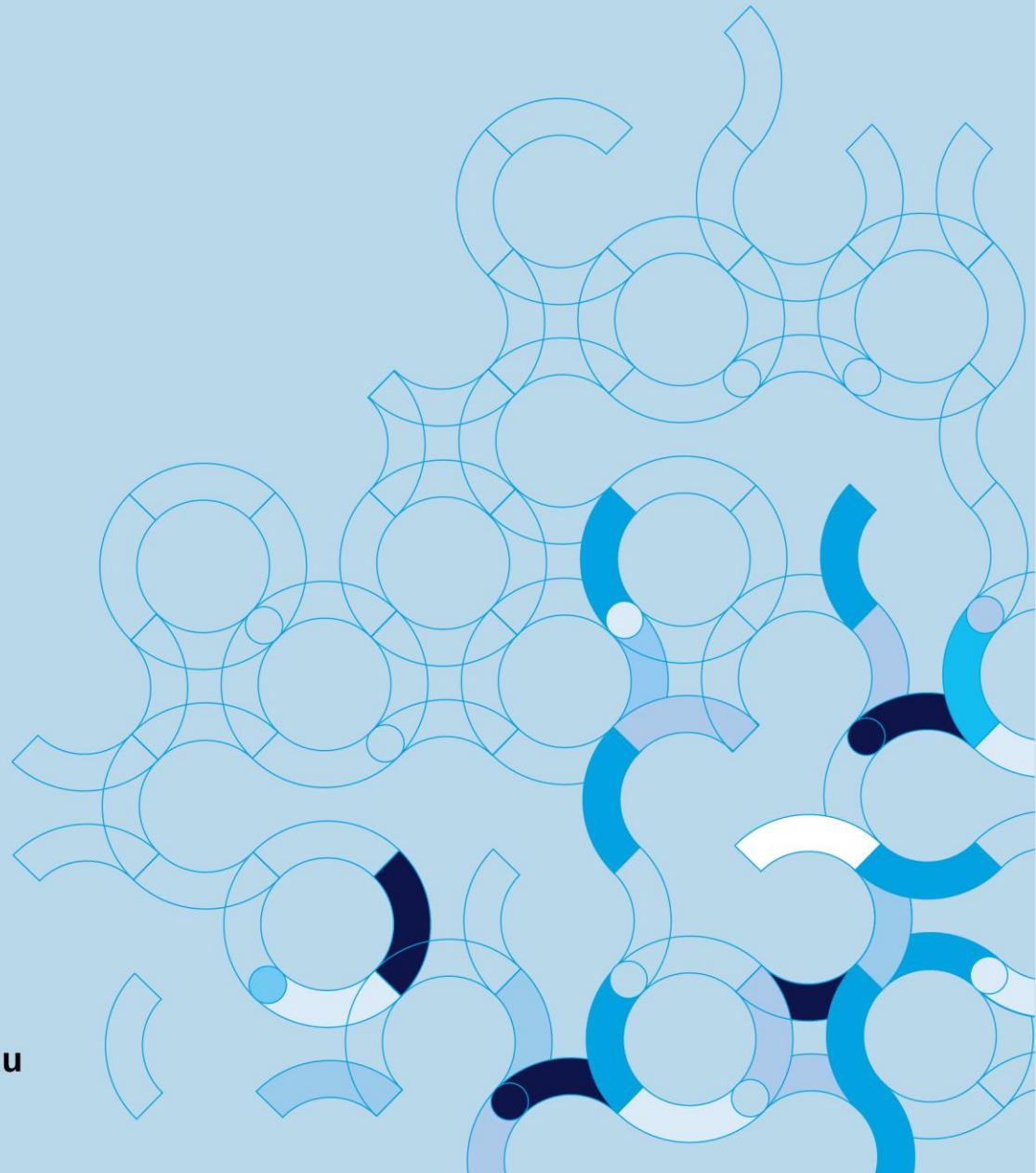
STD-SPE-G-024

Technical Specification

ENGINEERING DESIGN STANDARD

October 2025



iconwater.com.au

© 2025 Icon Water Limited (ABN 86 069 381 960)

This publication is copyright and contains information that is the property of Icon Water Limited. It may be used and reproduced only for the purposes of designing and constructing assets which will, if accepted by Icon Water, form part of Icon Water's water/wastewater networks and facilities (Icon Water Purposes).

Disclaimer

This document has been prepared for Icon Water Limited for the Icon Water Purposes only. Icon Water does not make any warranties or representations in relation to or assume any duty of care with respect to and is otherwise not responsible for the suitability of this document for any purpose other than the Icon Water Purposes.

talktous@iconwater.com.au | (02) 6248 3111 | **iconwater.com.au**

Document management

Document authorisation table

Issue	Date	Author	Reviewer	Approver
A	15/03/25	S. Asadollahi	Various	S. Asadollahi
1	27/10/25	M. Bursle	S. Asadollahi	S. Asadollahi

Version control table

Issue	Date	Reason for issue
A	15/03/25	Commentary — issued as full draft for internal use.
1	27/10/25	Issued for use

Document applicability table

Asset area	Applicable (Yes/No)	Asset area	Applicable (Yes/No)
Dams (DAM)	**Yes**	Water Network (WAT)	**Yes**
Bulk Water Supply (BWS)	**Yes**	Sewerage Network (SEW)	**Yes**
Water Treatment Plants (WTP)	**Yes**	Sewage Pump Stations (SPS)	**Yes**
Water Pump Stations (WPS)	**Yes**	Sewage Treatment Plants (STP)	**Yes**
Reservoirs (RES)	**Yes**	Recycled Water Systems (REC)	**Yes**

Contents

Table of abbreviations

Abbreviation	Meaning
ACT	Australian Capital Territory
BIM	Building Information Modelling
BoQ	Bill of Quantities
BWS	Bulk Water Supply
CAD	Computer Aided Design
CHAIR	Construction Hazard Assessment and Implications Review
CHAZOP	Control Hazard and Operability Study
CP	Cathodic Protection
D&C	Design and Construct
DAM	Dams
DCN	Design Change Note
DMP	Design Management Plan
DOAR	Design Opportunity and Risk
DTQR	Design Technical Quality Review
DTC	Design then Construct
ECI	Electrical, Control and Instrumentation
EPA	Environment Protection Authority
FMECA	Failure Modes Effects and Criticality Analysis
GA	General Arrangement
HAZID	Hazard Identification
HAZOP	Hazard and Operability Study
IFC	Issued for Construction
IFT	Issued for Tender
IMH	Inspection Maintenance Hole

Abbreviation	Meaning
IPaD	Investment Planning and Delivery
IPR	Independent Peer Review
IW	Icon Water
JV	Joint Venture
MCA	Multi Criteria Analysis
MCC	Motor Control Centre
MH	Maintenance Hole
O&M	Operations and Maintenance
PE	Polyethylene
PESA	Professional Engineering Services Agreement
PFD	Process Flow Diagram
P&ID	Piping and Instrumentation Diagram
QA	Quality Assurance
REC	Recycled Water Systems
RES	Reservoirs
RPZD	Reduced Pressure Zone Device
SEW	Sewerage Network
SiD	Safety in Design
SPS	Sewage Pump Station
STP	Sewage Treatment Plant
TA	Technical Authority
TCCS	Transport Canberra and City Services
URS	User Requirements Specification
WAE	Work as Executed
WAT	Water Network
WBS	Work Breakdown Structure

Definitions

Keyword	Definition
Acceptance	The act of endorsing or adding positive authorisation or both for apparent correctness, and to receive with consent.
Approver	Technical Authority who certifies the design has followed authorised processes and meets requirements and is ready for acceptance
Assessment	A generic term for any audit or surveillance
Audit	A documented activity performed in accordance with written procedures or checklists to verify, by examination and evaluation of objective evidence, that applicable elements of the program have been developed, documented, and effectively implemented in accordance with specified requirements.
Auditor	Any individual who participates in the performance of an audit; may also be referred to as “Assessor.”
Basis of Design	Documents the principles, assumptions, rationale, criteria, and considerations used for calculations and decisions required during design.
Biddability Review	Review of the contract documents to identify errors, omissions, and conflicts in the plans, specifications, and bid item schedule. Review shall include staff from Construction Management and Contract Specialists, if applicable.
Check (Review)	Determination of the suitability, adequacy, or effectiveness of a design output to meet stated objectives, carried out under the project Design Management Plan.
Checker	A subject matter expert from the consultant, not the originator of the work, who performs the design review for accuracy, completeness, and compliance before verification. This separates duties from the designer in line with good practice under ISO standards controls.
Competence	The ability to perform tasks and duties to a required standard
Constructability	Ensuring the infrastructure can be constructed using the available level of technology (knowledge, skills, materials and equipment) at the site concerned and within specified constraints, e.g. maintaining specified traffic requirements during the construction period.
Constructability review	means ensuring the infrastructure can be constructed using the available level of technology at the site concerned (knowledge, skills, materials and equipment) within specified constraints. A review of project deliverables performed to identify and address opportunities to improve the cost-effectiveness of construction, the suitability of the design to traditional construction means and methods, and the clarity of the construction documents.
Consultant	A consultancy (organisation) for Icon Water infrastructure projects or with the capacity / capability to provide engineering services. These consultancies will usually comprise an engineer, engineering consultancy undertaking services on engineering projects.
Deliverable	A deliverable is the physical outcome of a task resulting from applying defined processes to a set of inputs. A deliverable is a measurable, tangible, verifiable item produced as part of a project.

Keyword	Definition
Design & Engineering Team	The Design & Engineering team, managed by the Technical Director, is responsible for ensuring the assurance and quality of design deliverables. This team is accountable for managing all capital delivery projects throughout the concept and detailed design phases, ensuring designs meet required standards, regulatory requirements, and project objectives.
Design Criteria	means the relevant design information set out in the design basis report and Icon water standards
Design Development Report	A document that records how the design responds to the Basis of Design, covering options considered, analysis performed, decisions, departures, and the resulting design outputs, with notes on cost, risk, constructability and operation.
Design Engineer	Design Engineers are part of the Engineering & Design Team responsible for managing design submissions, coordinating reviews, and ensuring compliance with technical standards. They work with consultants and internal teams, resolve technical issues. They also support procurement, track design modifications, and maintain project documentation to ensure Concept and Detailed Design phase high quality outcomes.
Designer	Designer is a Professional Engineer who shall be accepted as qualified to certify designs & drawings including roadworks, drainage works, bridgeworks, water supply reticulation, sewerage reticulation works, retaining walls, miscellaneous structures, buildings, pumping stations for sewer and water and flood control structures commensurate with that person's training and experience.
Detailed Design	means that part of the design stage where the details including Engineering Drawings, Other Engineering Documents, Detailed Estimate and Project Plan of the preferred design solution are completed and documented for construction purposes.
Discipline Engineers	Discipline Engineers are registered professionals in the Design and Engineering Team, specialising in process, dam, civil, structural, electrical, and mechanical engineering. They are Registered/Chartered Engineers. Their role includes providing expert advice, overseeing design changes, and ensuring compliance with standards. They are responsible for maintaining technical integrity, approval of deviations from standards, and ensuring all project deliverables meet regulatory, technical, and organisational requirements.
ENGINEERING DESIGN STANDARD — Commentary	Revision A of this standard and an informative companion to the Technical Specification, ENGINEERING DESIGN STANDARD (STD-SPE-G-024). It provides background, rationale, and worked examples to aid interpretation.
Ignite	Beca HunterH2O-GHD, a Joint Venture known as Ignite, has been engaged by Icon Water to provide Professional Engineering Services for a transformative upgrade of the Australian Capital Territory's water infrastructure. This initiative, known as the Professional Engineering Services Agreement (PESA), aims to ensure a secure and resilient water supply for the ACT, supporting community growth over the coming decades.
IPaD	Investment Planning and Delivery, provides project governance mechanisms by ensuring conformance and consistency in all investment processes whilst encouraging high performance by reporting, streamlined processes and lessons learned sharing.

Keyword	Definition
may	may indicates the existence of an option
Project	A project is a temporary endeavour undertaken to create a unique product, service, or result. A project is temporary in that it has a defined beginning and end in time, and therefore defined scope and resources
Safety in Design	A systematic process used to assess engineering designs for their performance against safety goals. Typically involves (but not limited to) HAZOP, HAZID, CHAIR and other specific workshops.
shall	shall indicates that a statement is mandatory
specification	A document that fully describes a design element or its interfaces in terms of requirements (functional, performance, constraints, and design characteristics) and the qualification (validation) conditions and procedures for each requirement
Technical Authority	person recognised as having responsibility for assuring technical integrity of a particular class of assets and area of engineering as clarified in Icon Water Technical Code
Verifier	An ACT registered engineer, independent of the package's design team, who confirms through a documented verification that the design and its deliverables meet the specified requirements, applicable standards and Icon Water specifications, and that the required reviews and records are complete. The verifier also confirms the work was carried out in compliance with the Professional Engineers Act 2023 and that the designer and the reviewer performed their roles in compliance with the Act. Under the WHS Regulations the design verifier must document the design verification process that they carried out and the results of that process.

1 Background and Application

Quality in engineering and design deliverables is critical to the success of Icon Water's capital delivery program. Poorly defined or inconsistently reviewed designs can lead to costly rework, delays, and safety risks during construction. Strengthening design quality controls, ensuring thorough reviews at key milestones, and setting clear expectations for consultants are essential to improving outcomes.

Historically, the absence of a single, unified design standard has resulted in varied approaches, incomplete references to Icon Water requirements, and differences in review rigour across projects. A two year review of Icon Water asset creation projects was undertaken to prepare this standard, identify opportunities to improve design quality, and better align the process with the IPaD framework and the organisational changes that brought the design and engineering functions together.

This work produced two companion documents:

- ENGINEERING DESIGN STANDARD — Commentary, issued as Issue A (March 2025), a comprehensive and informative resource that captures the background, rationale, worked examples, and detailed guidance developed during the review. It is retained as an informative reference and does not create obligations.
- Technical Specification, ENGINEERING DESIGN STANDARD (STD-SPE-G-024), issued as Version 1 (October 2025), a standard that sets the mandatory requirements for design and engineering activities within Icon Water projects delivered.

The Commentary provides additional context for users who require deeper understanding or detailed examples to apply the requirements in practice. This Technical Specification converts that earlier comprehensive work into a brief set of requirements that define what must be achieved in planning, developing, reviewing, verifying, and accepting design deliverables.

This Technical Specification is intended for the Design and Engineering team, Icon Water design consultants, and other parties engaged to deliver Icon Water assets, including gifted assets in complex developments.

2 Objective and Scope

The purpose of this Technical Specification is to set the requirements that govern the Icon Water design process and to provide guidance to Icon Water engineers and external consultants on performance expectations, the required level of detail at each design stage, and the quality assurance activities needed to deliver robust design outcomes. It establishes the minimum processes and controls for planning, developing, reviewing, verifying, and accepting engineering design so that deliverables are suitable for procurement, construction, commissioning, and handover.

This Technical Specification applies to infrastructure projects delivered by, or on behalf of, Icon Water under the IPaD framework. It is intended for use by the Design and Engineering team and by design consultants engaged to produce design deliverables for Icon Water assets. Specific sections may be used as reference material for related design activities outside the IPaD framework; the mandatory requirements apply to IPaD projects.

The aim is to give a concise overview of Icon Water's project and design processes, identify common tools and methods expected on Icon Water projects, and set expectations for the content and maturity of deliverables at each stage of design. The objective is to reduce ambiguity and rework, minimise wasted effort and delays, and improve the quality, traceability, and consistency of design deliverables across Icon Water projects.

3 Icon Water Project Life-cycle Overview

3.1 IPad framework

Asset creation and renewal at Icon Water are delivered through infrastructure projects that follow the Infrastructure Planning and Delivery, IPaD, process. IPaD is the project delivery framework used to standardise oversight, governance, and progression from inception to handover. It comprises three phases, Initiate, Implement, and Integrate, and six stages, Envisage, Evaluate, Plan, Develop, Execute, and Monitor. The pathway through these phases depends on project size, complexity, and risk, informed by the project type and project tier.

The intention of this section is to provide a brief orientation so the reader understands where the design process sits within IPaD. It does not amend, replace, or update IPaD. For the complete and current requirements refer to the IPaD Manual on Icon Water SharePoint.

Figure 3.1.1 IPaD Phase and stage processes

3.1.1 Initiate phase

The Initiate phase includes problem definition, prioritisation, concept design, feasibility study, and options investigation. It extends stakeholder consultation for problems identified in the planning phase and formalises resource commitments.

3.1.1.1 Identify Stage

Captures current and projected issues and opportunities to be resolved by the business. Uses an indicative industry solution to approximate timing, scale, and cost for high-level analysis.

3.1.1.2 Envisage Stage

The purpose of the Envisage stage is to engage with stakeholders to understand the problem in more detail and develop a high-level User Requirements Specification (URS). This stage involves developing an indicative project estimate with ±75% accuracy and obtaining endorsement for the Concept Development Statement.

3.1.1.3 Evaluate Stage

The purpose of the Evaluate stage is to develop options that meet the User Requirements Specification (URS), design these options to a level that demonstrates feasibility and allows cost estimates with ±30% accuracy, and prepare necessary estimates and reports recommending the preferred option for delivery progression and obtaining endorsement for the Business Case.

Towards the end of the initiate phase, the Project Manager and Technical Authority should address the design delivery model. This will likely have an impact on the scope of design works to occur in the next stage, or even what the next stage should be.

The Technical Authority will provide a recommendation on the design strategy, which will vary depending on the project's size, complexity, and level of uncertainty. Projects are usually categorised as either Major Projects (Category Network or Plant) or Minor Projects.

3.1.2 Implement Phase

The Implement Phase involves project planning, design, building, and handover of project deliverables. It is managed by the Infrastructure Delivery Teams and consists of three sub-stages: Plan, Develop, and Execute.

3.1.2.1 Plan stage

The Plan stage aims to identify delivery efficiencies, hand the project to the Infrastructure Delivery Team, start procurement and tender evaluations, initiate long lead time activities, develop and endorse the Project Scope Statement, plan handover deliverables, create Project Management Plans for major projects, and ensure the Develop stage proposal is endorsed with ±15% accuracy. In projects where a Design and Construct delivery methodology has been identified as preferred this stage would be where the reference design and performance specifications would be prepared. For more information around available delivery methodologies refer to the ENGINEERING DESIGN STANDARD Commentary document, which discusses in more detail the factors to be considered regarding the most appropriate method.

3.1.3 Develop stage

The purpose of the Develop stage is to execute detailed design, update project handover deliverables, undertake procurement for the Execute stage, update Project Management Plans, prepare environmental and planning approvals, and ensure the Execute stage proposal is endorsed with ±10% accuracy. In projects where a Design and Construct delivery methodology is preferred, the Develop Stage would typically be skipped and the project would proceed directly into the Execute Stage

3.1.4 Execute stage

Focuses on the actual implementation of the project, ensuring delivery according to specifications. Activities include implementing the final design, conducting comprehensive testing and commissioning, maintaining configuration management, and delivering asset information for smooth handover and integration into operations.

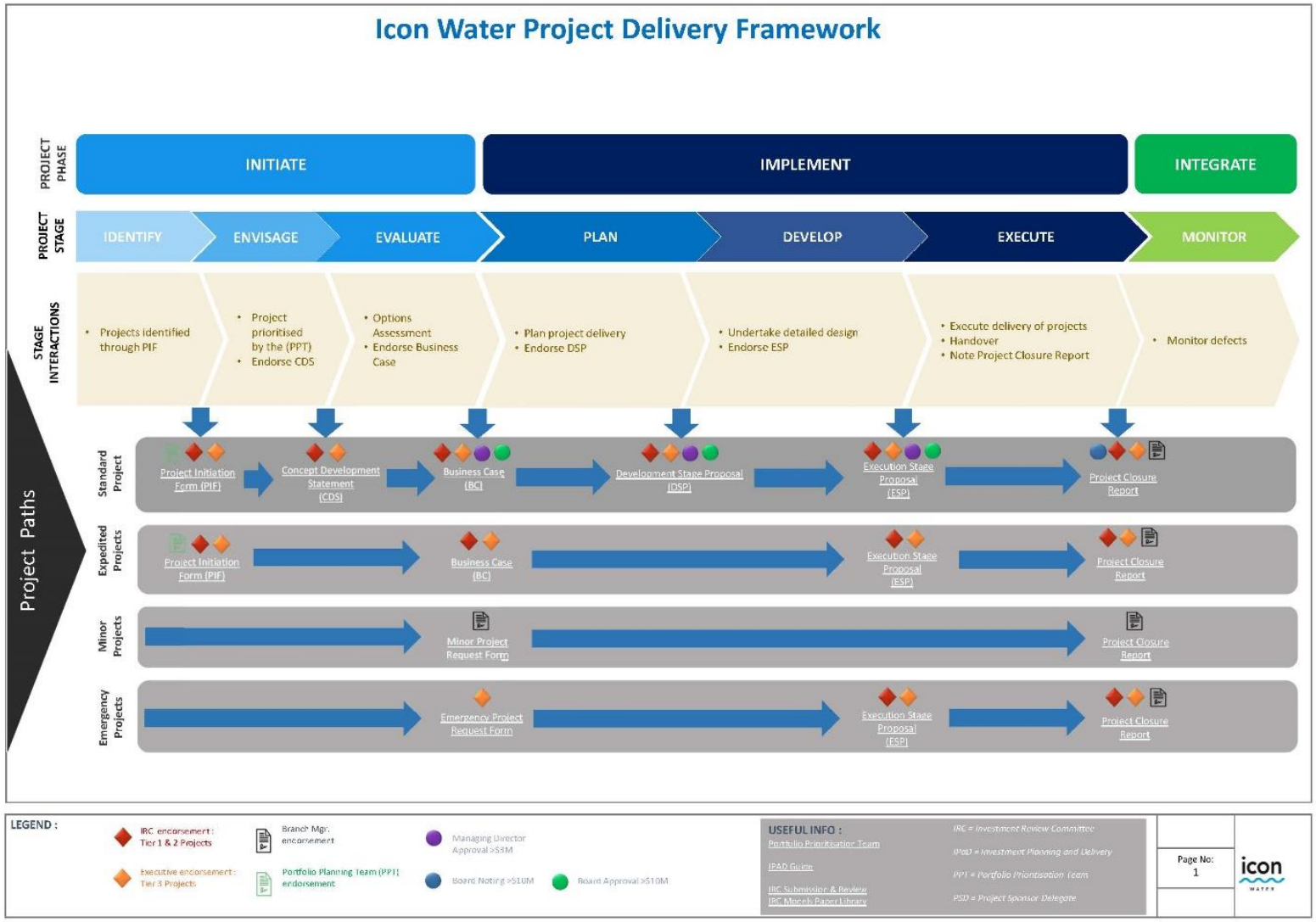


Figure 3.1.2 Overview of design deliverables in the Icon Water project lifecycle

4 Design Consultant Involvement

Design consultants play a significant role in the delivery of engineering design at Icon Water. Internal design is preferred where capability and capacity exist, however the scale and timing of the capital program mean external support is routinely required to meet delivery timeframes, manage peaks in workload, and access specialist skills that are not always available in-house.

External consultants are engaged to prepare design deliverables, undertake reviews and verification as required, and contribute discipline expertise under the direction of Icon Water's Design and Engineering team.

In 2024 Icon Water established the Professional Engineering Services Agreement, PESA, to provide this assistance through to at least 2034. PESA is not an exclusive arrangement, but it is the default mechanism for engaging external design services.

Engagements under PESA shall follow the processes published on the Icon Water PESA SharePoint page, including request, evaluation, approval, and onboarding steps. Engagements outside PESA shall follow Icon Water's standard procurement processes via the Procurement Portal.

In all cases, consultants are required to comply with Icon Water standards and specifications, the Professional Engineers Act 2023, and any project specific requirements set by the Design and Engineering team, including roles and responsibilities, review and verification expectations, deliverable content and issue milestones, and record keeping obligations.

Providing existing information at the start of an engagement, for example surveys, service proving results, geotechnical and environmental reports, condition and capacity assessments, operational and performance data, asset records, previous design or feasibility work, and known operational constraints, enables a shared understanding of context and constraints, improves the accuracy of scope, method, program, and pricing, reduces rework and duplication, and supports efficient, risk-aware delivery.

4.1 Icon Water's Design Project Delivery

Icon Water deliver assets with a specific team structure designed to standardise how projects are delivered. Project management activities are delivered by Project Planning Engineers for projects in the Initiate Phase and by Project Managers and Project Engineers in the Implement Phase. Throughout the project life cycle Icon Water Design Engineers are responsible for the management of designs (whether internally or externally delivered) and for the review of technical deliverables on projects. Design Engineers report to the project teams responsible for the overall delivery of the project.

External consultants will be expected to work directly with Icon Water Design Engineers with regards to the technical delivery of their engagement, this will include accessing internal stakeholders who will contribute to the technical design with operability and maintenance requirements or the review of technical outputs such as reports, specifications and design drawings.

For all contractual matters and invoicing, consultants will work with the Planning Engineers or Project Managers.

5 Typical Delivery Methodology

5.1 Delivery methods commonly used

Icon Water typically delivers projects using two approaches, Design then Construct and Design and Construct. Each approach suits different circumstances and has strengths and limitations. For readers who wish to explore further background, practical examples, or detailed discussion of each delivery method, the relevant sections of the ENGINEERING DESIGN STANDARD — Commentary provide additional context and supporting information.

Table 5.1.1 summarises common reasons to select each approach. There is rarely a single correct option, as the decision depends on project context and the capability of the delivery team and market. The proposed delivery methodology for each project shall be discussed with the Infrastructure Delivery team before the business case is prepared.

Other variants of these methodologies may be suitable for particular projects, especially larger or more complex works. Where an alternative is being considered, selection should be developed with subject matter experts and the Infrastructure Delivery project teams.

Table 5.1.1 Design & Construct versus Design then Construct

Criteria	Design & Construct	Design then Construct
Project Complexity	Moderate complexity, standardised solutions, or clear performance outcomes	High complexity, custom solutions requiring detailed design control
Time Constraints	Accelerated timelines with overlapping design and construction phases	Longer timelines with detailed design prior to tendering and construction
Budget Certainty	Greater certainty, contractor bears more risk and responsibility for delivering within agreed price, requires a strong specification	Less certainty, risk of design changes and cost variations typically borne by Icon Water
Icon Water Control	Reduced Icon Water design control, contractor leads detailed design decisions	Increased Icon Water design control, detailed design is directly managed and approved by Icon Water
Risk Allocation	Higher transfer of design and construction risks to the contractor	Icon Water retains design risk, contractor primarily responsible for construction risks
Innovation Opportunities	Higher potential, encourages contractor-driven innovation to meet performance outcomes	Lower potential, innovation typically limited to the design team or requires Icon Water approval
Quality Control & Assurance	Contractor responsible for delivering specified outcomes, Icon Water oversight essential but less direct	Direct Icon Water oversight of design, detailed Icon Water approvals ensure compliance with Icon Water standards
Flexibility in Design Changes	Limited, changes during construction may lead to variations and additional cost	Greater flexibility, easier to accommodate Icon Water-driven changes before construction
Market Capability & Competition	Strong market with experienced contractors capable of delivering D&C contracts	Availability of skilled consultants and contractors capable of detailed design and construction

6 Design Steps in Asset Creation Cycle

6.1 Design steps

The design process shall be a structured approach tailored for the development of Icon Water infrastructure projects. Each phase of the design process is interconnected, ensuring that the project transitions smoothly from pre-design phase to completion of detailed design, with each step building upon the last. This structured approach emphasises clear objectives, thorough planning, and risk management to ensure the project meets its intended goals and standards. For Icon Water projects in asset creation, this process is segmented into phases as below:

- Pre-Design
- Options assessment
- Concept design
- Detailed design

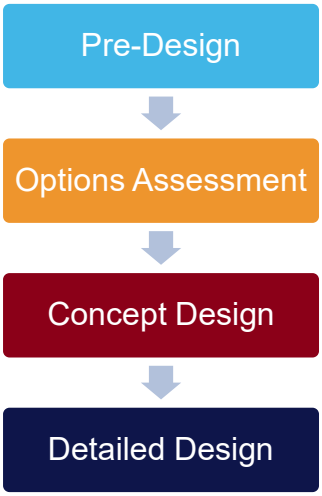


Figure 6.1.1 Design steps

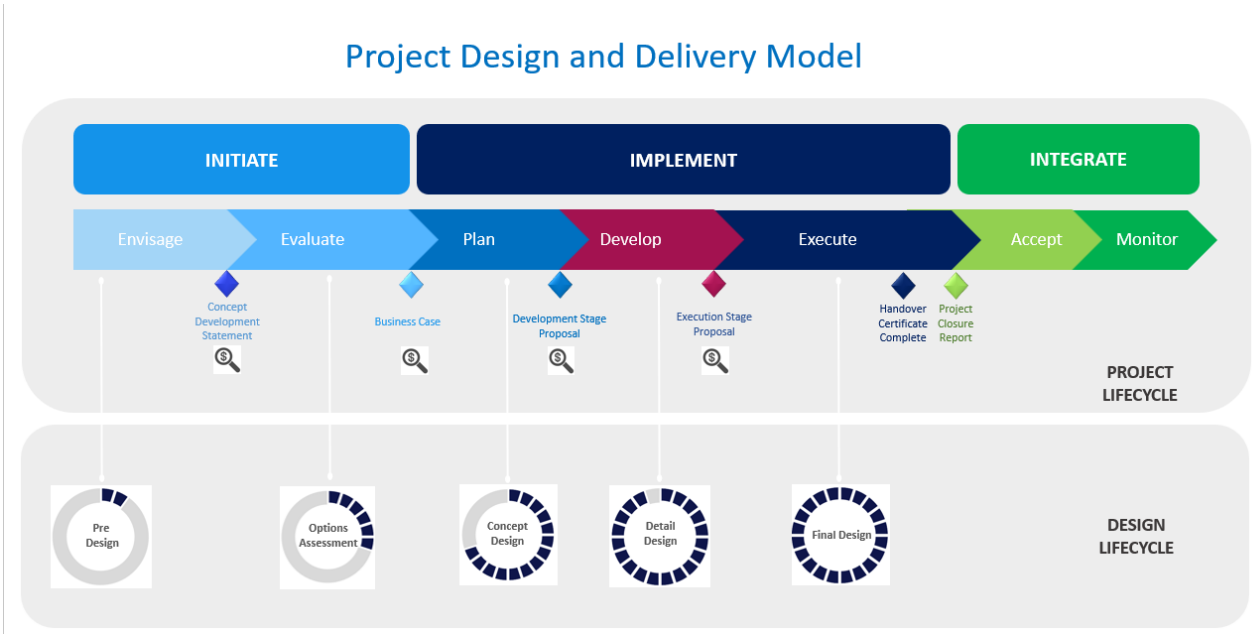


Figure 6.1.2 Design steps - typical project and design stage alignment

6.2 Design continuity

To maintain the project intent through each design phase, it is essential that, at the conclusion of each stage, the consultant develop and the Design and Engineering team accept a clear scope for the subsequent phase. This shall set out the design intent to be carried forward, the required deliverables and level of detail.

Loss of design continuity has been a cause of delay, rework, and cost growth on past Icon Water projects, arising from gaps in scope, unclear ownership of tasks, and late identification of constraints. A documented scope at each transition reduces these risks, supports efficient planning, and provides a sound basis for delivery.

The agreed scope shall be accompanied by an indicative program and a fee proposal traceable to the defined deliverables so the expected cost of the next stage of design can be communicated in a timely manner and considered in the project budget. Assumptions, constraints, departures, and risks shall be recorded, together with any allowances for site access, shutdowns, stakeholder engagement, third party input, and statutory approvals, so time and cost implications are understood before work proceeds.

7 Design Steps Summary

The following is a high level description of the purpose of each of the key design steps in the IPaD process. It is not intended to be prescriptive or exhaustive but rather informative of what the design is expected to achieve at each project stage to better inform the designers and design engineers on what level or detail of design effort is required at each stage. It should be noted that this can and will change from project to project depending on scale, complexity and other factors. For more detail regarding background and explanation for the requirements below please refer to the ENGINEERING DESIGN STANDARD — Commentary.

7.1 Pre-Design

Pre-Design occurs within the Envisage Stage. The purpose of the pre-design step in the design process is to adequately define the problem to be solved, develop some key project objectives, understand critical constraints associated with the project and to identify key stakeholders.

Key Deliverables:

- User Requirements Specification (URS)
- Key Stakeholders List
- Draft PESA Task Proposal (if required)
- Estimate of the Options Assessment effort

7.2 Options Assessment

The purpose of the Options Assessment stage in a project is to identify viable options to meet the project objectives and the URS identified in the Pre-Design stage. The reason for identifying these options is to ensure Icon Water considers the best possible solutions available while spending capital funds. Once developed these options are costed and scored against a series of objective criteria (usually developed from the URS) in a Multi-Criteria Analysis (MCA).

Once a preferred option is selected, safety in design workshops should be held (CHAIR 1, HAZOP 1 or other hazard assessments) are to be undertaken as required. Prior to heading into a more detailed Concept Design in the Plan Stage a detailed scope of works should be developed and a fee prepared by consultants to deliver that scope. This fee shall be used in the Business Case to ensure sufficient funds are available in the Plan Stage.

Key Deliverables:

- Updated URS
- Options Design Development
- Cost Estimates for Options
- Multi-Criteria Analysis (MCA)
- Options Assessment Report
- Safety in Design Report

7.3 Detailed Design

The Detailed Design is typically conducted during the Develop Stage of the IPaD process. The purpose of this stage of the design process is to complete the design to sufficient detail such that a competent contractor could construct the asset in the design documentation without excessive input from the designers. This stage should also include all remaining safety in design workshops and documentation, constructability reviews and shut plans for all work in brownfield sites or on operating assets. It is expected that at a minimum there would be multiple issues of the deliverables, commonly at 50%; 70%; IFT, and IFC.

Key Deliverables:

- Safety in Design Reports
- Design Drawings
- Specifications
- Draft Commissioning Plans
- Design Certification
- Design Opportunity and Risk Register

As noted above significantly more detail on expectations of design content for each of the design stages can be found in the ENGINEERING DESIGN STANDARD – Commentary.

8 Quality Assurance

Quality Assurance is critical to the successful delivery of engineering design. Quality Assurance in the design phase is a systematic process to ensure that engineering designs meet all required standards and Icon Water needs before they are released for construction. Unlike quality control, which involves catching errors after the fact, QA is a proactive, process oriented approach. This reduces the likelihood of design mistakes that could cause issues during construction, thus maintaining project timelines, budgets, and safety.

The key objectives of Quality Assurance in Icon Water design projects are:

- Establishment of consistent understanding of deliverables, roles and terminology
- Minimising construction change orders due to incomplete or incorrect design
- Delivering projects more quickly and avoiding scheduling delays

It is expected that Quality Assurance will be driven in projects through the Design Management Plan.

8.1 Design Management Plan

The Consultant is required to develop a Design Management Plan in each stage of the design process for Icon Water's review and approval. Depending on the size of the project the Design Management Plan can be a detailed document explicitly outlining the design processes being followed in the project, or a brief description of the important design processes involved in the project.

The Design Management Plan of a design project includes the following but is not limited to:

- Project Overview, including high level scope
- Roles and Responsibilities
- Basis of Design (This can be a separate document for sufficiently large projects)
- Design Schedule, at a minimum, key deliverable dates to be listed
- Risk Management; should include usage of Opportunity and Risk Register
- Quality Assurance; detailing review and verification processes including any areas of the design critical for user feedback
- List of key stakeholders for both user groups and technical reviews
- Communication Plan; detailing communication pathways for the project particularly processes for change management

An example of design management plan is provided in Appendix A – Icon Water Design Management Plan Required Content. A Design Management Plan shall be prepared and scaled to the project's size, complexity, risk profile, and delivery method, so the level of detail, controls, and review effort are proportionate to the needs of the work. The Icon Water Design Engineer shall be consulted to review the plan and confirm its suitability.

8.1.1 Design Technical Quality Review Requirements

All design submissions prepared for Icon Water shall undergo a Design Technical Quality Review, DTQR, before issue. The DTQR is an internal review conducted by the consultant to confirm that the design is complete, coordinated, and compliant with the project scope, Icon Water requirements, applicable standards, and legislation. Reviewers shall be competent and independent of the original authors. Where more than one discipline is involved, an interdisciplinary review is required to confirm that interfaces are correctly integrated and documented.

The Design Management Plan shall set out how and when the DTQR will be performed, who will undertake it, the deliverables to be reviewed, and the evidence that will be produced. The DTQR shall cover all deliverables within the consultant's scope, including those prepared by subconsultants, and the lead consultant remains responsible for confirming the quality and completeness of subconsultant outputs.

Each submission to Icon Water shall include a DTQR record that identifies the project and deliverable, states the scope of the review undertaken, lists any checklists or procedures used, and confirms that review comments have been addressed. The record shall include the names, disciplines, signatures, and dates of the reviewers and the verifier, and it shall note any unresolved items with justification.

Where Icon Water requires an Independent Peer Review, it shall be undertaken by a suitably qualified engineer independent of the design team and the peer reviewer's signed confirmation shall be included in the DTQR record.

If preliminary documents are issued before the DTQR is complete, they shall be marked "Draft – has not undergone internal Design Technical Quality Review". A verifier within the consultant's organisation shall confirm that the DTQR has been completed and properly documented prior to submission. All DTQR records, including mark ups, check prints, comment registers, and review forms, shall be retained in the project file for a minimum of ten years in accordance with the ACT Professional Engineers Code of Practice.

The DTQR shall be scaled to the project's size, complexity, risk, and delivery method, does not replace Icon Water's stakeholders reviews, and shall include a comment resolution record and version control so the reviewed document set matches the submission provided to Icon Water.

9 Roles and Responsibilities in the Design Process

Roles and responsibilities must be defined as part of each design project based in the guides provided in this section. Design roles and responsibilities should not duplicate or conflict with other roles of areas of the project's overall structure, for example, project management, technical assurance, drafting review, stakeholder engagement and others.

The following roles will typically be required on any design project within Icon Water. More detailed information on the specifics of each position's role can be found in the ENGINEERING DESIGN STANDARD - Commentary.

9.1 Icon Water Internal Stakeholders

9.1.1 Design Engineers

A representative of Icon Water responsible for overseeing that the design process is followed correctly and that design submissions meet project requirements, standards and schedules. Design Engineers may, but are not required to be, registered professional engineers and are not necessarily subject matter experts in all design disciplines.

9.1.2 Owner's Engineer

An employee or representative of Icon Water, Owner's Engineers are subject matter experts regarding specific aspects or disciplines in the design. They are required to ensure the design deliverables meet Icon Water's design standards and needs. Owner's Engineers must be registered engineers in the ACT for the discipline(s) they are overseeing.

9.1.3 Icon Water Other Stakeholders

Icon Water's design process requires that the design project engage with a range of internal stakeholders to ensure the design is practical, operable, and compliant with broader business requirements. In addition to the formal design review roles, input from operational, maintenance, environmental, safety, sustainability, and asset reliability teams shall be obtained during the design development process.

The Design Engineer is responsible for identifying and coordinating these reviews, ensuring that relevant stakeholders are consulted at the appropriate design stages. Their comments and recommendations shall be documented and considered within the design deliverables and the review process.

9.2 Design Consultant / Contractor Stakeholders

9.2.1 Designer

Engineers who are responsible for the production of the design deliverables on the project, including but not limited to drawings, specifications, reports, condition assessments, etc. Designer's will more commonly be an employee of consultants or contractors, however can be Icon Water employees. Designers must be a registered engineer in the ACT or work directly under the direct supervision of such an engineer.

9.2.2 Design Reviewer

An experienced engineer registered in the ACT for the area of design they are reviewing. Typically a senior (or higher) engineer within the team producing the design products, the design reviewer is responsible for ensuring the design meets the requirements of the project, is compliant with all relevant codes and standards and is fit for purpose.

9.2.3 Design Verifier

An experienced engineer, registered in ACT for the area of design they are verifying. The Design Verifier is to be independent from the design team (although would typically be from the same consultancy / contractor). The Design Verifier is the final check of the design products to ensure their technical quality. Documented evidence of design verifications are required by Icon Water upon “Issued For Construction” deliverables.

9.2.4 Design Manager

An experienced engineer who understands the design process, resource management and scheduling of design projects. The Design Manager is responsible for ensuring the designers have all of the necessary resources to produce quality design deliverables and ensures they are aware and working to the requirements and schedule necessary to deliver a fit for purpose design.

10 Design Reviews by Icon Water

Design reviews shall be undertaken by Icon Water at various stages of the design development. The number of reviews required will be project dependant and nominated and documented by Icon Water prior to requesting pricing from a consultant or contractor. Project Managers and Design Engineers shall consider an appropriate balance between quality assurance and efficiency when nominating the number of reviews.

Reviews conducted by Icon Water shall not alleviate the responsibilities of the consultant regarding the quality and accuracy of the content of the design. The reviews are to ensure that Icon Water's user groups are considered in the design, it is also critical that Icon Water reviewers consider how the proposed designs allow for operational and maintenance considerations and the connectivity in the wider processes the design is a component of.

The key components that an Icon Water review should be assessing are:

- Feasibility
- Compliance with Icon Water requirements and standards
- Technical accuracy
- Operational feasibility
- Maintainability
- Constructability
- Potential risks proposed by the new design

Icon Water's Design Engineer shall compile all comments, concerns, requested changes and queries into a single document for issue back to the consultant or designer. Compiling of this document shall include a check of the comments to ensure that different reviewers have not requested conflicting changes and that the review results are clear and unambiguous. Icon Water's reviewers shall use caution in requesting changes to ensure that directions to make changes can create ambiguity regarding responsibility for the design. It is expected that consultants communicate back to Icon Water if any comments made in the review compromise the performance of the design.

Once the review document has been issued back to the consultant, the necessary changes shall be made to the design for final issue. The Icon Water Design Engineer will then be responsible for confirming the design changes are in accordance with the review document before accepting the final issue.

11 Management of Design Changes

Design changes occur frequently during the early stages of design development and become less common as the design progresses. These changes shall be monitored to ensure that changes do not compromise either the key objective(s) or the indicative cost estimate of a project. If either of these parameters have been significantly altered it could result in a project no longer being efficient or prudent. This is particularly of concern if the changes have occurred after the business case approval and may require adjustment and reapproval of the business case. These changes and the reason for them shall be recorded to ensure a record is kept for future reference.

Design changes that occur after construction has commenced are typically unavoidable, however can have significant impacts on the performance of the design. Even seemingly minor changes can have a disproportionately large impact on the overall outcome of the project if not carefully managed. Accordingly, the ACT Engineering Registration Scheme requires that registered engineers approve design changes after the issue of construction documentation.

Icon Water require that Design Change Notes (DCN) be used and recorded to track these changes during the Execute Phase of a project. These DCN shall record:

- DCN Number (for reference to the DCN Register)
- Date
- Project
- Change requester / identifier
- Design Drawings / Documents affected by the DCN
- Affected components
- Reason for the change
- Impact estimate (cost, schedule, quality, safety)
- Approval by Registered Engineer

Icon Water shall maintain a Design Change Note Register and store the DCN in the project folder.

A DCN shall be completed if a change on site requires a change of the Issued For Construction (IFC) drawings or documentation. This requirement does not mean a DCN can be avoided if no changes are made to the drawing, if that change will require a change to be made to the WAE drawings from the IFC drawings.

12 Deviation from Standards

Icon Water has a Deviation from Standards process. Deviations from Icon Water Standards are not permitted except under exceptional circumstances. Any proposed deviation shall be raised as early as possible and before the submission of final design drawings. The Applicant, being a suitably qualified consultant, designer, or nominated person, shall complete and submit the Deviation from Standards form available on the Icon Water website.

Early submission allows discussion and assessment prior to issue of final drawing packages. No deviation shall be incorporated into any design or construction without written approval from the Icon Water Technical Authority or delegate.

During the construction phase, the Contractor shall construct, test, and hand over the works in accordance with the Issued for Construction drawings accepted in writing by Icon Water, and in accordance with Icon Water Standards and the Icon Water Approved Products List.

If a constructability issue arises that prevents the accepted design from being constructed in whole or in part, the Contractor shall immediately raise the matter with Icon Water. For Design and Construct (D&C) contracts, the Contractor shall raise the matter through their authorised design consultant. For Construct Only contracts, the Contractor shall raise the matter directly with Icon Water.

In all cases, the issue shall be formally notified to Icon Water in writing as soon as it becomes known and before construction of the affected elements. The notification shall include supporting evidence, a description of the issue, and proposed options for resolution.

Where a redesign or deviation is proposed, the Contractor (or the Contractor's design consultant under a D&C arrangement) shall complete and submit a Deviation from Standards form for Icon Water's review and written approval prior to implementation. Construction shall not proceed until written approval has been issued by Icon Water. Any unapproved deviation may be directed by Icon Water for rectification or removal at the Contractor's cost.

If redesign is required due to non compliance with Icon Water Standards or due to a constructability issue, all responsibility for redesign, including any associated cost and delay, shall rest with the Contractor and their authorised design consultant (where applicable). Icon Water will not be responsible for redesigning, resolving, or bearing any cost for issues arising from non-compliance to Icon Water standards.

The Contractor shall coordinate all communication with Icon Water regarding design or constructability issues through their authorised design consultant (for D&C contracts) to maintain alignment with the accepted design intent. Approved redesigns and deviations shall be incorporated into the As Constructed documentation submitted to Icon Water at project completion.

13 Engineering Registration Requirements in Design

Under the provisions of the Professional Engineers Act 2023 (ACT), it is a legal requirement for individual engineers to register before they can practise as a professional engineer in ACT and for ACT. That is, persons who in their employment or business provide an engineering service must be a registered Professional Engineer of ACT. The exception is for persons who provide an engineering service to be under the direct supervision of a registered engineer in the same field of engineering. The requirement applies regardless of whether the professional engineer provides professional engineering services to their employer or to external clients.

A condition of designing Icon Water assets, is that engineering consultants comply with the statutory requirements of the Professional Engineers Act 2023 and ensure at all times that persons employed as professional engineers are registered, or work under the direct supervision of a professional engineer registered in the same field (discipline) of engineering.

A further condition of prequalification is that a person's engineering registration is in the relevant area (discipline) of engineering for the engineering service being provided. While the overall responsibility for engineering project design and documentation services rest with the organisation carrying out the work, Icon Water requires that individual design responsibility for each area of engineering under the Professional Engineers Act 2023 is identified and recorded in design documentation.

Consultants are required to demonstrate in their design management plan and their deliverables how the above requirements will be addressed. If overseas personnel are nominated in an application, consultants are required to advise how the organisation would manage the above engineering registration requirements.

The Professional Engineers Act 2023 (ACT) controls how professional engineering services are provided in the Australian Capital Territory. This means any engineering work that uses engineering principles, calculation and data for designing, constructing, or producing something related to engineering requires to be carried out by a registered engineer. Here are the main rules that the Act and the Code say Registered Engineers need to follow:

- They can only work in areas they're competent in.
- They have to follow the relevant Code when doing their professional work.
- They must obey all government laws, like the Work Health and Safety Act 2011 (ACT).

All engineering design work has to be done by a Registered Engineer or supervised by one. This work must meet Australian standards and the department's rules, manuals, and guidelines. It is accepted by Icon Water that a Registered Engineer may delegate the carrying out of professional engineering services to a non-Registered Engineer, but that work must be performed under the direct supervision of the Registered Engineer. Ultimately, Registered Engineer(s) must exercise their judgment to determine if the delegate is competent to undertake the work (includes design and inspection), as the Registered Engineer will retain responsibility for work performed.

Appendix A – Icon Water Design Management Plan Required Content

The following is a sample project design management plan:

1. Executive summary
2. Introduction
    - Project background
    - Primary objectives of this plan
3. Definitions and acronyms
4. Design organisation
    - Design organisation chart
    - Design resources and competency
    - Design authorisation
    - Design roles and responsibilities
5. Design responsibilities, authorities and competencies
6. Relevant design stakeholders
7. The project
    - Scope of work
    - Scope of design services - design phase
        - Design disciplines
        - Design phase services
    - Scope of design services - construction and commissioning phase
        - Procurement support services
        - Manufacturing and fabrication support services
        - Construction support services
        - Commissioning support services
    - Technical review process (could be 70% or 90% or 100% review)
        - 70% design review
        - 90% design review
        - 100% design review
        - Issued for construction (IFC)
        - Post-IFC design changes and reviews
    - Design work package deliverables
        - Design report
            - Design drawings
            - Design models and calculation records
            - Specifications and other reports
            - As-built documentation

Appendix B – Example of Meetings and Workshops List

The Consultant shall facilitate, prepare briefing papers and minutes of the meetings and workshops identified in the below Table. As a minimum, the Consultant shall allow for attendance at each workshop / meeting by the personnel. The Consultant shall allow for whatever time it believes may be required to prepare briefing papers and reports to support each meeting / workshop.

No.	Title	Description	Duration	Location	Lead	Briefing Papers	Facilitator	Minutes
1.	Project Kick-off Meeting (incl. Work Breakdown Structure (WBS))	Review: Project scope, roles and responsibilities, schedule, communications protocols, risks, documentation	4hrs					
2.	Fortnightly Progress Meetings	Complete project status review.	2hrs					
3.	Project Risk Workshop	Complete a Project Risk Assessment at the start of the project	4hrs					
4.	Value Engineering Workshop	Identify opportunities to enhance the project value.	8hrs					
5.	50% Detailed Design Review	Review early detailed design proposed by design consultant to allow contractor to develop a construction methodology and constructability review	8hrs					
6.	Safety in Design Review (CHAIR2/3)	Present a proposed construction methodology and identify potential concept design amendments to enhance project safety and constructability.	8hrs					
7.	HAZOP	Complete a Hazards and Operability review of the proposed detailed design. The briefing shall present P&IDs, layout drawings and process control descriptions	4hrs					
8.	CHAZOP and E-Stop Risk Assessment	Complete a Control Hazard and Operability Study for the safety and reliability of the instrumentation and control system	4hrs					
9.	FMECA Review	Review the Failure Mode Effects and Criticality Analysis for the infrastructure	4hrs					
10	70% Detailed Design Review	Review the detailed design as developed at roughly the 90% stage to provide feedback to the PSC.	4hrs					
11	90% Detailed Design Review	Review the detailed design as developed fully to provide feedback to the consultant.	8hrs					
12.	Project Risk Workshop	Project Risk Assessment towards the completion of the detailed design.	4hrs					
13.	Technical meetings (provisional)	Allow for 15 additional technical meetings with Icon Water relevant technical lead and designer	2hrs					

Appendix C – Example of DOAR Register

DESIGN OPPORTUNITY AND RISK REGISTER (DOAR)

Project number: CX 11070
Project name: O'Connor Reservoir Roof Replacement and Floor Repair detailed design
Date DOAR commence: 7/11/2019
Date DOAR closed:

DOAR responsibility Project Manager / Design Leads
DM signature on completion
PM acceptance

Item No.	Date/Time/Meeting or Doc advice Attendees (refer Initials attached)	Risk/Opportunity/Change/Event/Innovation idea	Raised by	Required action	Action by	Effect on design	Effect on schedule	Effect on cost	Close out comments	Close out date	Verification reference	Rev. No.	Priority	Action status
	Opportunities and risks identified in DOAR enclosed in Concept Engineering Design Report, August 2018 (Open items only) - PRIOR TO COMMENCEMENT OF SMEC'S COMISSION OF WORKS													
1	Review RB,YK, JG,JT,MB, PB, IM,SM,GM,JS, MM, IB - Design	Opportunity - Early constructor engagement (ECI) will be required in detailed design stage because of the complexity of roof modifications and floor repairs. The final solution is likely to be heavily influenced by constructability.	MB	Include in procurement plan in Technical Report	GM	N/A	N/A	N/A						open
2	Review RB,YK, JG,JT,MB, PB, IM,SM,GM,JS, MM, IB - Design	Innovation Idea - Installation of solar panels on reservoir roof.	Design team	Icon Water to consider feasibility.	GM	Additional weight of solar panels has no impact on the sizing of roof steel members.	N/A	Minimal						open
3	Review RB,YK, JG,JT,MB, PB, IM,SM,GM,JS, MM, IB - Design	Risk - Splash corrosion of roof, particularly if hypochlorite is added.	Design team	Consider reservoir infeed design to reduce splash corrosion during detailed design.	GM									open
4	Review RB,YK, JG,JT,MB, PB, IM,SM,GM,JS, MM, IB - Design	Risk - column footings are not in good condition and require repair as part of the roof repair/replacement.	Design team	Concept design report to address.	JS		Significant	Major	Existing footings are adequate for applied loads. Concrete footings are assumed to be in good condition - testing					open
	07/11/2019 - Kick-off meeting and Site inspection													
5	07/11/2019 - Kick-off meeting and Site inspection SMEC - GP, DS, AA, DG, BM Icon Water - AVM, PN, IM, JT	Risk - Approximate +/-5mm accuracy in measurements taken of key dimensions of the existing valve chamber.	BM	Incorporate appropriate dimensional tolerances into bypass design. Dimensions to be confirmed on site by Contractor.	BM	Incorporate dimensional tolerances. Include instruction for dimensions to be confirmed on site by Contractor.								
6	07/11/2019 - Kick-off meeting and Site inspection SMEC - GP, DS, AA, DG, BM Icon Water - AVM, PN, IM, JT	Opportunity - Review of Combiflex joint sealant proposed in the concept design, assess construction and O&M risks associated with the product and propose alternative joint sealant options with enhanced construction and O&M performance. Emer-seal was recommended as preferred option.	DG	Icon to provide details/feedback on other Icon sites where Combiflex has been used. SMEC to provide information on preferred joint sealant product for assessment by Icon Water.	AVM DG	Adopt agreed joint sealant product in the design once confirmed by Icon Water. SMEC require confirmation on the preferred product within the agreed timeframes in order to enable delivery in line with agreed schedule/cost.								
7	07/11/2019 - Kick-off meeting and Site inspection SMEC - GP, DS, AA, DG, BM Icon Water - AVM, PN, IM, JT	Innovation idea - Consider floating liner instead of roof replacement which would be significantly more cost effective, when considering construction costs as well as whole of life costs.	DG	Provide technical details and contact details for reference checks on liner for assessment by Icon Water.	DG	Adopt floating liner in the design once confirmed by Icon Water. SMEC to continue detailed design of the roof based on the concept design currently agreed until otherwise instructed.								

Appendix D – Design & Engineering Checklist for Deign Deliverables (Pipeline Design)

The below Checklist for Design Deliverables is a structured tool developed by Technical Director of Design & Engineering team at Icon Water to ensure that all necessary documentation and requirements are met when delivering an engineering task internally or preparing a task proposal. It helps verify that critical elements such as technical reports, surveys, safety considerations, and regulatory requirements are addressed in the design, ensuring a complete and coordinated design package. The checklist is particularly useful in managing deliverables, assigning responsibilities, and tracking progress, ultimately improving design quality, compliance, and efficiency in project execution.

Task Name: **Date:**

Design Eng

No.		Document	Existing (Y/N)	Required (Y/N)	Action By	Completed (Y/N)	Date	Links
1		**Planning**						
1.1		Situation Report						
1.2		Options Assessment						
1.3		Survey Brief						
1.4		Service Proving/Potholing Brief						
1.5		Geotechnical Brief						
1.6		Approvals						
1.7		Relevant Technical Information						
2		**Concept Design**						
2.1		**Documentation**						
2.1.1		Situation Report						
2.1.2		As Constructed Drawings						
2.1.3		Concept Design						
2.1.4		Planning Reports						
2.1.5		Options Assessments						
2.1.6		Additional Technical Reports						
2.1.7		Geotechnical Investigation						

2.1.8		Surveys						
2.1.9		Technical Calculations						
2.1.10		Identified Approvals						
2.1.11		Relevant Specifications, Legislation						
2.2		**Detailed Design Deliverables**						
2.2.1		Job Specification						
2.2.2		IFC Drawings						
2.2.3		Geotechnical Report						
2.2.4		Survey						
2.2.5		Safety in Design						
2.2.6		Schedule of Construction						
2.2.7		Schedule of Lump Sum						
2.2.8		Schedule of Technical Data						
2.2.9		Standard Specifications						
2.2.10		Approvals						
2.2.11		Registered Engineer Design Endorsement						
2.2.12		Design Report						
2.2.13		Technical Calculations						
2.2.14		Additional Technical Reports						
2.2.15		Functional Specification						
2.2.16		Control Narrative						
3		**Construction Package**						
3.1		Project Brief						
3.2		Technical Specification						
3.3		Design Drawings						
3.4		Geotechnical Reports						
3.5		Survey						
3.6		Safety in Design						
3.7		Schedule of Construction Method						
3.8		Schedule of Lump Sum						
3.9		Schedule of Technical Data (Equipment)						
3.10		Schedule of Technical Data (Pipelines)						
3.11		Standard Specifications						
3.12		Additional Reports for Information Only						
3.13		Approvals						

3.14		Design Report						
3.15		Schedule of Preferred Instruments						
3.16		Design Calculations						
3.17		Functional Specifications						
3.18		Bill of Quantities						
3.19		Construction Estimate						
4		**Approvals**						
4.1		Department of Enviro Authority						
4.2		TCCS						
4.3		Rail						
4.4		Evo Energy						
4.5		Cultural and Heritage Approvals						
5		**Technical Information**						
5.1		As Constructed Drawings						
5.2		Geotechnical Investigations						
5.3		Planning Reports						
5.4		Hydraulic Investigations						
6		**Additional Calculations/Technical Information**						
6.1		Thrust Block Design Calculations						
6.2		PE Pipe Restraint Calculations						
6.3		Flexible Pipe -Trench Fill Calculations						
6.4		Pipe Jacking Calculations						
6.5		Pavement Design						
6.6		Pavement Design TCCs						
6.7		Hydraulic Calculations						
6.8		Structural calculations						
6.9		Pump Curves						
6.10		Technical data sheets						

Appendix E – Reservoir Concept Design Example

GENERAL	TITLE 1	TITLE 2
2024-GEN-001	ICON WATER RESERVOIR - PACKAGE B	TITLE SHEET, DRAWING INDEX & LOCALITY PLAN
2024-GEN-002	ICON WATER RESERVOIR - PACKAGE B	RESERVOIR SITE GENERAL ARRANGEMENT
CIVIL	**TITLE 1**	**TITLE 2**
2024-CIV-001	ICON WATER RESERVOIR - PACKAGE B	CIVIL NOTES
2024-CIV-002	ICON WATER RESERVOIR - PACKAGE B	EXISITING FEATURES PLAN - 1 OF 2
2024-CIV-003	ICON WATER RESERVOIR - PACKAGE B	EXISITING FEATURES PLAN - 2 OF 2
2024-CIV-004	ICON WATER RESERVOIR - PACKAGE B	EROSION AND SEDIMENT CONTROL LAYOUT PLAN
2024-CIV-005	ICON WATER RESERVOIR - PACKAGE B	EROSION AND SEDIMENT CONTROL DETAILS
2024-CIV-006	ICON WATER RESERVOIR - PACKAGE B	SITE GENERAL ARRANGEMENT - 1 OF 2
2024-CIV-007	ICON WATER RESERVOIR - PACKAGE B	SITE GENERAL ARRANGEMENT - 2 OF 2
2024-CIV-008	ICON WATER RESERVOIR - PACKAGE B	CONTROL LINE SETOUT
2024-CIV-009	ICON WATER RESERVOIR - PACKAGE B	PAVEMENT DETAILS
2024-CIV-010	ICON WATER RESERVOIR - PACKAGE B	ACCESS ROAD CONCRETE JOINT DETAILS
2024-CIV-011	ICON WATER RESERVOIR - PACKAGE B	LONGITUDINAL SECTION - CONTROL LINE ROAD01
2024-CIV-012	ICON WATER RESERVOIR - PACKAGE B	TYPICAL CROSS SECTIONS AND DETAILS
2024-CIV-013	ICON WATER RESERVOIR - PACKAGE B	ROAD01 TYPICAL CROSS SECTIONS
2024-CIV-014	ICON WATER RESERVOIR - PACKAGE B	SITE SETOUT - SHEET 1 OF 2
2024-CIV-015	ICON WATER RESERVOIR - PACKAGE B	SITE SETOUT - SHEET 2 OF 2
2024-CIV-016	ICON WATER RESERVOIR - PACKAGE B	CULVERT CROSS SECTIONS AND DETAILS
2024-CIV-017	ICON WATER RESERVOIR - PACKAGE B	SECURITY FENCE - ARRANGEMENTS AND DETAILS
STRUCTURAL	**TITLE 1**	**TITLE 2**
2024-S001	ICON WATER RESERVOIR - PACKAGE B	STRUCTURAL NOTES - 1 OF 2
2024-S002	ICON WATER RESERVOIR - PACKAGE B	STRUCTURAL NOTES - 2 OF 2
2024-S003	ICON WATER RESERVOIR - PACKAGE B	FOUNDATION PLAN
2024-S004	ICON WATER RESERVOIR - PACKAGE B	TANK WALL SETOUT & CONSTRUCTION
2024-S005	ICON WATER RESERVOIR - PACKAGE B	ROOF FRAMING PLAN & SECTION
2024-S006	ICON WATER RESERVOIR - PACKAGE B	STEELWORK DETAILS
2024-S007	ICON WATER RESERVOIR - PACKAGE B	ROOF ACCESS LADDER DETAILS
2024-S008	ICON WATER RESERVOIR - PACKAGE B	VALVE PIT AND PIPE SUPPORT DETAILS
2024-S009	ICON WATER RESERVOIR - PACKAGE B	VALVE PIT LID MEMBER SUPPORT DETAILS
Pipe Work	**TITLE 1**	**TITLE 2**
2024-W001	ICON WATER RESERVOIR - PACKAGE B	LAYOUT PLAN AND NOTES
2024-W002	ICON WATER RESERVOIR - PACKAGE B	INLET PIPEWORK PLAN AND LONGITUDINAL SECTION - 1 OF 2
2024-W003	ICON WATER RESERVOIR - PACKAGE B	INLET PIPEWORK PLAN AND LONGITUDINAL SECTION - 2 OF 2
2024-W004	ICON WATER RESERVOIR - PACKAGE B	OUTLET PIPEWORK PLAN AND LONGITUDINAL SECTION
2024-W005	ICON WATER RESERVOIR - PACKAGE B	VALVE PIT DETAILS AND SECTIONS - 1 OF 3
2024-W006	ICON WATER RESERVOIR - PACKAGE B	VALVE PIT DETAILS AND SECTIONS - 2 OF 3
2024-W007	ICON WATER RESERVOIR - PACKAGE B	VALVE PIT DETAILS AND SECTIONS - 3 OF 3
2024-W008	ICON WATER RESERVOIR - PACKAGE B	INLET/ OUTLET PIPELINE CONNECTION DETAILS
2024-W009	ICON WATER RESERVOIR - PACKAGE B	MISCELLANEOUS DETAILS - 1 OF 2
2024-W010	ICON WATER RESERVOIR - PACKAGE B	MISCELLANEOUS DETAILS - 2 OF 2
2024-W011	ICON WATER RESERVOIR - PACKAGE B	STEEL PIPEWORK DETAILS - 1 OF 3
2024-W012	ICON WATER RESERVOIR - PACKAGE B	STEEL PIPEWORK DETAILS - 2 OF 3
2024-W013	ICON WATER RESERVOIR - PACKAGE B	STEEL PIPEWORK DETAILS - 3 OF 3

Appendix F – Example of Deliverable and Drawing List for a Pipeline Project Detailed Design

Document Name	Concept Design	70% Design	90% Design	100% Design	IFC% Design
Project Execution Plan	✓	✓			
Project Program Schedule	✓	✓	✓	✓	✓
Document Register	✓	✓	✓	✓	✓
Information Request Register	✓	✓	✓	✓	✓
Actions Register	✓	✓	✓	✓	✓
Decisions Register	✓	✓	✓	✓	✓
Risk Register (including SiD Risks)	✓	✓	✓	✓	✓
Kick off Meeting – Progress meeting	✓	✓	✓	✓	✓
Review of Environmental Studies	✓				
Review of Project Approvals	✓				
Design Basis Report	✓				
Concept Review Report	✓				
Hydraulic Assessment Tech Memo		✓	✓	✓	
Geotechnical Interpretive Report		✓			
Cathodic Protection Memo		✓	✓		
Pipeline Design Memo		✓	✓		
Chemical Dosing Memo		✓	✓		
Cotter River Crossing - Options Assessment	✓				
Cotter River Crossing - Reference Design Note		✓			
Operational Plan		✓	✓		
Electrical, Control and Instrumentation Design Report		✓	✓		
Construction Staging & Commissioning Plan		✓	✓	✓	✓
Procurement Strategy (including a procurement package plan)		✓	✓		
Basis of Estimate Report		✓	✓		
70% Design Brief		✓			
70% Comments Register		✓			
70% Design Review Minutes		✓			
Safety in Design Minutes		✓			
90% Design Brief			✓		
90% Comments Register			✓		
90% Design Review Minutes			✓		
100% Design Brief				✓	
100% Comments Register				✓	
100% Design Review Minutes				✓	
IFC% Design Report					✓
Cotter to Stromlo New Pipeline - Cover Sheet		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - General Notes 1			✓	✓	✓
Cotter to Stromlo New Pipeline - General Notes 2			✓	✓	✓
Cotter to Stromlo New Pipeline - Layout Plan		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Process Flow Diagram		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Pipping & Instrumentation Diagram		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Scheme Long Section & Hydraulic Grade		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Plan & Longsection sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Plan & Longsection sheet 2			✓	✓	✓
Cotter to Stromlo New Pipeline - Plan & Longsection sheet 3			✓	✓	✓
Cotter to Stromlo New Pipeline - Plan & Longsection sheet 4			✓	✓	✓
Cotter to Stromlo New Pipeline - Plan & Longsection sheet 5			✓	✓	✓
Cotter to Stromlo New Pipeline - Construction Corridor Cross-sections		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Pipe Trench and Embedment Details		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Buried and Surface Marker Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Jointing Details		✓	✓	✓	✓

Cotter to Stromlo New Pipeline - Air Valve Chamber General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Air Valve Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Air Valve Chamber Reinforcing Details				✓	✓
Cotter to Stromlo New Pipeline - Scour Valve Chamber General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Scour Valve Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Scour Valve Chamber Reinforcing Details				✓	✓
Cotter to Stromlo New Pipeline - Isolating Valve Chamber General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Isolating Valve Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Isolating Valve Chamber Reinforcing Details				✓	✓
Cotter to Stromlo New Pipeline - Cleaning Access Pit General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Cleaning Access Pit Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Cleaning Access Pit Reinforcing Details				✓	✓
Cotter to Stromlo New Pipeline - Cut-in details		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Cotter Road Future Connection Detail		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Booster Pump Station Tie-in Details		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Cut-in Details		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Surge mitigation Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Cotter River Crossing		✓	✓		
Cotter to Stromlo New Pipeline - Trenchless River Crossing Typical Details		✓	✓		
Cotter to Stromlo New Pipeline - Creek Crossings Typical Details		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Erosion Protection Typical Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Access Track Plan Sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Access Track Plan Sheet 2			✓	✓	✓
Cotter to Stromlo New Pipeline - Access Track Typical Preparation		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Access Track Typical Details - Sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Access Track Typical Details - Sheet 2			✓	✓	✓
Cotter to Stromlo New Pipeline - Chemical Dosing Access and Storage GA		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Chemical Dosing Access and Storage Sections			✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Chamber Reinforcing Details			✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Process Flow Diagram		✓	✓		
Cotter to Stromlo New Pipeline - CHEMICAL Dosing P& ID		✓	✓		
Cotter to Stromlo New Pipeline - CHEMICAL Dosing General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Chamber Reinforcing Details			✓	✓	✓
Cotter to Stromlo New Pipeline - CHEMICAL Dosing Process Flow Diagram		✓	✓		
Cotter to Stromlo New Pipeline - CHEMICAL Dosing p&ID		✓	✓		
Cotter to Stromlo New Pipeline - Flow Meter Chamber General Arrangement		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Flow Meter Chamber Concrete Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Flow Meter Dosing Chamber Reinforcing Details			✓	✓	✓
Cotter to Stromlo New Pipeline - Cathodic Protection Site Plan		✓	✓	✓	✓
Cotter to Stromlo New Pipeline - Cathodic Protection Details - Sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Cathodic Protection Details - Sheet 2			✓	✓	✓
Electrical / Instrument / GA Power & Cable Layout Sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Single Line Diagram - sheet 1			✓	✓	✓
Cotter to Stromlo New Pipeline - Single Line Diagram - sheet 2		✓	✓	✓	✓
Scope of Works - Pipeline Construction - Package 1			✓	✓	✓
Scope of Works - Long Lead Material Supply - Package 2			✓	✓	
Scope of Works - Cotter River Crossing - Package 3			✓	✓	
Scope of Works - ECI and Chemical Dosing - Package 4			✓	✓	
Technical Specification & Datasheets - Pipeline Construction - Package 1			✓	✓	✓
Technical Specification & Datasheets - ECI and Chemical Dosing - Package 4			✓	✓	
Bill of Quantities - Pipeline Construction - Package 1			✓	✓	✓
Bill of Quantities - Long Lead Material Supply - Package 2			✓	✓	

Appendix G – Example of Drawing List for a Sewage Pumpstation

Document Name	Concept Design	70% Design	90% Design	100% Design	IFC% Design
Cover Sheet & Drawing List		✓	✓	✓	✓
General Notes - Sheet 1 Fo 2		✓	✓	✓	✓
General Notes - Sheet 2 Fo 2		✓	✓	✓	✓
Pressure Main - Plan & Long Section		✓	✓	✓	✓
Overflow Pipe - Plan & Long Section		✓	✓	✓	✓
Discharge MH - Plan & Section		✓	✓	✓	✓
Headwall & Erosion Protection		✓	✓	✓	✓
Pump Station - Site Layout		✓	✓	✓	✓
Earth Works, Roads & Drainage Plan		✓	✓	✓	✓
Earth Works, Roads & Drainage Sections		✓	✓	✓	✓
Access Road Turning Path		✓	✓	✓	✓
Yard Piping Plan		✓	✓	✓	✓
Valve Pit - Concrete		✓	✓	✓	✓
Valve Pit - Reinforcement		✓	✓	✓	✓
Electrical Kiosk - Concrete Details		✓	✓	✓	✓
Concrete Joints Details		✓	✓	✓	✓
IMH - Plan And Section		✓	✓	✓	✓
Wet Well - Plan & Sections		✓	✓	✓	✓
Wet Well - Roof Details		✓	✓	✓	✓
Emergency Relief Structure - Plan & Section		✓	✓	✓	✓
Concrete Details		✓	✓	✓	✓
Pipework Penetration Details		✓	✓	✓	✓
Retaining Wall - Details		✓	✓	✓	✓
Retaining Wall - Details		✓	✓	✓	✓
IMH - Reinforcement Details		✓	✓	✓	✓
General Arrangement Plan		✓	✓	✓	✓
Material Takeoff		✓	✓	✓	✓
Pump ByPass Details		✓	✓	✓	✓
Jetting Point Arrangement		✓	✓	✓	✓
Valve Pit - Details - 1 Of 2		✓	✓	✓	✓
Valve Pit - Details - 2 Of 2		✓	✓	✓	✓
Valve Pit - Ladder Details		✓	✓	✓	✓
Wet Well Access Cover - Sheet 1 Of 5		✓	✓	✓	✓
Wet Well Access Cover - Sheet 2 Of 5		✓	✓	✓	✓
Wet Well Access Cover - Sheet 3 Of 5		✓	✓	✓	✓
Wet Well Access Cover - Sheet 4 Of 5		✓	✓	✓	✓
Wet Well Access Cover - Sheet 5 Of 5		✓	✓	✓	✓
IMH And Gas Check Access Cover		✓	✓	✓	✓
Bracket Details		✓	✓	✓	✓
RPZD Assembly Details		✓	✓	✓	✓
P & ID		✓	✓	✓	✓
P & ID Legend		✓	✓	✓	✓
P & ID Legend & Notes		✓	✓	✓	✓
Scope Of Works - Pipeline Construction		✓	✓	✓	✓
Scope Of Works – Rising Main Construction		✓	✓	✓	✓
Scope Of Works – Pumpstation Construction		✓	✓	✓	✓
Technical Specification & Datasheets		✓	✓	✓	✓
Bill Of Quantities - Pipeline Construction		✓	✓	✓	✓

Appendix H – Required Improvements in Cost Estimates

Improving cost estimation for Icon Water requires the adoption of a consistent, documented approach. This includes implementing a structured framework that aligns with industry standards and stakeholder expectations. Key components such as the estimating strategy, standards, processes, and procedures must be clearly defined to ensure reliable and accurate cost estimates throughout the project lifecycle. During the preparation of this document, the project cost estimate was identified as an important aspect needing improvement. There have been cases where a cost estimate was based on the full detailed design but turned out to be significantly off once Icon Water approached the market. To address this, it is recommended that the Design & Engineering team work closely with project delivery to track actual project costs and develop a reliable cost database based on real costs, project specifics, and asset types.

To strengthen cost estimation practices, ensuring the scope definition is clear and well-defined is critical. A detailed project scope reduces the risk of future cost overruns and provides a solid foundation for accurate projections. Using cost guidelines and templates, alongside agreed definitions, promotes consistency in the estimating approach and ensures alignment with organisational objectives.

Effective collaboration between estimators, design engineers, and project managers is essential to support a shared understanding of the project scope, risks, and assumptions. This collaboration fosters consistency and facilitates accurate cost estimates. A unit rates database, regularly updated with historical actual costs, can be used for routine projects such as new mains construction and renewals. For more bespoke asset classes, cost estimation should rely on unit rate models and analysis of recent contracts.

Incorporating cost estimating software into the process improves efficiency and consistency, while ensuring that indirect costs are documented and based on historical project cost analysis. This provides a clearer understanding of likely and actual indirect costs, ensuring all cost components are accounted for. External validation of cost estimates should also be applied where appropriate, especially for complex projects, to improve cost certainty and ensure alignment with market rates. The use of documented cost estimating procedures acts as a guide to outline the required level of project development from engineering, asset management, and project management teams. These procedures help align with the specific requirements of each class of estimate, as accuracy improves through the estimation phases.

A classification system similar to other utilities in water industry can be adopted, a phased approach ensures that cost estimates improve in accuracy as the project develops. By leveraging these practices, Icon Water can strengthen its cost estimation function, ensuring it supports reliable project cost management and provides a robust basis for infrastructure investment decisions. These improvements will align Icon Water's cost estimation process with industry best practices, facilitating better outcomes across the project lifecycle. As part of the gap analysis conducted for this document, we identified that the definition and application of cost estimates have been comparatively loose and require greater precision. To align with practices observed in other water utilities, Icon Water must adopt a more accurate approach, particularly at critical stages of design and asset creation milestones. This involves tightening the tolerance levels within cost estimates to ensure greater reliability and consistency, ultimately reducing risks and improving financial outcomes throughout the project lifecycle.

Appendix I – General Detailed Design Requirements

General design requirements that need to be considered and addressed in the design phase of Icon Water projects include:

- The design shall aim for reliable, efficient, and robust performance, and ease of operation and maintenance.
- All mechanical and critical equipment shall be provided with duty/standby capability and operated on rotating duty, with spares provided as appropriate. Any reduction in redundancy shall be discussed and agreed upon as part of the design phase and shall be approved by Icon Water technical assurance team, technical assurance shall engage with the relevant stakeholders to form a position.
- The design shall include online monitoring of key parameters with consultation with Icon Water operations team. To ensure the continuous functionality of online monitoring systems, the plant shall include redundancy of monitoring/measuring equipment, or the provision of spares which can be readily exchanged.
- All facilities must comply with EPA noise regulations in the ACT.
- The design must optimise operation and performance while minimising or eliminating the need for on-going maintenance.
- The works shall be designed with ease of operation as a major criterion. Ease of operations means an operator can carry out routine operations without the need to shutdown units, carry tools, and remove grids or the like.
- The works shall be designed with ease of maintenance a major criterion. maintenance personnel can carry out their routine tasks without the need to shut down process.
- The layout of the design and the location of all plant, equipment, switchboards, etc. are to be designed with ease of accessibility as a major consideration,
- All tanks, and storages shall be capable of being rapidly drained to the suitable discharge location by a permanently installed piping system,
- Lifting facilities shall be considered during the design stage to enable routine maintenance and equipment removal for all major pieces of equipment. Lifting equipment shall comply with all statutory requirements.
- All equipment installed in any building shall be readily removable without damage to or dismantling of the building.
- All calibration and adjustment points shall be accessible from floor level.
- Equipment to be maintained to be at comfortable working height – sitting or standing rather than having to lie down or use ladders.
- Adequate room for Icon Water maintenance staff to move around equipment, e.g. in pits and wells.
- All gearboxes and other pieces of equipment shall allow for lubricant drain and fill facilities from normal operator access.

- Acoustic covers or other protection for equipment shall be readily removable for easy maintenance access.
- All equipment and appurtenances shall include isolation devices (e.g. valves) to allow for servicing without interrupting the process.
- Adequate lighting - inside buildings and outside for night work, including emergency lighting.
- Access shall be provided for all motor circuit control (MCC) panels and distribution panels to allow maintenance staff to conduct thermograph testing on the busbar, joints and major contactors without isolating the panels and physically opening the panel enclosure or doors.
- Adhere to all relevant legislation, codes, and industry guidelines, including the most recent version of the Technical Specification, Australian Standards and Codes, and Icon Water Specification.
- Obtain approval and sign-off from a qualified Registered Engineer in the Australian Capital Territory (ACT).
- Satisfy operational requirements for equipment, materials, processes, and functions, prioritizing minimum life spans and minimal future maintenance.
- Consider efficiency, operating costs, life cycle costing, and maintenance provisions when selecting facility services, design for flexibility and versatility.
- Ensure compatibility with existing services, energy-efficient design, and seamless integration with the existing environment.
- Least life-cycle-cost.
- A level of service to the Icon Water's customers in accordance with the Water Agency's policies, customer charters and operating contracts.
- Minimal adverse environmental and community impact.
- Compliance with environmental requirements including, but not limited to, noise, odour, buffer zone, aesthetics for above ground buildings.
- Compliance with WHS requirements.
- Sufficient hydraulic capacity to service the full catchment.
- Ability to be staged if necessary or appropriate.
- Minimal maintenance.
- Safe and easy access for operations and maintenance.
- Control of odour.
- Resistance to internal and external corrosion and chemical degradation.
- Resistance to applied loads.
- Telemetry.
- A level of reliability and redundancy appropriate to the risk of the asset failing.

Appendix J – Technical Specification Update History

A.1 Update History

Issue A (15/03/25): *Original work by S Asadollahi (2025) for internal review.*

Issue 1 (27/10/25): *Issued for use.*

A.2 Issue 2 Updates (future use)

Section	Update	Description

iconwater.com.au