



Infrastructure Quality Applied Vocabulary Standard

IQI STANDARD VOC1

Revision 2.1 - September 2026

Applied Concepts for Energy Infrastructure within the Whole Quality Methodology

INFRASTRUCTURE QUALITY INITIATIVE

Foreword

Energy infrastructure is the principal application domain of the Infrastructure Quality Initiative within Whole Quality. It includes the assets, facilities, networks, and systems-of-systems used to produce, process, convert, store, transport, transmit, distribute, and deliver energy. These long-lived objects require language capable of representing operating media, technical and organizational interfaces, changing lifecycle conditions, public consequences, and evidence generated across many years and responsibilities.

This Standard establishes the IQI Applied Vocabulary for energy infrastructure. It adopts the Root Concepts defined in WQI_VOC1 without modification and defines only the additional concepts needed to describe energy Infrastructure Quality Objects and the energy-infrastructure application of the Whole Quality methodology.

The distinction is deliberate. Whole Quality Root Concepts and supporting WQI-controlled concepts—including Quality, Quality Object, Intended Function, Intended Result, Function Realization, Scale, Methodological Resolution, Boundary, Interface, Context, Applicable Basis, Quality Factor, Quality Indicator, Quality Outcome Criterion, Reference Layer, Evidence, Evidence Quality, Evidence Sufficiency, Evidence Trustworthiness, Evidence Applicability, Uncertainty, Evidence-Supported Finding, Quality Factor Interpretation, Critical Condition, Non-Compensability, Quality Determination, Quality State, Quality Claim, Traceability, Management System, and Management System Quality—are controlled by WQI_VOC1. IQI uses those terms with their authoritative WQI meanings and extends them only where energy-infrastructure application requires additional Applied Concepts.

This Revision 2.1 aligns the IQI Applied Vocabulary with WQI_VOC1 Revision 2.1. It incorporates the current Root Conceptual Framework and supporting WQI-controlled Evidence architecture, including Evidence Sufficiency, Evidence Trustworthiness, Evidence Applicability, and their supporting Evidence Quality Indicators; preserves the distinction between Root Concepts and supporting controlled concepts; and retains infrastructure-specific concepts needed for IQC1, the IQI Management System Quality Core Standard, IQI Context Guides, Management System Context Guides, diagrams, tools, and supporting publications.

This Standard is voluntary and non-regulatory. It does not establish technical design requirements, operating limits, engineering methods, certification requirements, legal duties, or context-specific acceptance thresholds. Its purpose is to preserve a coherent applied language for Quality Determination and bounded Quality Claims concerning energy infrastructure.

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1 Introduction

This Standard supports consistent terminology across IQI standards, Context Guides, methods, diagrams, tools, and supporting publications.

1.5 Intended Use

IQI Context Guides apply and interpret the applicable Core Standard for defined energy-infrastructure contexts. They may provide context-specific detail without changing the authoritative definitions established by the governing vocabularies.

IQI Core Standards use the vocabulary established by WQI_VOC1 and IQI_VOC1.

1.4 Relationship to IQI Core Standards and Context Guides

IQI_VOC1 does not redefine those concepts. It defines only the additional infrastructure-specific concepts needed for IQI applications.

WQI_VOC1 governs the Whole Quality Root Concepts and other WQI-controlled concepts used by IQI.

1.3 Relationship to WQI_VOC1

- IQI Context Guides interpret those requirements for defined infrastructure contexts.
- IQI Core Standards establish requirements.
- IQI_VOC1 extends that vocabulary for energy infrastructure.
- WQI_VOC1 defines the common Whole Quality vocabulary.
- Foundational Articles explain.

Within the Whole Quality document architecture:

IQI_VOC1 is the Applied Vocabulary for energy infrastructure.

1.2 Position Within the Whole Quality Architecture

It adopts the Whole Quality concepts governed by WQI_VOC1 and defines the additional Applied Concepts needed for consistent use of the Whole Quality methodology within the Infrastructure Quality Initiative.

This Standard establishes the IQI Applied Vocabulary for energy infrastructure.

1.1 Purpose

2 Reference Documents

- WQI_VOC1 - Whole Quality Root Vocabulary Standard, Revision 2.1 or current revision-controlled edition.
- WQI Foundational Articles 1-11, current revision-controlled editions, including FTA5, FTA7, and FTA11.
- IQC1 - Infrastructure Quality Standard - Core, current edition.
- IQI Management System Quality Core Standard for Energy-Infrastructure Products and Services, current edition.
- Current IQI Context Guides and controlled drafts used for terminology testing, including MNT1,

LDN1, UGS1, LNG1, GPP1, and subsequent energy-infrastructure Context Guides.

- Relevant IQI diagrams, guidance, and Quality Determination tools used to test vocabulary consistency. External laws, regulations, codes, technical standards, scientific sources, contracts, design bases, operating procedures, and professional guidance may form part of the Applicable Basis or Reference Layer, depending on their methodological role. They do not control the meaning of WQI Root Concepts or IQI Applied Concepts unless expressly incorporated for a defined purpose.

3 Applied Conceptual Framework and Vocabulary Scope

3.1 Root-to-Applied Conceptual Dependency

IQI applies the WQI conceptual dependency to energy infrastructure by defining the object-specific concepts needed to represent energy assets, systems-of-systems, configuration, operating media, lifecycle stages, infrastructure work, realization pathways, bounded infrastructure claims, and the energy-infrastructure application context in which Management Systems produce required products or provide required services.

3.2 Principal IQI Dependency

The principal IQI conceptual pathway is: Infrastructure Quality Object -> Infrastructure Intended Function(s) and Infrastructure Intended Result(s) -> Function Realization -> Core Quality Factors -> Core Quality Indicators -> Context-Specific Quality Outcome Criteria -> Evidence -> Evidence-Supported Findings -> Quality Factor Interpretation -> Infrastructure Quality State -> Infrastructure Quality Claim Statement(s). Scale, Boundaries, Interfaces, Context, Methodological Resolution, Applicable Basis, Reference Layer, Evidence Quality—including Evidence Sufficiency, Evidence Trustworthiness, and Evidence Applicability—Uncertainty, Failure-Mode Families, Critical Infrastructure Conditions, Infrastructure Non-Substitutability, and Traceability support or constrain this pathway. Evidence Quality governs the transition from Evidence to Evidence-Supported Findings by determining whether the Evidence is sufficient, trustworthy, and applicable for the Finding being made. Application may involve iterative refinement; it is not a rigid one-pass sequence.

3.3 Cross-Platform Work-Result-Outcome Relationship

For comparability across Whole Quality platforms, IQI uses the following realization relationship: Infrastructure Work + Infrastructure Result = Infrastructure Outcome. Infrastructure Work identifies what is performed. Infrastructure Result identifies what is actually produced, maintained, changed, or made available. Infrastructure Outcome is the bounded combination of the Work performed and the Result produced. An Infrastructure Outcome may take the form of an infrastructure product, an infrastructure service, or a maintained or changed infrastructure condition or capability. The relationship does not determine quality by itself; the Work and Result remain subject to applicable Quality Outcome Criteria, Evidence, boundaries, and Quality Determination. In AMSI, the corresponding service form is expressed as Support Work + Support Result = Service. IQI uses the broader term Infrastructure Outcome because energy-infrastructure outcomes may be products, services, or maintained or changed states. This shared architecture supports comparison without treating products and services as identical.

3.4 Infrastructure Quality Object as the Primary Reference Point

Every energy-infrastructure Quality Determination begins with definition and description of the Infrastructure Quality Object. The object provides the primary reference point for its Intended Functions and Intended Results, Function Realization, Scale, Boundaries, Interfaces, Context, Methodological Resolution, Applicable Basis, Quality Factors, Quality Indicators, Quality Outcome Criteria, Evidence needs, and permissible Quality State and Quality Claim scope. Infrastructure Quality Objects may overlap or share infrastructure, resources, Interfaces, organizations, information, or other elements without merging their Quality States.

3.5 Structural Completeness Before Interpretation

Structural Checkpoints provide an IQI application-level completeness check on the Infrastructure Quality Object Description before detailed interpretation proceeds. They are supporting applied documentation checks, not WQI Root Concepts or supporting WQI-controlled concepts, and not a mandatory step in the WQI principal conceptual pathway.

3.6 Core Invariance and Context Specificity

The IQC1 Intended Function, Core Quality Factors, and Core Quality Indicators are invariant across IQI Infrastructure Context Guides. The IQI Management System Quality Core Intended Function, Core Quality Factors, and Core Quality Indicators are likewise invariant across Management System Context Guides. Context Guides provide context-specific interpretation through object description, boundaries, interfaces, lifecycle conditions, failure modes, Quality Outcome Criteria, evidence, Critical Conditions, and claim limits without changing the applicable Core architecture.

3.7 Scale, Lifecycle, and System-of-Systems Reality

The same Applied Vocabulary may be used at different energy-infrastructure Scales and Methodological Resolutions. Scale concerns the level of aggregation or extent at which the Quality Object is defined; Methodological Resolution concerns the degree of quality-relevant detail used to examine that defined object. A Quality State established for one Quality Object or Scale does not automatically transfer to another.

3.8 Vocabulary Scope

This Standard defines Applied Concepts for energy infrastructure. It does not define every energy asset type, process, engineering discipline, failure mechanism, technical requirement, performance threshold, regulatory duty, inspection method, certification procedure, or context-specific Quality Outcome Criterion.

4 WQI Concepts Adopted by Reference

4.1 Governing Rule

WQI Root Concepts and supporting WQI-controlled concepts apply within IQI with the authoritative definitions established in WQI_VOC1. This Standard does not reproduce those definitions as IQI definitions.

4.2 Object, Function, Boundary, and Context Concepts

IQI adopts by reference the WQI_VOC1 definitions of Quality Object, Quality Object Description, Intended Function, Intended Result, Function Realization, Scale, Methodological Resolution,

Boundary, Interface, Boundary Transparency, Interface Transparency, Context, Applicable Basis, Failure Mode, and Failure-Mode Family.

4.3 Quality Architecture and Determination Concepts

IQI adopts by reference the WQI_VOC1 definitions of Quality, Quality Factor, Quality Indicator, Quality Outcome Criterion, Evidence-Supported Finding, Quality Factor Interpretation, Critical Condition, Non-Compensability, Quality Determination, Quality State, Quality Claim, and Traceability.

4.4 Evidence, Uncertainty, and Reference Concepts

IQI adopts by reference the WQI_VOC1 definitions of Reference Layer; Evidence; Evidence Intended Function; Evidence Intended Result; Evidence Quality; Evidence Sufficiency; Evidence Trustworthiness; Evidence Applicability; Coverage; Completeness; Resolution; Source Reliability; Validity; Accuracy; Evidence Integrity; Subject Applicability; Context Applicability; Determination Applicability; Uncertainty; Unresolved Condition; Assumption; Assumption Drift; Absence of Observed Failure; and Data. Evidence Sufficiency, Evidence Trustworthiness, and Evidence Applicability are WQI Root Concepts and the Quality Factors used to examine Evidence Quality. Their supporting Evidence Quality Indicators retain the WQI-controlled meanings established in WQI_VOC1.

4.5 Management-System Concepts

IQI adopts by reference the WQI_VOC1 definitions of Management System and Management System Quality. Within IQI, these WQI-controlled concepts apply to the actual management used by organizations to produce required energy-infrastructure products or provide required energy-infrastructure services. The IQI Management System Quality Core Standard establishes the particular Intended Function, invariant Core Quality Factors and Core Quality Indicators, Quality Determination requirements, and bounded claim structure for Management Systems within its scope. IQI_VOC1 does not redefine Management System or Management System Quality.

4.6 Lifecycle, Claim, and Document-Architecture Concepts

IQI adopts by reference the WQI_VOC1 definitions of Lifecycle, Applied Vocabulary, Applied Concept, Core Standard, Context Guide, Context-Specific Interpretation, Authoritative Definition, and Conceptual Dependency. Lifecycle Gate, Stakeholder / Interested Party, Quality Claim Scope, Technology, and Technology Governance are not defined as WQI Root Concepts in Revision 2.1; where IQI uses related infrastructure-specific terms, they are controlled as IQI Applied Concepts or ordinary domain language as appropriate.

4.7 Non-Definitional Application Notes

IQI documents may explain how a WQI Root Concept or supporting WQI-controlled concept applies to infrastructure or to Management Systems within the energy-infrastructure application, identify examples, or use a qualified Applied Concept. Such explanation shall preserve the WQI-controlled meaning and shall not create a competing definition.

5 Energy-Infrastructure Applied Terms and Definitions

5.1 Infrastructure Quality Object

Within IQI, a defined energy infrastructure asset, facility, network, subsystem, zone, lifecycle program, interface condition, asset population, or energy infrastructure system-of-systems whose Quality is being determined.

Note 1. Infrastructure Quality Object is the IQI applied form of the WQI Root Concept Quality Object.

Note 2. Definition of the object establishes the subject of the Quality Determination; Scale, Boundaries, Interfaces, Context, and Methodological Resolution further establish how that subject is considered and examined.

Note 3. The object may be broad or narrow, but its scale, boundaries, interfaces, and lifecycle condition must be sufficiently clear for the intended determination.

Note 4. Whether a constituent, system, organization, operating medium, environment, responsibility arrangement, or other condition is internal or external depends on the defined Infrastructure Quality Object and its Scale; classification shall not be inferred solely from the type or title of the constituent.

5.2 Infrastructure Quality Object Description

A documented description of an Infrastructure Quality Object sufficient to identify its Scale, composition, Intended Functions and Intended Results, relevant configuration, operating medium and conditions, lifecycle condition, Boundaries, Interfaces, responsibilities, Context, Applicable Basis, Methodological Resolution, and Evidence needs for the intended Quality Determination.

Note 1. This is the infrastructure applied form of Quality Object Description.

Note 2. The description should be proportionate to the object's complexity, consequence, uncertainty, and claim scope.

Note 3. An object description supports interpretation but does not itself determine the Quality State.

Note 4. The description should identify material internal and external Boundaries and Interfaces where necessary for Function Realization, Evidence interpretation, or the intended Quality Claim.

5.3 Structural Checkpoint

An IQI application-level completeness checkpoint used to confirm that the defined Infrastructure Quality Object and its description are sufficiently developed for the intended infrastructure Quality Determination.

Note 1. Structural Checkpoints are performed before detailed interpretation of internal and external Boundaries and Interfaces, lifecycle conditions, Quality Factors, Quality Indicators, Quality Outcome Criteria, Evidence, Critical Conditions, Quality State, and Quality Claims.

Note 2. A Structural Checkpoint is not a Quality Factor, Quality Indicator, Quality Outcome Criterion, technical inspection, or quality assessment, and it does not determine the Quality State.

Note 3. Where a Structural Checkpoint is not satisfied, the object description, scope, or claim basis should be refined, restricted, or qualified before interpretation continues.

5.4 Infrastructure Asset

A physical, functional, informational, organizational, and lifecycle-based infrastructure arrangement intended to realize defined infrastructure functions over time.

Note 1. An Infrastructure Asset may include structures, equipment, materials, controls, software, operating media, monitoring arrangements, records, interfaces, and responsibility arrangements where they are included within the defined object boundary.

Note 2. An Infrastructure Asset may itself be an Infrastructure Quality Object or may form part of a broader Infrastructure Quality Object.

Note 3. Inclusion is determined through the defined Infrastructure Quality Object and Scale, not automatically by ownership, location, operational association, or organizational responsibility.

5.5 Infrastructure System-of-Systems

A defined infrastructure arrangement in which multiple independently identifiable assets or systems interact to realize broader intended functions or intended results that cannot be adequately represented by any one constituent alone.

Note 1. A system-of-systems may cross organizational, technical, jurisdictional, environmental, or lifecycle boundaries.

Note 2. Its Quality State depends on constituent behavior and on the interfaces, dependencies, responsibilities, and Evidence that connect the constituents.

Note 3. Constituent systems may remain independently bounded Quality Objects while also participating through internal or external Interfaces of the declared system-of-systems Quality Object.

5.6 Infrastructure Subsystem

A functionally or physically identifiable part of an Infrastructure Asset or infrastructure system-of-systems that performs one or more supporting, intermediate, protective, control, or transfer functions.

Note 1. A subsystem may be declared as a separate Infrastructure Quality Object when its boundaries, interfaces, evidence, and claim scope are independently defined.

Note 2. A satisfactory subsystem finding does not by itself establish the Quality State of the broader Infrastructure Quality Object.

5.7 Infrastructure Element / Component

A distinguishable item, material, assembly, equipment unit, structure, software or control unit, or other constituent that forms part of an Infrastructure Asset or subsystem.

Note 1. Component conformity or satisfactory component evidence may support an infrastructure Quality Determination.

Note 2. Component conformity does not by itself establish the Quality State of the assembled Infrastructure Quality Object.

5.8 Infrastructure Configuration

The defined arrangement and functional relationship of infrastructure elements, subsystems, controls, interfaces, and operating media through which intended infrastructure functions are realized.

Note 1. Configuration may be described as intended, designed, constructed, commissioned, current, modified, temporary, or decommissioned/transitioned.

Note 2. Differences between intended, recorded, and actual configuration may affect Evidence Quality, including Evidence Sufficiency or Evidence Applicability, Critical Conditions, and the Quality State.

Note 3. Configuration description should distinguish internal constituent relationships from external connected-system Interfaces where that distinction affects Function Realization or Evidence attribution.

5.9 Infrastructure Intended Function

The infrastructure-specific form of Intended Function: what the Infrastructure Quality Object is required or intended to do.

Note 1. An Infrastructure Quality Object may have more than one Intended Function.

Note 2. The IQC1 Intended Function is invariant across Context Guides; a Context Guide may identify context-specific subfunctions without changing the invariant Core meaning.

Note 3. Infrastructure Intended Functions should be distinguished from activities performed on the object.

Note 4. Where the Infrastructure Quality Object has multiple Infrastructure Intended Functions, their associated Intended Results, dependencies, interactions, and applicable priorities should be made clear where they affect Function Realization, Evidence needs, the Infrastructure Quality State, or a Quality Claim.

5.10 Infrastructure Intended Result

The infrastructure-specific condition, output, protection, continuity, separation, control state, or other result required or intended to be produced or maintained through realization of an Infrastructure Intended Function.

Note 1. An Intended Result is a required or intended state or result, not merely completion of work or production of documentation.

Note 2. Context Guides may identify Intended Results needed to interpret Core Quality Indicators and Quality Outcome Criteria.

5.11 Infrastructure Work

Work performed to design, construct, commission, operate, maintain, inspect, monitor, repair, modify, decommission, transition, or otherwise affect an Infrastructure Quality Object or realization of its intended functions.

Note 1. Infrastructure Work may occur on site or off site when its intent, lifecycle contribution, and traceability to the defined object are established.

Note 2. Completion of Infrastructure Work does not by itself demonstrate a satisfactory Infrastructure Result, Infrastructure Outcome, or Infrastructure Quality State.

Note 3. Infrastructure Work may be declared as a narrower Infrastructure Quality Object when the quality of the work itself is to be determined separately.

5.12 Infrastructure Result

The actual condition, product, service, capability, change, protection, continuity, or other effect produced, maintained, or made available through Infrastructure Work or operation of an Infrastructure Quality Object.

Note 1. Infrastructure Result is distinguished from Infrastructure Intended Result: the Intended Result is expected; the Infrastructure Result is what is actually produced, maintained, changed, or made available.

Note 2. An Infrastructure Result may be tangible or intangible, immediate or delayed, intended or unintended, complete or partial, stable or unstable, and sufficiently or insufficiently evidenced.

Note 3. The existence of an Infrastructure Result does not by itself establish that the Result, the Work that produced it, or the broader Infrastructure Outcome has a satisfactory Quality State.

5.13 Infrastructure Outcome

The bounded realization consisting of Infrastructure Work performed together with the Infrastructure Result produced, maintained, changed, or made available in relation to a defined Infrastructure Quality Object.

Note 1. The relationship is expressed as Infrastructure Work + Infrastructure Result = Infrastructure Outcome.

Note 2. An Infrastructure Outcome may take the form of an infrastructure product, an infrastructure service, or a maintained or changed infrastructure condition or capability.

Note 3. Infrastructure Work and Infrastructure Result may be interpreted separately and together. Satisfactory Work does not by itself establish a satisfactory Result, and a satisfactory Result does not by itself validate all Work performed.

Note 4. The formula does not mean that any Work and any Result automatically form a valid or satisfactory Outcome. Their relationship must be bounded to the defined object, context, time, interfaces, and Evidence.

5.14 Infrastructure Quality

The application of the WQI Root Concept Quality to an Infrastructure Quality Object: the degree to which the defined Infrastructure Quality Object realizes its Infrastructure Intended Functions and Infrastructure Intended Results within declared Boundaries and Interfaces, as interpreted against defined Quality Outcome Criteria and supported by Evidence whose Quality is sufficient for the intended Infrastructure Quality Determination.

Note 1. Infrastructure Quality is object-relative, function-based, bounded, evidence-supported, and dependent on defined criteria.

Note 2. Where the defined Infrastructure Quality Object includes an Infrastructure Outcome, the Work performed and Result produced should be interpreted both separately and together.

Note 3. Satisfactory Infrastructure Work does not by itself establish a satisfactory Infrastructure Result, and a satisfactory Infrastructure Result does not by itself establish that all relevant Work was satisfactory.

Note 4. Infrastructure Quality is not established by component conformity, documentation, compliance, current operation, data volume, or absence of observed failure alone.

5.15 Infrastructure Safety

The condition in which unacceptable risk to people, workers, communities, the environment, the Infrastructure Quality Object, and the conditions necessary for its essential intended functions is prevented or controlled within the declared boundaries and interfaces.

Note 1. Infrastructure Safety is an infrastructure quality dimension where loss of control, containment, stability, separation, protection, or continuity may create unacceptable consequences.

Note 2. This definition does not establish a universal risk threshold or replace applicable safety laws, codes, or technical standards.

5.16 Infrastructure Operating Medium

A material, substance, energy flow, physical state, or process condition present within or interacting with an Infrastructure Quality Object that directly affects realization of its intended functions.

Note 1. Examples include crude oil, natural gas, LNG, hydrogen blends, electrical current, steam, water, process fluids, pressure, temperature, chemical composition, and phase behavior.

Note 2. Compatibility between the operating medium, infrastructure configuration, materials, controls, and intended conditions is an infrastructure quality consideration.

Note 3. This Standard does not establish commercial or product acceptance criteria for operating media.

5.17 Infrastructure Operating Condition

A defined physical, technical, operational, environmental, loading, demand, or transient condition under which an Infrastructure Quality Object is expected to realize its intended functions.

Note 1. Operating conditions may include pressure, temperature, flow, load, composition, demand, mode, environmental exposure, startup, shutdown, upset, emergency, and reduced-capability conditions.

Note 2. A Quality State or Quality Claim may be valid only within specified operating conditions.

5.18 Infrastructure Lifecycle Stage

A defined stage in the Lifecycle of an Infrastructure Quality Object used to organize responsibilities, work, evidence, conditions, and Quality State interpretation.

Note 1. The principal IQI lifecycle sequence is Design - Construction - Commissioning - Operation - Maintenance - Repair/Modification - Decommissioning/Transition.

Note 2. Context-specific activities or sub-stages may be identified where needed, but they should not replace or destabilize the principal sequence.

Note 3. Evidence and assumptions originating in one stage may affect Quality Determination in a later stage.

5.19 Infrastructure Lifecycle Gate / Quality Gate

An IQI Applied Concept describing a defined transition or decision point between Infrastructure Lifecycle Stages at which specified Evidence, responsibilities, assumptions, Unresolved Conditions, Critical Infrastructure Conditions, or Quality Determinations are reviewed.

Note 1. A gate may occur at construction completion, commissioning authorization, return to service, modification acceptance, or decommissioning/transition, depending on the context.

Note 2. An Infrastructure Lifecycle Gate is not necessarily a formal regulatory or contractual gate.

Note 3. Passage through a gate does not by itself establish a broader Infrastructure Quality State unless the relevant determination has been completed.

5.20 Infrastructure Realization Pathway

A defined technical, physical, operational, and organizational pathway by which an Infrastructure Quality Object is configured and managed to realize one or more Infrastructure Intended Functions and Infrastructure Intended Results.

Note 1. Different infrastructure realization pathways may use different technologies, process arrangements, sequences, controls, or configurations while serving the same intended function.

Note 2. The term is preferred to engineering approach where the subject is the pathway by which infrastructure functions are realized.

Note 3. A realization pathway is not itself a Quality State; its quality significance depends on the object, context, criteria, Evidence, Interfaces, and Critical Conditions.

Note 4. A realization pathway may cross multiple internal and external Interfaces; successful action at one constituent does not establish successful realization across the complete pathway.

5.21 Degradation and Aging

Infrastructure-specific processes by which the condition, behavior, capability, configuration, evidence base, or operating context of an Infrastructure Quality Object changes over time.

Note 1. Mechanisms may include corrosion, fatigue, wear, settlement, deformation, erosion, material aging, environmental effects, obsolescence, software or control degradation, and deterioration or loss of evidence.

Note 2. Degradation and aging do not automatically determine an unsatisfactory Quality State, but they may affect function realization, uncertainty, evidence sufficiency, Critical Conditions, and claim validity.

5.22 Infrastructure Repair / Modification / Reconstruction

An intervention that restores, alters, replaces, reconfigures, renews, or substantially rebuilds part or all of an Infrastructure Quality Object in a manner that may affect its functions, configuration, boundaries, interfaces, evidence, or Quality State.

Note 1. Repair generally seeks to restore an intended condition or capability; modification changes configuration or function; reconstruction substantially renews or rebuilds the object or a major part of it.

Note 2. The applicable lifecycle treatment should be determined by the effect of the intervention, not only by the name assigned to the work.

Note 3. Such intervention may require renewed Structural Checkpoints, review of internal and external Boundaries and Interfaces, Evidence review, and renewed Quality Determination.

5.23 Core Quality Factor

A Quality Factor established in IQC1 as an invariant major dimension of infrastructure Function Realization for use across IQI Context Guides.

Note 1. Core Quality Factors are not created ad hoc by individual Context Guides.

Note 2. Context Guides interpret how each Core Quality Factor applies to the defined Infrastructure Quality Object and context.

5.24 Core Quality Indicator

A Quality Indicator established in IQC1 under a Core Quality Factor and retained as an invariant point of examination across IQI Context Guides.

Note 1. A Core Quality Indicator identifies what is examined; it does not by itself define the acceptable or expected condition.

Note 2. Context Guides interpret the Indicator and connect it to context-specific Quality Outcome Criteria, evidence, failure modes, and Critical Conditions without replacing it.

5.25 Context-Specific Quality Outcome Criterion

An infrastructure-applied Quality Outcome Criterion expressing the expected state or result against which observations associated with a Core Quality Indicator are interpreted within a defined infrastructure Context.

Note 1. The substantive basis for the Criterion should be traceable to the Applicable Basis and, where appropriate, supported by the applicable Reference Layer.

Note 2. Context specificity shall not alter the meaning of the Core Quality Indicator or permit a conflicting Root or Applied definition.

Note 3. Context may affect applicability of a Criterion without itself creating the substantive expected state. The Criterion and its basis should remain traceable for the intended Quality Determination.

5.26 Critical Infrastructure Condition

An infrastructure-specific Critical Condition whose absence, failure, violation, or unresolved status prevents a responsible positive Infrastructure Quality Determination or Infrastructure Quality Claim Statement.

Note 1. A Critical Infrastructure Condition may concern system behavior, containment, separation, control, interface integrity, essential function, consequence prevention, Evidence Quality, responsibility, or another non-compensable condition.

Note 2. Criticality arises from the effect of the condition on the Infrastructure Quality Object and intended determination, not solely from designation of a critical component.

5.27 Infrastructure Non-Substitutability

The infrastructure application of the WQI Root principle Non-Compensability: satisfactory findings for one Core Quality Factor, Core Quality Indicator, subsystem, or Evidence area cannot substitute for a failed, prohibited, unresolved, or insufficiently supported Critical Infrastructure Condition or other declared non-compensable condition.

Note 1. Infrastructure Non-Substitutability prevents averaging, scoring, or favorable findings in unrelated areas from masking a condition that invalidates a positive Quality State or Quality Claim.

Note 2. The rule should be applied through the Critical-Condition and Non-Compensability Review required by the Whole Quality dependency.

5.28 Infrastructure Quality State

The Quality State of a defined Infrastructure Quality Object in relation to its Infrastructure Intended Functions and Infrastructure Intended Results, within declared Boundaries, Interfaces, Context, time, lifecycle and operating conditions, criteria, Evidence, Evidence Quality, Uncertainty, and Critical Infrastructure Conditions.

Note 1. Infrastructure Quality State is the IQI applied form of the WQI Root Concept Quality State.

Note 2. It is Evidence-supported and bounded; it is not an intrinsic label detached from the object, time, Evidence basis, or claim scope.

Note 3. Different Infrastructure Quality States may be determined where the declared Quality Object, Boundary, Scale, lifecycle stage, operating condition, period, or other material basis of the determination differs. Where one defined Infrastructure Quality Object has multiple Intended Functions or Intended Results within one declared determination, distinct Findings or bounded Claims may concern them while the Infrastructure Quality State remains the interpreted condition of that defined object for that determination.

5.29 Infrastructure Quality Determination

The structured application of Whole Quality to establish the Infrastructure Quality State of a defined Infrastructure Quality Object, including Evidence evaluated for applicable Evidence Quality, Evidence-Supported Findings, Quality Factor Interpretation, review of applicable Critical Infrastructure Conditions and Non-Compensability, and synthesis of the resulting Infrastructure Quality State.

Note 1. The determination should preserve Traceability from the Infrastructure Quality State to the object description, Boundaries, Interfaces, Core Quality Indicators, Context-Specific Quality Outcome Criteria, Evidence and Evidence Quality, Uncertainty, and declared limitations.

Note 2. Infrastructure Quality Determination is broader than inspection, audit, compliance review, certification, measurement, data collection, or component acceptance.

5.30 Infrastructure Quality Claim Statement

A bounded written, visual, digital, or otherwise recorded Quality Claim that communicates an Infrastructure Quality State or another quality conclusion supported by the Infrastructure Quality Determination about a defined Infrastructure Quality Object.

Note 1. The statement should identify or make traceable the object, Scale, relevant internal and external Boundaries, lifecycle and operating conditions, applicable criteria, Evidence basis, relevant Evidence Quality limitations, and relevant internal and external Interfaces included, excluded, or treated as external dependencies, together with Assumptions, Uncertainty, Unresolved Conditions, Critical Infrastructure Conditions, limitations, and conditions of continued validity.

Note 2. An Infrastructure Quality Claim Statement shall not exceed the scope, certainty, or support of the Infrastructure Quality Determination from which it is derived. Where one or more Infrastructure Intended Functions or Infrastructure Intended Results remain failed, unresolved, or not sufficiently supported by Evidence, a Claim addressing the Infrastructure Quality Object as a whole shall reflect that limitation.

Note 3. The statement does not constitute IQI certification, approval, endorsement, legal compliance, or continuing conformity unless a separate authorized process expressly establishes such status.

5.31 Infrastructure Quality Claim Scope

The defined scope and limits within which an Infrastructure Quality Claim Statement is intended to be valid.

Note 1. The scope should identify the Infrastructure Quality Object, Scale, physical and functional extent, lifecycle or evaluation period, operating conditions, relevant internal and external Boundaries, and relevant internal and external Interfaces included, excluded, or treated as

external dependencies, together with applicable criteria, Evidence basis, relevant Evidence Quality limitations, Assumptions, Uncertainty, Unresolved Conditions, and conditions of continued validity.

Note 2. Infrastructure Quality Claim Scope is an IQI Applied Concept used to make the bounded nature of an infrastructure Quality Claim explicit; WQI_VOC1 Revision 2.1 does not define Quality Claim Scope as a Root Concept.

5.32 Infrastructure Technology Governance

The infrastructure-specific allocation and exercise of responsibility, authority, controls, oversight, and accountability for the selection, integration, validation, use, modification, monitoring, cybersecurity-relevant control, and retirement of technology that affects an Infrastructure Quality Object or its Quality Determination.

Note 1. Technology may support operation, control, monitoring, evidence, analysis, and decision-making, but it does not by itself establish Infrastructure Quality.

Note 2. Responsibility for infrastructure decisions and Quality Claims remains with accountable parties regardless of automation or model use.

Note 3. Governance should address limitations, uncertainty, misleading outputs, incomplete information, change control, and the consequences of technology-enabled decisions.

5.33 Infrastructure Evidence Continuity

The maintained availability, Traceability, interpretability, integrity, and transfer of infrastructure Evidence across lifecycle stages, modifications, organizational changes, responsibility transfers, and changes in technology or record systems.

Note 1. Infrastructure Evidence Continuity is not limited to document retention; Evidence should remain connected to the relevant object, configuration, Boundary, Indicator, Criterion, time, source, transformations, and use where those relationships are material to Evidence Quality or the Quality Determination.

Note 2. Loss of Evidence Continuity may reduce Evidence Quality, create Uncertainty or an Unresolved Condition, cause a failed Structural Checkpoint, or limit an Infrastructure Quality Determination or Quality Claim. Evidence Continuity supports Evidence Quality but does not by itself establish Evidence Sufficiency, Evidence Trustworthiness, or Evidence Applicability.

Note 3. Evidence Continuity should preserve Traceability across relevant Interfaces, including Evidence of transfer, receipt, interpretation, acceptance, action, and responsibility where these are material to Function Realization or the evidentiary use being made.

6 Rules for IQI Applied Vocabulary Use and Development

6.1 Adoption of WQI-Controlled Concepts

IQI documents shall adopt WQI Root Concepts and supporting WQI-controlled concepts with their authoritative definitions and classifications established in WQI_VOC1. Application notes may explain infrastructure use, but shall not create a competing meaning or promote a supporting controlled concept to a Root Concept.

6.2 Introduction of Infrastructure Applied Concepts

A new IQI Applied Concept may be introduced only when energy-infrastructure application requires language not already provided by WQI_VOC1. The definition shall identify its relationship to the relevant WQI Root Concept or supporting WQI-controlled concept where such a relationship exists.

6.3 Qualified and Unqualified Terms

An unqualified WQI-controlled term such as Quality State, Evidence Quality, or Critical Condition retains its WQI_VOC1 meaning. A qualified term such as Infrastructure Quality State or Critical Infrastructure Condition adds infrastructure-specific scope while preserving the governing WQI meaning.

6.4 Core Invariance

IQC1 Intended Function, Core Quality Factors, and Core Quality Indicators shall remain invariant across Context Guides. A Context Guide may interpret, organize, or provide context-specific criteria and Evidence for them, but shall not rename, redefine, omit, or replace them in a manner that changes the Core architecture.

6.5 Context Guide Interpretation

A Context Guide shall use this Applied Vocabulary to identify and interpret the Infrastructure Quality Object, object description, Structural Checkpoints, Boundaries, Interfaces, lifecycle and operating conditions, infrastructure realization pathways, Infrastructure Work, Infrastructure Results, Infrastructure Outcomes, Failure Modes, Context-Specific Quality Outcome Criteria, Evidence and applicable Evidence Quality, Critical Infrastructure Conditions, Uncertainty, Quality State, and Quality Claim scope relevant to the Context.

6.6 Stabilized Terminology Rules

- Use Management System and Management System Quality with their authoritative WQI_VOC1 meanings. Do not redefine them as IQI Applied Concepts; the IQI Management System Quality Core Standard establishes their invariant energy-infrastructure application architecture.
- Use Quality State and Infrastructure Quality State rather than status, rating, condition score, or certification label when the Whole Quality concept is intended.
- Use Quality Determination for the structured application of Whole Quality that establishes the Quality State of a defined Quality Object. Use Infrastructure Quality Determination when the infrastructure-specific applied form is needed.
generic quality determination where the structured Whole Quality process is intended.
- Use Infrastructure Quality Object consistently as the defined object whose Quality State is being determined.
- Use Quality Outcome Criterion for the expected condition or result and Quality Indicator for what is examined; do not treat the terms as interchangeable.
- Use Evidence, Evidence Quality, Evidence Sufficiency, Evidence Trustworthiness, and Evidence Applicability with their WQI_VOC1 meanings. Evidence Sufficiency asks whether there is enough support; Evidence Trustworthiness asks whether the Evidence can be relied upon as representing what it purports to represent; Evidence Applicability asks whether it can properly support the particular Finding and Quality Determination. Use Evidence-Supported Finding for a bounded Finding justified by applicable Evidence before Quality Factor Interpretation.

- Use Critical Condition and Non-Compensability for the Root concepts; use Critical Infrastructure Condition and Infrastructure Non-Substitutability when the infrastructure-specific applied form is needed.
- Use infrastructure realization pathway rather than engineering approach where the concept concerns alternative pathways for realizing the same intended infrastructure function.
- Use Infrastructure Result for what is actually produced, maintained, changed, or made available. Use Infrastructure Outcome for the bounded combination Infrastructure Work + Infrastructure Result. Do not use Outcome as a synonym for Result.
- Use the principal lifecycle sequence Design - Construction - Commissioning - Operation - Maintenance - Repair/Modification - Decommissioning/Transition unless a document expressly identifies a context-specific sub-stage.

6.7 Cross-References and Reproduction

IQC1, the IQI Management System Quality Core Standard, Context Guides, diagrams, tools, and related documents should cross-reference the authoritative WQI or IQI definition. Reproduction may be used for usability only when wording is unchanged and the authoritative source is clearly identified.

6.8 Controlled Evolution

Changes to IQI Applied Concepts require assessment of effects on IQC1, the IQI Management System Quality Core Standard where applicable, Context Guides, diagrams, tools, Quality Determination logic, claim structures, and application-specific terminology. Changes should be edition-controlled, traceable, and proportionate to demonstrated infrastructure need.

7 Scope, Applicability, and Exclusions

7.1 Scope

This Standard applies to vocabulary used within the Infrastructure Quality Initiative for energy infrastructure and related energy-system applications of the Whole Quality methodology.

7.2 Applicability

The vocabulary is principally applicable to energy infrastructure assets, facilities, networks, zones, subsystems, lifecycle programs, interface conditions, asset populations, and systems-of-systems at different Scales, provided the Infrastructure Quality Object, Boundaries, Context, Evidence basis, Evidence Quality, and claim scope are declared or sufficiently established for the intended Quality Determination.

- oil, natural gas, LNG, CNG, hydrogen, and related production, gathering, processing, conversion, storage, transport, distribution, and fuel-station infrastructure;
- electric power generation, transmission, distribution, storage, and related energy-conversion infrastructure;
- interfaces between energy infrastructure and water, communications, transportation, industrial, environmental-protection, and other critical systems where those interfaces affect energy- function realization or consequences;

- energy-infrastructure lifecycle programs, modifications, asset populations, and interface conditions where a bounded Infrastructure Quality State or Quality Claim is intended. Application of this edition to a non-energy infrastructure domain as an independent field is outside its principal scope and would require controlled vocabulary review.
- Management Systems used by organizations to design, manufacture, construct, install, inspect, test, commission, operate, maintain, repair, modify, decommission, or provide other technical or professional products and services for energy infrastructure, where the Management System is declared as the Quality Object under the applicable IQI Management System Quality Core Standard.

7.3 Relationship to Laws, Regulations, Codes, and Contracts

This Standard does not replace or modify applicable laws, regulations, permits, contracts, engineering codes, technical standards, professional duties, or operator requirements. Such sources may contribute to the Applicable Basis, the Reference Layer, or both, depending on the methodological role they perform in the particular infrastructure application.

7.4 Exclusions

This Standard does not establish:

- technical design rules, engineering calculations, or prescribed infrastructure realization pathways;
- asset-specific operating limits, inspection methods, acceptance thresholds, or maintenance intervals;
- regulatory compliance or legal determinations;
- procurement specifications, management-system requirements, or commercial product criteria;
- certification schemes, accreditation requirements, audit protocols, or authorization to make any particular Quality Claim; or
- context-specific Quality Outcome Criteria except as illustrative examples in informative material.

Annex A (informative) - WQI Root-to-IQI Applied Vocabulary Matrix

The following matrix illustrates how selected WQI Root Concepts and supporting WQI-controlled concepts are adopted and extended within IQI for energy-infrastructure application. The WQI definition and classification remain authoritative for every WQI-controlled concept.

WQI-Controlled Concept / Status	IQI Applied Concept	Infrastructure Application
Quality Object	Infrastructure Quality Object	Declares the asset, facility, network, subsystem, zone, program, interface condition, population, or system-of-systems under determination.
Quality Object Description	Infrastructure Quality Object Description; Structural Checkpoint	Adds infrastructure composition, configuration, operating medium, lifecycle condition, responsibilities, and a completeness checkpoint.
Boundary; Interface; Boundary Transparency; Interface Transparency	No separate Applied Concept presently required	Governs identification of internal and external infrastructure limits, connections, transfers, dependencies, and the visibility needed to interpret Function Realization and Evidence.
Intended Function	Infrastructure Intended Function	Represents what the Infrastructure Quality Object is required or intended to do.
Intended Result	Infrastructure Intended Result	Defines the required or intended infrastructure condition, output, continuity, protection, or control state.
Lifecycle	Infrastructure Lifecycle Stage; Infrastructure Lifecycle Gate / Quality Gate	Applies the WQI-controlled Lifecycle concept through the principal IQI lifecycle sequence; IQI separately defines Infrastructure Lifecycle Gate / Quality Gate as an Applied Concept for infrastructure transition reviews.
Quality Factor; Quality Indicator	Core Quality Factor; Core Quality Indicator	Identifies IQC1 invariants interpreted, but not replaced, by Context Guides.
Quality Outcome Criterion	Context-Specific Quality Outcome Criterion	Connects a Core Quality Indicator to expected infrastructure conditions and the applicable Reference Layer.
Critical Condition; Non-Compensability	Critical Infrastructure Condition; Infrastructure Non-Substitutability	Prevents satisfactory findings elsewhere from offsetting a failed or unresolved non-compensable infrastructure condition.
Quality State; Quality Determination	Infrastructure Quality State; Infrastructure Quality Determination	Applies the WQI determination sequence to a defined Infrastructure Quality Object.
Quality Claim	Infrastructure Quality Claim Statement; Infrastructure Quality Claim Scope	Communicates one or more bounded infrastructure conclusions without exceeding the scope, certainty, or support of the Infrastructure Quality Determination.
No corresponding WQI Root Concept	Infrastructure Technology Governance	IQI controls Infrastructure Technology Governance as an Applied Concept for responsibility and control of infrastructure operation, monitoring, models, software, automation, and Evidence systems.
Evidence; Evidence Quality; Evidence Sufficiency; Evidence Trustworthiness;	Infrastructure Evidence Continuity	Applies the WQI Evidence Quality architecture to infrastructure Evidence and adds lifecycle continuity across stages, modifications, organizations, responsibility transfers, technologies, and Interfaces. Evidence Continuity supports but does not

WQI-Controlled Concept / Status	IQI Applied Concept	Infrastructure Application
Evidence Applicability		replace evaluation of Sufficiency, Trustworthiness, or Applicability.
Management System	No separate IQI Applied Concept presently required	Applies the WQI-controlled definition to the actual management used by an organization to produce a required energy-infrastructure product or provide a required energy-infrastructure service.
Management System Quality	No separate IQI Applied Concept presently required	Applies the WQI-controlled definition to determination of the degree to which the declared Management System realizes its Intended Function under the IQI Management System Quality Core Standard.

A.1 Cross-Platform Work-Result-Outcome Alignment Note

Infrastructure Work, Infrastructure Result, and Infrastructure Outcome are included in this edition to make IQI comparable with the AMSI Work-Result-Service relationship. Because the underlying relationship may be cross-domain, it should be reviewed for later stabilization in WQI_VOC1. Until that review is completed, these terms remain IQI Applied Concepts.

Annex B (informative) - Structural Checkpoints and Conceptual Dependency Map

B.1 Purpose

This Annex provides practical questions for confirming object-description completeness and for reading the IQI conceptual dependency. It is informative and does not replace IQC1 or a Context Guide.

B.2 Structural Checkpoint Questions

- Is the Infrastructure Quality Object clearly named and classified?
- Is the Scale of the object clear, including whether it is an asset, facility, network, subsystem, zone, program, interface condition, asset population, or system-of-systems?
- Is the relevant physical, functional, informational, and organizational composition sufficiently described?
- Are the Infrastructure Intended Functions and Infrastructure Intended Results identified?
- Are the relevant Infrastructure Configuration, Infrastructure Operating Medium, and Infrastructure Operating Conditions identified?
- Is the external Boundary of the defined Infrastructure Quality Object identifiable?
- Are material internal Boundaries identifiable?
- Are relevant internal and external Interfaces identifiable?
- Does internal or external classification follow the defined Infrastructure Quality Object and Scale?
- Are the applicable Infrastructure Lifecycle Stage and any transition condition identified?
- Are relevant responsibility arrangements and Evidence sources identified, including information needed to evaluate Evidence Quality where material?
- Are Boundary Transparency and Interface Transparency sufficient for detailed interpretation to begin?
- Is it clear what materials, energy, information, authority, responsibility, Evidence, risk, or effects pass or are realized through each material Interface?
- Are changes in Boundaries or Interfaces across lifecycle stages visible?
- Are known assumptions, Uncertainty, Unresolved Conditions, and changes from earlier lifecycle descriptions visible?
- Is the description sufficient for the intended Quality Determination and proposed Quality Claim scope?

B.3 Conceptual Dependency Questions

- What is the Infrastructure Quality Object, and has its description passed the Structural Checkpoints?
- What is inside and outside the external Boundary?
- What internal Boundaries distinguish material constituents, functions, responsibilities, or conditions?
- Through which internal and external Interfaces does the object interact and realize its functions?
- Are Boundary Transparency and Interface Transparency sufficient for responsible interpretation?
- What Infrastructure Intended Functions and Infrastructure Intended Results apply to the defined Infrastructure Quality Object? What Applicable Basis establishes or justifies them, including any priority among multiple Intended Functions or Intended Results?

- How is Function Realization expected to occur, and what Methodological Resolution is adequate for the intended Infrastructure Quality Determination?
- Which Infrastructure Realization Pathway and configuration are relevant?
- What Infrastructure Work is performed, and what Infrastructure Result is produced, maintained, changed, or made available?
- What Infrastructure Outcome is formed by the Work-Result combination, and does it take the form of a product, service, or maintained or changed condition or capability?
- How can the intended functions or results fail, degrade, become unstable, or remain unproved?
- How do the IQC1 Core Quality Factors represent the major dimensions of Function Realization?
- How do the Core Quality Indicators identify what should be examined to understand those dimensions?
- Which Context-Specific Quality Outcome Criteria define the expected states or results?
- What Evidence supports the Findings; is the Evidence sufficient, trustworthy, and applicable for each Finding and the intended Infrastructure Quality Determination; and is relevant Infrastructure Evidence Continuity preserved across lifecycle stages and Interfaces?
- Where multiple Infrastructure Intended Functions or Infrastructure Intended Results are examined, is the Evidence sufficient, trustworthy, and applicable for each Finding it is used to support? What Uncertainty, Assumptions, Unresolved Conditions, Critical Infrastructure Conditions, and non-compensable conditions remain?
- What Infrastructure Quality State can responsibly be established through the Infrastructure Quality Determination?
- What bounded Infrastructure Quality Claim Statement or Statements can responsibly be communicated, and does each remain within the scope, certainty, and support of the Infrastructure Quality Determination?

B.4 Relationship to Context Guides

An IQI Infrastructure Context Guide or Management System Context Guide should use the applicable questions and governing vocabulary to organize context-specific interpretation while preserving WQI Root meanings, supporting WQI-controlled meanings, IQI Applied meanings, and the invariants of the applicable IQI Core Standard. Context Guide use does not authorize redefinition of concepts, omission or replacement of Core Quality Factors or Core Quality Indicators, or expansion of a Quality Claim beyond the supporting Evidence, Evidence-Supported Findings, Quality Determination, and declared Boundary.

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