



Infrastructure Quality Applied Vocabulary Standard

IQI STANDARD VOC1

Second Draft Edition - Updated July 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. Quality, Quality Object, Boundary, Interface, Quality Factor, Quality Indicator, Quality Outcome Criterion, Evidence, Critical Condition, Quality State, Quality State Determination, and Quality Claim belong to the WQI Root Vocabulary. IQI uses those terms with their authoritative WQI meanings and extends them through applied concepts such as Infrastructure Quality Object, Structural Checkpoint, Infrastructure Realization Pathway, Core Quality Factor, Critical Infrastructure Condition, Infrastructure Quality State, and Infrastructure Quality Claim Statement.

This updated Second Draft Edition therefore removes duplicated Root definitions from the earlier IQI_VOC1 structure and replaces them with controlled references to WQI_VOC1. It also aligns IQI vocabulary with the invariant architecture of IQC1 and with terminology tested through IQI Context Guides for natural gas production and processing, pipelines, local distribution, underground storage, LNG and CNG facilities, and energy-conversion infrastructure.

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 State determination and bounded Quality Claims concerning energy infrastructure.

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Revision and Development Note

This updated Second Draft Edition restructures IQI_VOC1 as an Applied Vocabulary under the document architecture established by the Whole-Quality Institute: Foundational Articles explain, the WQI Root Vocabulary defines, Applied Vocabularies extend, Core Standards require, and Context Guides interpret.

The principal changes are:

- repositioning IQI_VOC1 from a partly duplicated foundational glossary to an Applied Vocabulary centered on energy infrastructure;
- removal of definitions that now belong exclusively to WQI_VOC1 and replacement of those definitions with controlled Root Concept references;
- addition or stabilization of Infrastructure Quality Object Description, Structural Checkpoint, Infrastructure System-of-Systems, Infrastructure Configuration, Infrastructure Realization Pathway, Infrastructure Result, the Work-Result-Outcome relationship, Core Quality Factor, Core Quality Indicator, Context-Specific Quality Outcome Criterion, Critical Infrastructure Condition, Infrastructure Non-Substitutability, Infrastructure Quality State, Infrastructure Quality State Determination, Infrastructure Quality Claim Statement, and Infrastructure Evidence Continuity;
- standardization of the principal infrastructure lifecycle sequence as Design - Construction - Commissioning - Operation - Maintenance - Repair/Modification - Decommissioning/Transition;
- consistent use of Quality State, Quality State determination, Infrastructure Quality Object, Quality Outcome Criterion, Evidence-Supported Finding, Critical Condition, and bounded Quality Claim terminology;
- replacement of the earlier expression engineering approaches with the preferred term infrastructure realization pathways where the concept concerns alternative means of realizing the same intended infrastructure function; and
- alignment with IQC1 invariants and the role of Context Guides as interpretation documents that do not redefine Root Concepts or create alternative Core Quality Factors and Core Quality Indicators.

The Work-Result-Outcome relationship is introduced in this IQI Applied Vocabulary for cross-platform comparability. Because the same relationship may apply to AMSI and future Whole Quality platforms, it should be reviewed for later stabilization in WQI_VOC1. Until that review, Infrastructure Result and Infrastructure Outcome are treated as IQI Applied Concepts without modifying WQI Root definitions.

This update remains within the Second Draft Edition. A Third Draft Edition is intended after completion and controlled alignment review of the planned IQI Context Guides.

This edition remains a vocabulary standard. It does not establish technical requirements, asset-specific criteria, certification procedures, audit protocols, engineering calculations, or regulatory interpretations.

1 Introduction

1.1 Purpose

The purpose of this Standard is to establish authoritative definitions for Applied Concepts required to represent energy infrastructure and to define how WQI Root Concepts are adopted and used within the Infrastructure Quality Initiative.

1.2 Position Within the Whole Quality Architecture

IQI_VOC1 occupies the Applied Vocabulary layer of the Whole Quality document architecture. It follows WQI Foundational Articles and WQI_VOC1 and precedes IQC1 and IQI Context Guides.

- WQI Foundational Articles explain the methodology and its development.
- WQI_VOC1 defines Root Concepts that remain invariant across application domains.
- IQI_VOC1 extends the Root Vocabulary with Applied Concepts for energy infrastructure.
- IQC1 establishes invariant energy-infrastructure quality architecture and requirements.
- IQI Context Guides interpret IQC1 within bounded energy-infrastructure contexts.

1.3 One Concept - One Authoritative Definition

Each Whole Quality concept has one authoritative definition at the document layer appropriate to that concept. A Root Concept is defined in WQI_VOC1. An infrastructure Applied Concept is defined in this Standard. IQC1 and Context Guides use and cross-reference those definitions; they do not redefine them.

1.4 Relationship to WQI_VOC1

IQI_VOC1 adopts WQI Root Concepts without modification. Where infrastructure explanation is needed, this Standard provides an application note or defines a distinct Applied Concept whose relationship to the relevant Root Concept is explicit.

Where a Root term appears in an IQI document without an infrastructure qualifier, the WQI_VOC1 definition governs its meaning.

1.5 Relationship to IQC1

IQC1 establishes the invariant intended-function architecture, Core Quality Factors, Core Quality Indicators, evidence principles, Critical Conditions, non-compensability logic, Quality State determination requirements, and permissible Quality Claim structure for Infrastructure Quality Objects.

This Applied Vocabulary defines the energy-infrastructure-specific terms needed to interpret IQC1 consistently. It does not replace IQC1 and does not independently establish the complete Core architecture or asset-specific Quality Outcome Criteria.

1.6 Relationship to Context Guides

IQI Context Guides interpret IQC1 for defined energy-infrastructure contexts. They identify the Infrastructure Quality Object, object description, boundaries, interfaces, lifecycle conditions, infrastructure realization pathways, failure modes, context-specific Quality Outcome Criteria, evidence sources, Critical Conditions, uncertainties, and Quality Claim boundaries relevant to the context.

Context Guides do not alter Root definitions, change the invariant Intended Function, or create alternative Core Quality Factors or Core Quality Indicators.

1.7 Energy-Infrastructure Asset-Level and System-of-Systems Anchoring

IQI vocabulary is anchored in the declared Infrastructure Quality Object within the energy-infrastructure domain. The object may be an energy asset, facility, network, subsystem, zone, lifecycle program, interface condition, asset population, or energy infrastructure system-of-systems.

Individual components, activities, documents, tests, or compliance findings may provide evidence, but they do not by themselves determine the Quality State of a broader assembled object.

1.8 Intended Use

This Standard is intended to support consistent drafting, review, interpretation, comparison, revision, and expansion of IQI Core Standards, Context Guides, diagrams, tools, Quality State determinations, and Quality Claim Statements for energy infrastructure.

2 Reference Documents

- WQI_VOC1 - Whole Quality Root Vocabulary Standard, current draft edition.
- WQI Foundational Articles 1-8, including FTA5 - One Root Vocabulary, Many Applied Vocabularies, Second Edition.
- IQC1 - Infrastructure Quality Standard - Core, 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 State 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 Reference Layer for a defined infrastructure application. 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, and bounded infrastructure claims.

3.2 Principal IQI Dependency

The principal IQI dependency is:

Infrastructure Quality Object and Infrastructure Quality Object Description -> Structural Checkpoints -> Boundaries and Interfaces -> Infrastructure Intended Functions and Infrastructure Intended Results -> Failure-Mode Families -> Core Quality Factors -> Core Quality Indicators -> Context-Specific Quality Outcome Criteria -> Evidence-Supported Findings -> Quality Factor Interpretation -> Critical-Condition and Non-Compensability Review -> Infrastructure Quality State -> Infrastructure Quality Claim Statement

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 State 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 State determination begins with declaration and description of the Infrastructure Quality Object. The object controls the relevant functions, results, scale, composition, boundaries, interfaces, lifecycle conditions, configuration, operating medium, evidence, uncertainty, Critical Conditions, Quality State, and permissible claim scope.

3.5 Structural Completeness Before Interpretation

Structural Checkpoints confirm that the object description is sufficiently complete before interpretation proceeds. They prevent an incomplete or ambiguously bounded object from being carried forward into factor interpretation, evidence review, Quality State determination, or Quality Claims.

3.6 Core Invariance and Context Specificity

The IQC1 Intended Function, Core Quality Factors, and Core Quality Indicators are invariant across IQI 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.

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

The same Applied Vocabulary may be used at different energy-infrastructure scales, but evidence and claims are not automatically transferable between scales or lifecycle conditions. A component finding does not determine the Quality State of an assembled facility or network, and a system-level claim does not automatically describe every subsystem or component.

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 Root Concepts Adopted by Reference

4.1 Governing Rule

All WQI Root 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, Boundary, Interface, Boundary Transparency, Scale, Context, 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 State, and Quality State Determination.

4.4 Evidence, Uncertainty, and Reference Concepts

IQI adopts by reference the WQI_VOC1 definitions of Evidence, Evidence Sufficiency, Reference Layer, Uncertainty, Unresolved Condition, Assumption, Assumption Drift, Absence of Observed Failure, Data, Technology, and Technology Governance.

4.5 Lifecycle, Claim, and Document-Architecture Concepts

IQI adopts by reference the WQI_VOC1 definitions of Lifecycle, Lifecycle Gate, Stakeholder / Interested Party, Quality Claim, Quality Claim Boundary, Applied Vocabulary, Applied Concept, Core Standard, Context Guide, Context-Specific Interpretation, Authoritative Definition, and Conceptual Dependency.

4.6 Non-Definitional Application Notes

IQI documents may explain how a Root Concept applies to infrastructure, identify infrastructure examples, or use a qualified Applied Concept. Such explanation shall preserve the Root 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 State is being determined.

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

Note 2. The object declaration controls what is included, excluded, observed, interpreted, and claimed.

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.

5.2 Infrastructure Quality Object Description

A structured 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, and evidence basis for the intended Quality State 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.

5.3 Structural Checkpoint

An IQI completeness checkpoint used to confirm that the declared Infrastructure Quality Object and its description are sufficiently developed for quality interpretation to proceed.

Note 1. Structural Checkpoints are performed before detailed interpretation of boundaries, 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 declared object boundary.

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

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.

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 State 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 sufficiency, Critical Conditions, and the Quality State.

5.9 Infrastructure Intended Function

The infrastructure-specific form of Intended Function: what an Infrastructure Quality Object is expected to receive, contain, separate, treat, process, compress, transport, store, distribute, convert, generate, isolate, control, monitor, protect, maintain, transition, or otherwise realize within a defined context.

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.

5.10 Infrastructure Intended Result

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

Note 1. An intended result is an expected state or effect, 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 declared 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 declared 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 declared 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 object realizes its Infrastructure Intended Functions and Infrastructure Intended Results within declared boundaries and interfaces, including the quality significance of relevant Infrastructure Work, Infrastructure Results, and Infrastructure Outcomes, as interpreted against applicable Quality Outcome Criteria and supported by sufficient Evidence.

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

Note 2. Where the declared 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 State determination in a later stage.

5.19 Infrastructure Lifecycle Gate / Quality Gate

The infrastructure applied form of Lifecycle Gate: a defined transition or decision point between Infrastructure Lifecycle Stages at which specified evidence, responsibilities, assumptions, unresolved conditions, Critical 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.

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, boundary review, evidence review, and Quality State 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 declared 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 that defines an expected condition, result, relationship, threshold, prohibited condition, tolerance, or evidence-supported state for a Core Quality Indicator within a declared infrastructure context.

Note 1. The Criterion may be drawn from or 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. A Criterion should identify the object, boundary, lifecycle and operating conditions, evidence expectations, and claim relevance needed for responsible interpretation.

5.26 Critical Infrastructure Condition

An infrastructure-specific Critical Condition whose absence, failure, violation, loss of visibility, or unresolved status prevents a responsible positive Infrastructure Quality State determination or Infrastructure Quality Claim Statement, regardless of satisfactory findings elsewhere.

Note 1. A Critical Infrastructure Condition may concern system behavior, containment, separation, control, interface integrity, essential function, consequence prevention, evidence sufficiency, 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 evidenced 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, 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 for different boundaries, scales, lifecycle stages, operating conditions, or periods of the same broader infrastructure system.

5.29 Infrastructure Quality State Determination

The application of WQI Quality State Determination to an Infrastructure Quality Object, including derivation of Evidence-Supported Findings, Quality Factor Interpretation, Critical-Condition and Non-Compensability Review, and establishment of the 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, uncertainty, and declared limitations.

Note 2. Infrastructure Quality State 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, Quality Factor Interpretation, or other evidence-supported quality conclusion about a defined Infrastructure Quality Object.

Note 1. The statement should identify the object, scale, boundary, lifecycle and operating conditions, applicable criteria, evidence basis, included and excluded interfaces, assumptions, uncertainty, unresolved conditions, Critical Infrastructure Conditions, limitations, and conditions of continued validity.

Note 2. An Infrastructure Quality Claim Statement shall not exceed the Infrastructure Quality State determination from which it is derived.

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 Boundary

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

Note 1. The boundary should identify the Infrastructure Quality Object, scale, physical and functional extent, lifecycle or evaluation period, operating conditions, included and excluded interfaces, applicable criteria, evidence basis, assumptions, uncertainty, unresolved conditions, and conditions of continued validity.

Note 2. The Infrastructure Quality Claim Boundary is the IQI applied form of the WQI Root Concept Quality Claim Boundary.

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 State 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 must remain connected to the relevant object, configuration, boundary, Indicator, Criterion, time, and decision.

Note 2. Loss of evidence continuity may create uncertainty, an Unresolved Condition, a failed Structural Checkpoint, or a limitation on Infrastructure Quality State determination and claims.

6 Rules for IQI Applied Vocabulary Use and Development

6.1 Adoption of Root Concepts

IQI documents shall adopt WQI Root Concepts and their authoritative definitions without modification. Application notes may explain infrastructure use, but shall not create a competing meaning.

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 Root Concept where such a relationship exists.

6.3 Qualified and Unqualified Terms

An unqualified Root term such as Quality State 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 Root 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, Critical Infrastructure Conditions, uncertainty, Quality State, and Quality Claim boundary relevant to the context.

6.6 Stabilized Terminology Rules

- 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 State determination and Infrastructure Quality State Determination rather than a generic quality determination where the structured Whole Quality process is intended.

- Use Infrastructure Quality Object consistently as the declared 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-Supported Finding for a bounded finding justified by available 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, 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, Context Guides, diagrams, tools, Quality State determination logic, claim structures, and any 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, and claim scope are declared.

- 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.

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 form part of the Reference Layer for context-specific interpretation.

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 are adopted and extended within IQI for energy-infrastructure application. The WQI definition remains authoritative for every Root Concept.

WQI Root Concept	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.
Intended Function	Infrastructure Intended Function	Represents infrastructure functions such as containment, separation, treatment, transport, storage, conversion, control, protection, and transition.
Intended Result	Infrastructure Intended Result	Defines the expected infrastructure condition, output, capability, continuity, protection, or control state.
Lifecycle; Lifecycle Gate	Infrastructure Lifecycle Stage; Infrastructure Lifecycle Gate / Quality Gate	Uses the principal IQI lifecycle sequence and infrastructure transition reviews.

WQI Root Concept	IQI Applied Concept	Infrastructure Application
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 State Determination	Infrastructure Quality State; Infrastructure Quality State Determination	Applies the WQI determination sequence to a declared Infrastructure Quality Object.
Quality Claim; Quality Claim Boundary	Infrastructure Quality Claim Statement; Infrastructure Quality Claim Boundary	Communicates a bounded infrastructure conclusion without exceeding the supporting determination.
Technology Governance	Infrastructure Technology Governance	Applies responsibility and control to infrastructure operation, monitoring, models, software, automation, and evidence systems.
Evidence	Infrastructure Evidence Continuity	Addresses lifecycle traceability, availability, interpretability, integrity, and transfer of infrastructure Evidence.

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, operating medium, and operating conditions identified?
- Are the boundaries and interfaces sufficiently identifiable for detailed interpretation to begin?
- Is the applicable Infrastructure Lifecycle Stage or transition condition identified?

- Are relevant responsibility arrangements and evidence sources identified?
- Are known assumptions, uncertainty, unresolved conditions, and changes from earlier lifecycle descriptions visible?
- Is the description sufficient for the intended Quality State 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 its boundaries?
- Where and how does it interact through interfaces?
- What Infrastructure Intended Functions and Infrastructure Intended Results define its purpose?
- 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 make those dimensions observable?
- Which Context-Specific Quality Outcome Criteria define the expected states or results?
- What Evidence supports the findings, and is it sufficient and continuous across the relevant lifecycle?
- What uncertainty, assumptions, Unresolved Conditions, and Critical Infrastructure Conditions remain?
- What Infrastructure Quality State can responsibly be determined after Quality Factor Interpretation and Critical-Condition and Non-Compensability Review?
- What bounded Infrastructure Quality Claim Statement can responsibly be communicated?

B.4 Relationship to Context Guides

A Context Guide should use these questions to organize context-specific interpretation while preserving WQI Root meanings and IQC1 invariants. The questions do not authorize a guide to redefine concepts, omit Core Quality Factors or Core Quality Indicators, or expand a Quality Claim beyond the supporting evidence and declared boundary.

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