schemes rejected and why, the trade-offs accepted, and who accepted them
Register update	Every provision the decision touches, with evidence status, owner and due date
Questions for debrief	Did any average score conceal a mandatory failure? Which participant changed the decision, and with what evidence? What must exist before the next gate? What should be standardized for the next project?

15 Toolkit for the Authority Having Jurisdiction

Consistent enforcement is what makes a code work. A jurisdiction that has not published its option schedule, its submission requirements and its interpretation process will produce inconsistent decisions no matter how carefully its reviewers read the Code.

15.1 Setting up the jurisdiction

- Confirm legal authority, jurisdiction boundary, effective date, and the relationship with existing building, planning, fire, environmental, energy, plumbing and utility regulation.
- Publish the completed jurisdictional-options schedule and any adopted appendices.
- Define project thresholds, submission formats, registered-professional requirements, approved agencies and laboratories, and record retention.
- Issue a standard compliance statement and a clause-by-clause matrix, so that every submission arrives in the same form.
- Train reviewers and inspectors across site, water, energy, indoor environment, materials and commissioning interfaces, not within single disciplines.
- Create a formal alternative-method and interpretation process that issues reasons in writing.
- Align the permit, construction inspection, occupancy and post-occupancy evidence gates so that each receives the evidence the previous one produced.
- Collect the performance and implementation data anonymously to support the scheduled code review.

15.2 Submission requirements

Technical compliance and procurement are separate. The submissions described in this section are technical compliance submissions made to the authority under the adopted Code. Public procurement of the works, including tendering, bid evaluation and award, is separately governed by the federal or provincial public procurement rules applicable to the procuring agency. This Guide neither restates nor displaces those rules, and nothing in this section should be read as a procurement requirement.

Table 15.1 Submission requirements by group

Submission group	Minimum documents
Administrative	Application, owner and team appointments, occupancy and area, scope determination, selected routes, option schedule and other approvals
Site	Survey, master plan, flood and ecology screen, site inventory, grading and drainage, landscape, heat island, lighting, transport and site waste
Water	Fixture schedule, irrigation, water balance, harvesting and reuse, treatment, cross-connection and backflow prevention, meters and operating plan
Energy	Climate data, envelope, systems and equipment, renewable capacity and balance, grid route, meters, demand response and diagnostics, and the energy model

Submission group	Minimum documents
Indoor environment	Ventilation, source, moisture, comfort, acoustic and lighting control, material emissions, construction air quality and the preoccupancy route
Materials	Waste plan, claimed prescriptive options or the performance assessment, product evidence, recycling and storage areas, and service-life implications
Commissioning	Owner's requirements, Basis of Design, provider appointment and plan, specifications, access and sensors and sequences, test schedule, training and systems manual
Existing building	Baseline, the requirements triggered, risk and occupied-works plan, phased evidence and post-retrofit verification

15.3 Decision language

Table 15.2 Review decision language

Decision	What it must mean
Accepted	The requirement and its evidence are complete for this stage. Later field verification still applies.
Accepted with condition	Proceed subject to a specific dated condition, a named evidence item and an accountable party.
Revise and resubmit	The proposal is incomplete or does not meet the requirement, with the reasons and the required evidence stated.
Alternative under review	A proposed equivalent method requires independent evidence or test and a written decision before it can be relied on.
Not applicable	The project-specific basis and the clause are recorded. This is a reasoned determination, not a blanket omission.
Determination required	The governing interpretation or the current regulatory process is unsettled. The item cannot be closed as compliant until the determination is issued.

REQUIREMENT

Use risk-based sampling only after the full applicability matrix is established. Sampling changes how thoroughly evidence is checked. It does not change whether a requirement applies.

15.4 Institutional monitoring

The authority shall monitor implementation of the Code using, as a minimum, the measures listed in Table 15.3. Each measure shall be collected on a defined and recorded frequency. The results shall be reviewed against the previous period to identify trends. The findings shall be retained and used to direct training, guidance, process improvement and revisions to the Code.

Table 15.3 Institutional monitoring measures

Measure	What it tells the authority
Projects by type, size, climate and jurisdiction	Workload and the coverage implementation has reached

Measure	What it tells the authority
Most frequent non-compliances	Where training and guidance should be directed
Review cycle time and resubmission rate	Where process can be improved without weakening review
Interpretations awaiting determination	Which questions warrant a national or provincial ruling
Commissioning and occupancy closure	Whether systems are actually verified before buildings are used
Measured energy, water and comfort outcomes	Whether the Code is delivering performance in practice
Market gaps	Products, laboratories, skills or data that are not available locally
Accessibility and equity feedback	User outcomes, and barriers the requirements created unintentionally

16 Replication and Institutionalization

Scaling across jurisdictions and portfolios without losing legal traceability, technical quality or field usability requires that local adaptation runs through a controlled instrument rather than through local editing.

16.1 The replication package

Institutional custodianship. The Pakistan Engineering Council is the technical custodian of this Guide, consistent with the notification of GBCP-2023 through the PEC Bye-Laws and with PEC's professional route to registered consulting engineers and constructors. The National Disaster Risk Management Fund is the programme institutional partner for uptake and dissemination across its financed infrastructure portfolio and delivery partners. Neither institution acts as Authority Having Jurisdiction and neither exercises technical approval over an individual project, which remains with the authority identified under section 2.8. The custodian and partner roles are carried into the update calendar, the custodian level of the capability table and the first-period actions of the institutional action plan.

The replication package shall comprise the components listed in Table 16.1, each prepared to at least the minimum content stated against it. The package shall be assembled, dated and retained as a single controlled record. It shall not be treated as complete while any component is outstanding. Each component shall identify the institution or person responsible for preparing and maintaining it.

Table 16.1 Replication package components

Component	Minimum content
Implementation guide	This Guide, with its issue status, code basis and approval record
Jurisdiction annex	Local adoption instrument, recorded option choices, approved data sources, submission forms, process and fees, and enforcement contacts
Climate and market annex	Approved climate files, rainfall and flood sources, local material, product and laboratory availability, and maintenance capacity
Training package	Facilitator plan, exercises, worked applications, expected results, assessment and a field practicum
Pilot cases	At least one new building and one existing building where feasible, with evidence, costs, issues encountered and measured results
Review record	Multidisciplinary comments, their dispositions, the issues still unresolved, and the formal endorsement
Digital governance	Access control, backups, change log, data privacy, validation and user support for any registers held electronically
Update calendar	Responsible institution, review frequency, standards and regulatory monitoring, and the publication process

16.2 Localizing without weakening

- Localize climate, rainfall, flood and market data, terminology and process. Do not localize mandatory performance without the formal authority to do so.
- Convert every local change into a controlled annex item carrying its source, rationale, approver and effective date.
- Keep the national clause number in every form, so that evidence stays comparable between jurisdictions.
- Test translated and local-language material with technical and non-technical users, and fix the bilingual technical terms so that they do not drift between sessions.
- Pilot the instruments in real approvals and real field inspections before scaling them.
- Use field feedback to simplify instructions, never to delete evidence or safety checks.
- Publish the known limitations and the interpretations still awaiting determination alongside the release. A user who discovers a limitation independently stops trusting the whole instrument.

16.3 Capability levels

Table 16.2 Capability levels

Level	Audience	Competence demonstrated
Awareness	Decision-makers and senior officials	Understands the legal basis, the benefits, the risks, the resources required and the oversight owed
Practitioner	Designers, reviewers, contractors and operators	Completes the technical chapters, the worked applications and a supervised case
Assessor	Authority reviewers, peer reviewers and commissioning leads	Demonstrates clause interpretation, evidence review, field verification and written decision-making
Facilitator	Authorized trainers	Runs sessions, worked applications, inclusion measures, assessment and feedback
Custodian	National and provincial technical institutions	Maintains content, calibrates assessors, analyses performance and controls revisions

16.4 Institutional action plan

The actions in Table 16.3 shall be completed within the period stated, and the evidence listed for each shall be produced, dated and retained. The actions shall be carried out in the order of the periods shown, and each period's actions shall be completed before the next period begins. Where an action is not completed within its period, the reason and a revised completion date shall be recorded.

Table 16.3 Institutional action plan

Period	Action	Evidence produced
First 30 days	Confirm governance, reviewers, source documents, the option decision process and the pilot facilities.	Governance record and named reviewers
31 to 60 days	Run training and the worked applications; complete project profiles, applicability determinations and baseline compliance registers.	Completed registers and trained reviewer list

Period	Action	Evidence produced
61 to 90 days	Pilot permit and field reviews, issue the outstanding determinations, revise the instruments and approve dissemination.	Pilot review records and issued determinations
Beyond 90 days	Track adoption, project outcomes, user feedback and standards updates, and improve annually.	Monitoring report and annual revision record

Annex A Clause-to-Evidence Matrix

The matrix establishes, for each domain, the provisions engaged, the family of evidence that demonstrates them, and the discipline that leads. A project compliance register lists every applicable clause individually, checked against the controlling notified text.

Table A.1 Clause-to-evidence matrix

Domain	Provisions engaged	Evidence family	Lead
Administration and scope	Administrative chapter and the adoption table	Applicability determination, legal stack, option schedule, permit record, approvals, inspections and appeals	Authority and owner
Site	Site sustainability chapter and the site provisions of the operation chapter	Site inventory, flood and ecology evidence, hydrology, landscape, heat-island, lighting and transport calculations, and site waste records	Architect, civil, landscape
Water	Water efficiency chapter, the separately notified rainwater provisions, and water measurement in the operation chapter	Water balance, fixture schedule, irrigation design, harvesting and reuse and treatment, hot-water layout, meters and operating plan	Plumbing, civil, facility
Energy	Energy chapter with its appendices, and energy measurement in the operation chapter	Climate data, envelope and systems calculations, renewable capacity and balance, meters, demand response and diagnostics, energy model and procurement evidence	Energy, services, electrical
Indoor environment	Indoor environmental quality chapter, the standards it references, and the construction and operation air-quality provisions	Ventilation design, low-emitting material evidence, moisture and acoustic and comfort analysis, control narrative, construction air-quality records and preoccupancy results	Mechanical, architect, specialist
Materials	Materials chapter and the waste provisions of the operation chapter	Waste plan and receipts, product declarations and certificates, material cost and quantity basis, sourcing evidence and the performance assessment where selected	Architect, procurement, contractor
Construction and operation	Construction and operation chapter in full	Commissioning and testing documents, erosion and air-quality and waste logs, airtightness and air-quality and radon tests, systems manual, measurement plan, maintenance and service-life and transport plans	Commissioning provider, contractor, facility, owner

A.1 Testing the quality of a record

- Is the record linked to the correct clause, project and revision?
- Is the source competent, independent where independence is required, and acting within its accreditation scope?
- Are the inputs, units, methods, acceptance criteria and uncertainty visible on the face of the record?
- Does the evidence describe the installed or as-operated condition, rather than only the design intent?
- Has a named reviewer accepted it, and recorded any conditions or residual risk?
- Can the record be retrieved for inspection, audit, operation and future alteration?

Annex B Standards and Edition Control

The governing edition is fixed by the notified Code, by adopted law and by the AHJ's decision. The comparison below identifies where a later edition exists, so that the project can decide, and record, whether it adopts it, proposes it as an alternative, or notes it as a benchmark only. Confirm the position at project start and again at procurement.

Table B.1 Standards and edition comparison

Subject	Edition the Code works from	Later edition or change	Status for a project
Green building requirements	Green Building Code of Pakistan 2023, notified 11 August 2025	None	Governing
Building safety	Building Code of Pakistan 2021	Local adoption status varies	Applies alongside; confirm adoption
Energy conservation	Building Code of Pakistan energy provisions, 2011	Energy Conservation Building Code of Pakistan 2023 notified subsequently	Apply the more stringent adopted provision, or the AHJ's precedence decision
Green code benchmark	International Green Construction Code, 2021	2024 IgCC, carrying ANSI/ASHRAE/ICC/USGBC/IES 189.1-2023 as its technical content	Benchmark unless adopted
Energy efficiency	ANSI/ASHRAE/IES 90.1-2019	2022 and 2025 editions available	Benchmark unless adopted
Ventilation	ANSI/ASHRAE 62.1-2019	2022 and 2025 editions available	Benchmark unless adopted
Thermal comfort	ANSI/ASHRAE 55-2020	2023 edition available	Benchmark unless adopted
Commissioning process	ANSI/ASHRAE/IES 202-2018	2024 edition available	Benchmark unless adopted
Life-cycle assessment	ISO 14040 and ISO 14044	Base editions with amendments	Current benchmark
Environmental product declarations	ISO 21930:2017	No later edition	Current benchmark
Photovoltaic module qualification	IEC 61215 series, 2021	No later edition	Current benchmark
Photovoltaic module safety	IEC 61730 series, 2023	No later edition	Current benchmark; confirm at procurement
Photovoltaic cable	IEC 62930:2017	No later edition	Current benchmark
Renewable-energy institution	Alternative Energy Development Board named in the Code narrative	Functions merged into the Private Power and Infrastructure Board in 2023	Use the current institution
Grid connection	The process described in the Code narrative	Current regulator's distributed-generation regulations and distribution company procedures	Use the process in force at application

CAUTION

Compare editions for changes that materially affect safety, performance, measurement or procurement. A later edition is not automatically better for a project: adopting one part of it while the rest of the design follows the cited edition can produce an inconsistent basis. Record the position for each standard, with the approver.

B.1 Edition-control record

For each standard the project relies on, record the standard and its number, the governing edition, whether a later edition exists and its date, the material change identified, the action the project takes, and the person who approved that action.

Annex C Technical Interpretation Record

An interpretation is a quality-control instrument. A point of ambiguity is not settled until a competent authority has recorded a decision and the affected design and evidence have been updated to match it. The record below is the form each request and each decision takes.

Table C.1 Technical interpretation record

Field	Content
Project and permit reference	Identity of the project and the application the question affects
Reference and dates	Request identity, date raised, and the date by which the decision is needed
Clause and exact issue	The provision, quoted, and the precise ambiguity or conflict
Why a decision is needed now	The gate or decision the answer blocks
Related law, standards and option decisions	Everything else bearing on the answer
Options considered	The readings available, with their consequences
Proposed interpretation	The reading the project proposes, or the alternative method offered
Technical evidence and risk	Calculation, test, precedent and the risk carried by each reading
Effect	Consequences for safety, performance, cost, program and operation
Decision authority	Who decides, and who must be consulted first
Decision	The determination, its conditions and its date
Closure	Documents updated and the evidence that closure is complete

REQUIREMENT

Record material interpretations and alternatives in writing, with the reasons, the conditions, the approver and the documents affected. Meeting minutes that describe a discussion without stating the decision are not an interpretation, and a design built on a spoken assurance has no defense when the reviewer or the officer changes.

Annex D Facilitation Guide

This annex supports delivery of the worked applications to a mixed professional audience.

D.1 Facilitation rules

- Keep the stated inputs for the first pass. Participants vary them only after the base result is understood, so that the group is comparing like with like.
- A calculated pass is not an approval. Ask what evidence a real reviewer would require before accepting the result.
- When a result fails, redesign before proposing an exception.
- When a provision is ambiguous, record it as a request for determination rather than deciding it in the room.
- Every action gets an owner and a date.
- End each application with one project-specific action each participant will apply within 30 days.

D.2 Expected results

The results below follow from the stated inputs. They change as soon as participants vary an input, which is the purpose of the exercise. Ask for the reasoning and the evidence, not only the number.

Table D.1 Expected results from the stated inputs

Application and quantity	Result
1. Compliant hardscape share	55.0 per cent
1. Biodiverse landscape share	66.7 per cent
1. Retention volume, 95th-percentile event	210.4 m ³
1. Variation: hardscape and biodiverse shares	35.0 and 50.0 per cent, both below the required proportions
2. Annual roof yield	1,870 m ³ per year
2. Share of annual non-potable demand met	34.2 per cent
2. Storage for the 10-day dry-spell target	150 m ³
2. Owner's 50 m ³ tank expressed as supply	3.3 days, against a 10-day target
3. Required photovoltaic capacity	154.88 kWp
3. Estimated annual generation	229,291 kWh per year
3. Annual renewable requirement	264,000 kWh per year
3. Shortfall	34,709 kWh per year, 13.1 per cent of the requirement
3. Additional capacity to close the shortfall	23.4 kWp, needing about 242 m ² of further unshaded area
4. Overall window-to-wall ratio	24.2 per cent
4. Orientation test, east and west	82.5 m ² over the permitted area on each façade, 165 m ² in total
4. First-story projection factor	0.45 against an adopted 0.50
4. Upper-story projection factor	0.25; recorded for comparison, no upper-story factor adopted

Application and quantity	Result
4. Lighting	8.0 W/m ² installed against a 7.4 W/m ² allowance; 3.6 kW to be removed
5. Waste diversion	35.7 per cent against the 25 per cent required by clause 901.3.1.1 — passes
5. Further diversion to reach the 50 per cent total-waste exception	60,000 kg
5. Waste intensity	70 kg/m ² against the 100 kg/m ² limit in clause 901.3.1.2 — passes
5. Reduced-impact options	Recycled 11.0 per cent and regional 12.0 per cent pass; biobased 1.5 per cent fails; ten declarations pass
6. Verification track	Full commissioning, because the area exceeds 1,000 m ²

D.3 Judging a participant's work

Table D.2 Standard of participant work

Standard reached	What it looks like
Ready to apply	Correct result, the provision identified, assumptions stated, evidence named, cross-discipline effects recognized, an owner assigned and an action defined.
Competent	Correct result and a reasonable design response, with most of the evidence and responsibilities identified.
Developing	Calculation largely correct, but limited thinking about evidence, trade-offs or operation.
Awareness only	Result reproduced without understanding, or a solution resting on an unverified product claim or an assumed waiver.
Not acceptable	A mandatory failure ignored, an unsafe interaction introduced, or a result misrepresented.

D.4 Two-day delivery

Table D.3 Two-day delivery plan

Session	Content	Output
Day 1, morning	Legal basis, scope, assurance and responsibilities	Applicability determination and the questions it raises
Day 1, late morning	Integrated delivery and site	Application 1
Day 1, early afternoon	Water and rainwater harvesting	Application 2
Day 1, late afternoon	Scheme comparison set up	Initial scheme comparison and reflection
Day 2, morning	Energy, envelope and renewables	Applications 3 and 4
Day 2, late morning	Indoor environment, materials and waste	Application 5
Day 2, early afternoon	Construction, commissioning and operation	Application 6

Session	Content	Output
Day 2, late afternoon	Integrated closeout	Application 7 and the decision briefing
Day 2, close	Transfer to work	A 30-day action for each participant

Annex E Glossary

Table E.1 Glossary of terms used in this Guide

Term	Meaning
Authority Having Jurisdiction	The agency or officer responsible for adopting, interpreting and enforcing the Code in a given jurisdiction.
Basis of Design	The concepts, calculations, decisions and product selections through which the design meets the owner's requirements and the regulatory requirements.
Brownfield	A site documented as contaminated, or classified as a brownfield by the competent authority.
Commissioning	The quality-focused process that verifies systems are planned, designed, installed, tested, operated and maintained to meet the owner's requirements.
Environmental Product Declaration	A Type III environmental declaration produced under the applicable product category rules and life-cycle assessment rules.
Fault detection and diagnostics	Monitoring and analysis that identifies, prioritizes and tracks faults in building systems.
Functional and performance testing	Testing that verifies designated systems achieve their intended performance.
Greenfield	A site of which 20 per cent or less was previously developed with impervious surfaces.
Greyfield	A site of which more than 20 per cent is or was previously developed with impervious surfaces.
Jurisdictional option	A provision or value the Authority Having Jurisdiction may adopt, set within the stated choice, or opt out of through the adoption schedule.
Life-cycle assessment	Evaluation of the inputs, outputs and environmental impacts of a product or building across defined life-cycle stages.
Measurement and verification	Collection and assessment of performance data against a baseline or a target.
Owner's Project Requirements	The functional requirements, expectations, measurable criteria, cost, training and documentation needs the owner sets for the project.
Performance ratio	The ratio of actual to theoretical photovoltaic output, capturing temperature, soiling, wiring, inverter and availability losses.
Projection factor	The horizontal depth of a shading projection divided by the vertical distance from the bottom of the glazing to the underside of the projection.
Qualifying roof area	The unshaded horizontal roof area remaining after the exclusions the Code permits, and the area to which the photovoltaic capacity requirement is applied.
Solar heat gain coefficient	The fraction of incident solar radiation admitted through a glazing assembly.
Solar reflectance index	A measure of a surface's ability to reject solar heat, combining reflectance and emittance.

Term	Meaning
Systems manual	The integrated record of design intent, sequences, operation, maintenance, troubleshooting, warranties and commissioning information handed to the operator.
Window-to-wall ratio	Vertical fenestration area divided by gross above-grade wall area.

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