REGISTRATION AUTHORITY
FOR CHARTERED PROFESSIONAL ENGINEERS

Recognised Engineer (Dam Safety)

Guide to Assessments

February 2024

Contents

Introduction

The Recognised Engineer (RecEng) title is legislated in the Building Act and Building (Dam Safety) Regulations, allowing a dam safety engineer to certify and audit potential impact classifications and/or dam safety assurance programmes in the dam's operational (post-construction) context[1].

The Recognised Engineer has two separate, distinct certifications: (1) Potential Impact Classification (PIC) and (2) Dam Safety Assurance Programme (DSAP). A Recognised Engineer can have either one, or both, certifications[2].

The competencies for a Recognised Engineer focus on the 'post-construction' safety of the dam and dam system only. Recognised Engineer competencies are not associated with building dams, such as the investigation, design, analysis, construction and commissioning of dams. However, an understanding of the fundamentals of these aspects is important as they relate to PIC determination, and DSAP development and implementation, appropriate to the nature of the dam type and classification[3]. A Recognised Engineer designation does not provide any certification of an engineer's competencies to design, construct, or commission dams.

Potential Impact Classification (PIC)

The Recognised Engineer – Potential Impact Classification (RecEng PIC) is responsible for certifying dam Potential Impact Classifications (PICs). To register as a RecEng PIC, in addition to being registered as CPEng, you need to meet the qualifications in regulation 22 (1)–(3) and demonstrate experience and knowledge of:

a. The dam classification system under section 134B of the Building Act (including regulation 9)
b. The identification of appurtenant structures
c. Dam-break flood hazard assessment: the assessment of the hazard of potential dam-break floods to down-stream people and property and the environment (for example, assessing the extent of inundation, depth of inundation, velocity, flow, time to peak flow, and duration of inundation).

As a RecEng PIC, you will be considering the outputs of the hydrological, hydraulic engineering and consequence assessment components; you do not require specific capabilities to perform these tasks.

Dam Safety Assurance Programme (DSAP)

The Recognised Engineer – Dam Safety Assurance Programme (RecEng DSAP) is responsible for certifying and auditing Dam Safety Assurance Programmes (DSAPs). To register as a RecEng DSAP, in addition to being registered as CPEng, you need to meet the qualifications in regulation 23 (1)–(3) and demonstrate experience and knowledge of:

a. The general requirements for dam safety assurance programmes (see regulation 11)
b. Procedures for the operation and maintenance of dams and reservoirs (see regulation 12)
c. Surveillance procedures (see regulation 13)
d. Procedures for the identification, inspection, and maintenance of appurtenant structures (see regulation 14)
e. Procedures for the inspection, maintenance, and testing of gate and valve systems with dam or reservoir safety functions (see regulation 14)
f. Procedures for intermediate dam safety reviews (see regulation 15)
g. Procedures for comprehensive dam safety reviews (see regulation 16)
h. Procedures for emergency planning and response (see regulation 17)
i. Procedures for identifying and managing dam safety issues (see regulation 18).

1 The purpose for developing 'Recognised Engineer' competencies is to meet the requirements of Sections 149(1)(c)(i) and 149(1)(c)(ii) of the Building Act and Sections 22 and 23 of Building (Dam Safety) Regulations 2022.
2 The requirements for PIC and DSAP are expressly described in Sections 22 and 23, Building (Dam Safety) Regulations 2022.
3 Recommended PIC and DSAP practices in New Zealand are provided in the New Zealand Dam Safety Guidelines (NZDSG), prepared by the New Zealand Society on Large Dams (NZSOLD).

Recognised Engineer public register

Engineers registered as Recognised Engineers will be published on our online register. There are two possible Recognised Engineer registrations:

» Recognised Engineer – Potential Impact Classification (RecEng PIC)

» Recognised Engineer – Dam Safety Assurance Programme (RecEng DSAP)

You may choose to apply for both of the above registrations.

Eligibility

A Recognised Engineer must be registered both as a Chartered Professional Engineer (CPEng) and Recognised Engineer with Engineering New Zealand. The Recognised Engineer title is open to professional engineers who:

» are currently registered as a Chartered Professional Engineer, or eligible to apply to be a Chartered Professional Engineer (you can apply for RecEng and CPEng at the same time)

» are able to practise competently in the area of practice for PIC and DSAP referred to in the relevant Building Act sections[4] to the reasonable standard of a professional engineer practising in the area

» have at least 4 years' experience in the field of dam safety engineering within the previous 10 years

» have relevant experience in and knowledge of dam safety engineering, including relevant experience in and knowledge of 1 or more relevant practice fields for PIC[5] and/or DSAP[6]

You don't need to be a member of Engineering New Zealand to apply.

4 Building (Dam Safety) Regulations 2022 22(2)(a)(i) and 23(2)(a)(i)

5 PIC: The fields may include Civil Engineering, Water Engineering, or any other field of engineering that is relevant to 1 or more of the following: (i) identifying dam potential failure modes; (ii) analysing dam breaks; (iii) assessing dam hazards; (iv) applying other principles of dam safety engineering.

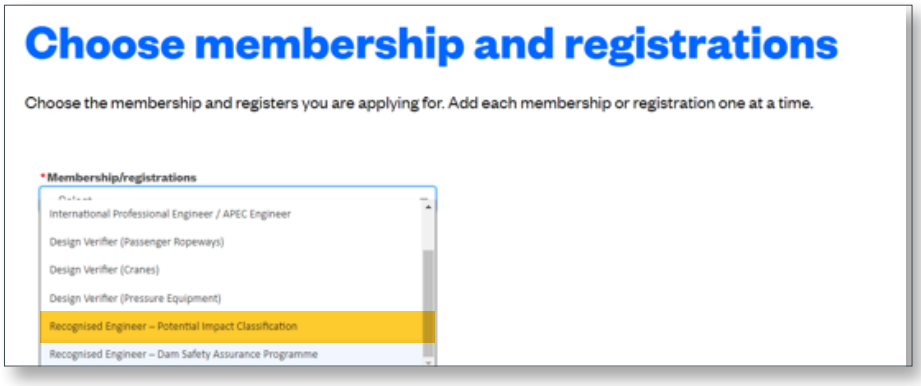
6 DSAP: The fields may include Civil Engineering, Water Engineering, or any other field of engineering that is relevant to 1 or more of the following: (i) designing and operating dam systems; (ii) managing dam safety risk; (iii) applying other principles of dam safety engineering.

How to apply

Applying if you're already registered as a CPEng

If you're already registered as a CPEng, you can apply to add registration as a RecEng to your current CPEng registration. Email assessment@engineeringnz.org and we'll open an assessment for you. The cost for this is $1,336.50 excluding GST. The assessment will require you to demonstrate your competence in dam safety engineering with a specific focus on CPEng Competency Group 1 (Engineering Knowledge) and Group 4 (Developing Technical Solutions). Refer to Appendix 1 for details on RecEng performance indicators for these CPEng competency groups.

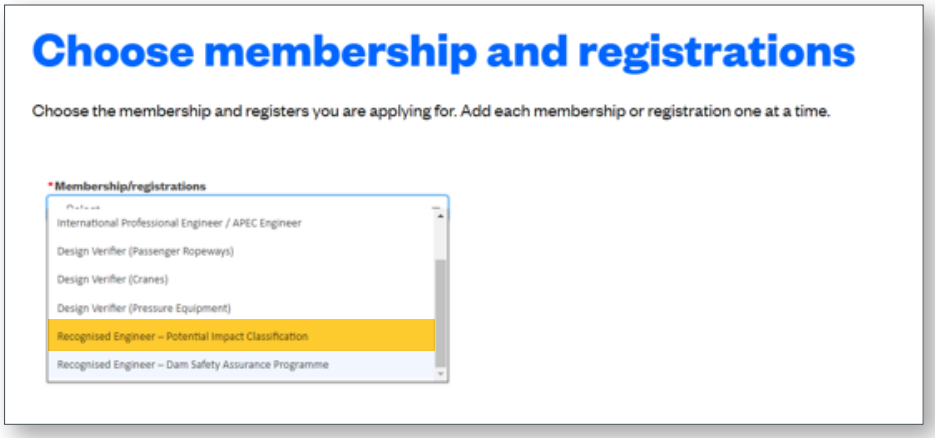
When completing your application, indicate your intention to register as a RecEng in the 'Memberships and Registrations' section. You'll be able to indicate whether you want to register for PIC, DSAP or both. If you want to apply for both, you'll need to add them one at a time:



If this is your first time applying for CPEng

The CPEng Assessment Guidance should be your main point of reference when submitting a first-time application for CPEng. If you are including an application for RecEng in your first time CPEng assessment, refer to Appendix 1 for details on RecEng performance indicators for each of the CPEng competency groups.

When completing your application, indicate your intention to register as a RecEng in the 'Memberships and Registrations' section. You'll be able to indicate whether you want to register for PIC, DSAP or both. If you want to apply for both, you'll need to add them one at a time:



Recognised Engineer (Dam Safety) assessment guidance

1. Referees

You'll need to nominate two referees to complete your application to register as a RecEng. Your nominated referees will be sent an invitation to provide a reference for you. If they accept the invitation, they'll be asked to provide information about your professionalism and technical competence in the field of dam safety engineering. If a referee declines your request, you'll need to provide another person.

At least one of your referees needs to be a current CPEng or equivalent. Both your referees must be familiar with your technical and professional capabilities in dam safety engineering and be able to confidently provide a reference.

WHAT IS AN EXAMPLE OF A GOOD REFEREE?

Referees should be competent in the practice area you're applying for. They should be familiar with your technical skills.

- ✓ Two referees should be provided. At least one of your referees for dam safety must be a CPEng or equivalent[7].
- ✓ Ideally, at least one of your referees does not work within the same company as you. They could be someone who has peer reviewed work samples or been involved in a collaborative project with you.
- ✗ A referee who is not familiar with your technical skills related to dam safety engineering.
- ✗ Referees who are conflicted; for example, through a close personal relationship with you or having a financial interest in the outcome of the assessment.

Tip: Finding referees can be a particular challenge for people in small companies. We recommend you consider who may act as your referee well in advance of your application, and ensure this person has sufficient familiarity with your dam safety engineering work.

Referees will be asked the following questions:

GENERAL

Provide details of your relationship to the applicant. Please also confirm you can provide a reference based on an understanding of the applicant's work within their practice area. If you're unable to provide a technical reference in the practice field of the applicant, please decline this request for a reference.

ENGINEERING COMPETENCY

Please comment on the technical engineering competence (specifically in analysis and design/problem solving) of the applicant to practice within their practice area. Do you consider the engineer to be competent in the engineering work they do? Do you think they demonstrate knowledge and application of current practice in their field and an ability to develop safe and effective engineering solutions? Why or why not?

PROFESSIONAL

What aspects of professionalism do you believe the applicant brings to their work? Please include detail of their relationships with stakeholders, compliance with legislation, and health and safety compliance, where appropriate. Is there anything about the practice of the applicant that would raise a potential concern? Do you support their registration as a Chartered Professional Engineer/Recognised Engineer?

7 CPEng equivalence means a qualification or title that the Registration Authority determines requires the holder to (a) have demonstrated competence at least equivalent to the minimum standard for registration under these rules; and (b) be bound by a code of ethical conduct that is substantially equivalent to the Code of Ethical Conduct under these rules. Examples of CPEng equivalence, therefore, include: A Chartered Member of Engineering New Zealand (CMEngNZ) who is not classified as an Engineering Technician (CMEngNZ (Engineering Technician)) or an Engineering Technologist (CMEngNZ (Engineering Technologist)); a Chartered Engineer (CEng) registered with the Engineering Council in the UK.

2. Continuing Professional Development

Continuing Professional Development (CPD) should be completed to show evidence you've taken reasonable steps to maintain the currency of your dam safety engineering knowledge and skills since your last assessment/graduation/ the past 6 years. You need to complete a minimum of 15 hours of dam safety engineering specific CPD activities per year.

WHAT IS AN EXAMPLE OF GOOD CPD?

Active involvement in the industry is essential, and you will need to demonstrate that you have a high level of networking with other professional engineers working in dam safety engineering.

Evidence of learning linked to the application of contemporary knowledge of the activities of dam safety engineers, for example:

- ✓ Reads dam publications and journals (such as *Hydro review*, *Waterpower and Dam Engineering*, NZSOLD guidance and newsletters, ANCOLD guidelines and ICOLD bulletins)
- ✓ Reads Ministry of Business, Innovation and Employment dam related guidance – website, guidance documents etc
- ✓ Attends and/or participates in dam conferences and workshops (such as NZSOLD symposiums, ANCOLD annual meetings and similar international events)
- ✓ Attends and/or participates in dam related technical group meetings
- ✓ Maintains relationships with others practising in the dam safety engineering area (eg NZSOLD members).
- ✓ Attends and participates in employer-provided dam related training
- ✓ Maintains currency with relevant standards, guidelines and codes.

- ✗ 15 hours of 'on-the-job reading'.
- ✗ 15 hours of 'mentoring'.

3. Work history

Your work history must be provided in the form of an up-to-date CV and should allow an assessor to see a minimum of 4 years' experience in the field of dam safety engineering within the last 10 years.

WHAT IS AN EXAMPLE OF GOOD WORK HISTORY?

Your work history should describe the projects you've been involved with, and more importantly, your role in each project. It should outline what your responsibilities were for the project and what challenges were presented by the project.

Aim to keep your CV under three pages.

- ✓ Provide the name, location and contact details of employing organisations, as well as the dates and duration of employment, the title of your position, details of your role and how your work demonstrates your competency as a Recognised Engineer.
- ✓ Provide sufficient work history to demonstrate the broad scope of competency required for registration as a Recognised Engineer.
- ✓ Clearly describe key projects you were involved in, and your role in the work, with a particular focus on the period since your last assessment/since graduation/in the last 10 years.

- ✗ A list of projects you have worked on with no information on your roles and responsibilities.

WHAT ARE ASSESSORS LOOKING FOR?

- ◯ Has the engineer provided work history for the period since their last assessment/since graduation/in the last 10 years?
- ◯ Does their work history align with the requirements for registration as a Recognised Engineer?
- ◯ Does their work history demonstrate successful completion of complex engineering work in dam safety engineering?
- ◯ Does their work history demonstrate ongoing involvement in the profession?

4. Selecting and documenting your work samples

This part of your application is key to demonstrating your current technical competence in dam safety engineering (PIC/DSAP). You'll be able to choose from your existing work and CPD records, or add new ones. For each record you choose, you'll need to explain how that record supports your assessment application. When you apply for registration as a Recognised Engineer, an assessor needs to confirm that the provided work samples clearly demonstrate competency in relation to the required core competencies for a Recognised Engineer.

You'll need to provide sufficient evidence to demonstrate competence as a Recognised Engineer. For most candidates, this is 2 work samples.

We recommend you review your application against the technical competency assessment checklist prior to submitting your application. If evidence is missing, incomplete, or can't be clearly interpreted by an assessor, you'll be advised and further information requested.

DEFINING ACCEPTABLE WORK SAMPLES

Your work samples must clearly show you understand the fundamentals of dam safety engineering – PIC and/or DSAP. You're responsible for ensuring you have appropriate work samples to demonstrate your current competence.

Tips for success

- When writing your submission, talk about yourself using 'I', 'me' or 'my'. The assessors don't want to know what the team did as part of the project; they are only interested in your involvement.
- Record your work samples as you go – you don't want to have to go looking for work you did years ago.
- Exercise judgement and submit your best evidence – not everything you think might be relevant. The assessors will come back to you if they find any gaps in your evidence, and will give you the opportunity to provide further evidence. You should show evidence of multiple competency groups and complexity in the majority of the projects that you are working on.
- Remember, it is up to you to demonstrate you are competent – not up to the assessors to interrogate you to ascertain your competency.

WHY WOULD FURTHER EVIDENCE BE REQUESTED?

If you don't provide clear evidence to allow for an assessment as per the following criteria, then further evidence may be requested.

5. Technical competency assessment checklist

Core skills

ALL CANDIDATES TO BE REVIEWED AGAINST THESE CRITERIA

Does the candidate demonstrate a working knowledge of:

- ◯ New Zealand Dam Safety Guidelines prepared by NZSOLD, and other relevant industry guidelines, including such dam safety international organisations insofar as they inform recommended NZ practice (eg ICOLD, ANCOLD, CDA)
- ◯ Building (Dam Safety) Regulations 2022
- ◯ Resource Management Act 1991 as applicable to dam safety
- ◯ New Zealand seismic hazard criteria
- ◯ New Zealand hydrological hazard criteria
- ◯ Risk management principles.

Has the candidate demonstrated active involvement in the industry, and shown they have a high level of networking with other professional engineers working in dam engineering? Has the candidate undertaken CPD activities in dam safety engineering such as:

- ◯ Reading dam publications and journals (such as '*Hydro review*', '*Waterpower and Dam Engineering*', NZSOLD guidance and newsletters, ANCOLD guidelines and ICOLD bulletins)
- ◯ Reading Ministry of Business, Innovation and Employment dam related guidance – website, guidance documents, etc.
- ◯ Attending and/or participates in dam conferences and workshops (eg NZSOLD symposiums, ANCOLD annual meetings and similar international events)
- ◯ Attending and/or participates in dam related technical group meetings
- ◯ Maintaining relationships with others practising in the dam safety engineering area (eg NZSOLD members)
- ◯ Attending and participates in employer-provided dam related training
- ◯ Maintaining currency with relevant standards, guidelines and codes.

Practice area specific

Assess against these criteria if they're listed by the engineer as a practice area.

POTENTIAL IMPACT CLASSIFICATION

Does the candidate demonstrate experience and knowledge of:

- ◯ The dam classification system under section 134B of the Building Act 2004 (including regulation 9)
- ◯ The identification of appurtenant structures
- ◯ Dam-break flood hazard assessment: the assessment of the hazard of potential dam-break floods to down-stream people and property and the environment (for example, assessing the extent of inundation, depth of inundation, velocity, flow, time to peak flow, and duration of inundation).

DAM SAFETY ASSURANCE PROGRAMME

Does the candidate demonstrate experience and knowledge of:

- ◯ The general requirements for dam safety assurance programmes
- ◯ Procedures for the operation and maintenance of dams and reservoirs
- ◯ Surveillance procedures
- ◯ Procedures for the identification, inspection, and maintenance of appurtenant structures
- ◯ Procedures for the inspection, maintenance, and testing of gate and valve systems with dam or reservoir safety functions
- ◯ Procedures for intermediate dam safety reviews
- ◯ Procedures for comprehensive dam safety reviews
- ◯ Procedures for emergency planning and response
- ◯ Procedures for identifying and managing dam safety issues.

Appendix 1: Assessment indicators

You'll need to demonstrate that you are able to practise competently as a Recognised Engineer – PIC and/or DSAP, to the standard expected of a reasonable professional engineer. The extent to which you're able to perform each of the following numbered elements must be taken into account in assessing whether you meet the overall standard. You'll also need to show you can carry out engineering work at a particular level of complexity (see Appendix 2).

Each competency standard is described below, together with performance indicators which help clarify how you may be able to demonstrate that you have met the standard as a Recognised Engineer. You don't need to provide evidence on every indicator – they are there as a guide. The indicators will help you provide the types of work or evidence required of a Recognised Engineer PIC and/or DSAP to meet the element descriptions, and build the holistic picture of a Recognised Engineer.

The Recognised Engineer assessment framework consists of the express regulatory competencies in four areas, which align with Parts 1 through 4 of the CPEng assessment framework.

1. An overview of the Recognised Engineer competencies is outlined under the heading "Professional Engineering – Recognised Engineer". General competencies for all Recognised Engineers are stated, and the competencies and qualifications specific for PIC and DSAP are provided as expressly stated in regulations 22 and 23 respectively, Building (Dam Safety) Regulations 2022
2. For each of Parts 1 through 4:
   a. The CPEng Competence Standard Description, Performance Indicators and General Practice Field Guidelines are included. This information is reproduced directly from the CPEng assessment framework to provide context and understanding of analogous Recognised Engineer competencies and performance indicators
   b. Competencies and performance indicators specific to Recognised Engineer are provided
   c. Any PIC and/or DSAP specific competencies and performance indicators are presented in the two parallel columns titled "Potential Impact Classification" and "Dam Safety Assurance Programme".

Professional Engineering: Part 1 – Engineering Knowledge

Competence standard description

a. Comprehend and apply their knowledge of accepted principles underpinning:
   i. widely applied good practice for professional engineering; and
   ii. good practice for professional engineering specific to New Zealand.

c. Maintain the currency of their professional engineering knowledge and skills.

Performance indicators

» Has a Washington Accord degree or recognised equivalent qualification or has demonstrated equivalent knowledge and is able to:
   » identify, comprehend, and apply appropriate engineering knowledge
   » work from first principles to make reliable predictions of outcomes
   » seek advice, where necessary, to supplement own knowledge and experience
   » read literature, comprehend, evaluate, and apply new knowledge.
» Demonstrates an awareness of legal requirements and regulatory issues within the jurisdictions in which they practice.
» Demonstrates an awareness, of and applies appropriately, the special engineering requirements operating within the jurisdictions in which they practices.
» Demonstrates a commitment to extending and developing knowledge and skills.
» Participates in education, training, mentoring or other programmes contributing to they professional development.
» Adapts and updates knowledge base in the course of professional practice.
» Demonstrates collaborative involvement with professional engineers (New Zealand engineers for CPEng assessments).

General practice field guidelines

» This element is intended to show the candidate currently has the level of knowledge of a Washington Accord degree – as evidenced by an accredited Washington Accord degree (or recognised equivalent qualification) supported by on-going CPD, although applicants can demonstrate they have acquired the same level of knowledge through other learning processes.
» Applicants are able to apply that knowledge through work experience. The competence required by the standard is that of a 4-year Washington Accord degree graduate with appropriate post-graduation work experience.
» Qualifications other than Washington Accord equivalent may require knowledge assessment.
» Applicants will be expected to show their ability to work from first principles and to comprehend and apply engineering knowledge – and evidence of this skill will be critical for non-Washington Accord qualified applicants in meeting this element of the standard.
» Evidence that shows the applicant understands and works in compliance with the relevant regulatory framework, for example, compliance regimes covered by statute or local body by-law, mandatory standards or codes of practice.
» Demonstrate an understanding of situations and responsibilities when/where standards/guidelines/specifications need to be modified or amended to suit specific situations and document the resulting implications.
» Maintains Continued Professional Development (CPD) records.
» Identifies future needs and plans competence development accordingly.
» Actively participates with professional bodies.
» Participates in diverse engineering activities leading to learning and betterment of engineering skills by a combination of training internal to organisation and external CPD, and self-directed learning.
» Maintains a network of professional engineers – peer reviews, collaborative activities.
» Evidence of reflecting and learning from mistakes with the benefit of hindsight.

Competencies and performance indicators

The following is a general indication of the competencies required to meet the components of this element for both PIC and DSAP requirements.

Demonstrates through activities a working knowledge of:

» New Zealand Dam Safety Guidelines prepared by NZSOLD, and other relevant dams practice guidelines, including such dam safety international organisations insofar as they inform recommended New Zealand practice (eg ICOLD, ANCOLD, CDA).
» Building (Dam Safety) Regulations 2022
» Resource Management Act 1991 as applicable to dam safety
» New Zealand seismic hazard criteria
» New Zealand hydrological hazard criteria
» risk management principles.

Undertakes CPD activities in dam safety engineering, for example:

» reads dam publications and journals (such as *Hydro review*, *Waterpower and Dam Engineering*, NZSOLD guidance and newsletters, ANCOLD guidelines and ICOLD bulletins)
» reads Ministry of Business, Innovation and Employment dam related guidance –website, guidance documents etc
» attends and/or participates in dam conferences and workshops (such as NZSOLD symposiums, ANCOLD annual meetings and similar international events)
» attends and/or participates in dam related technical group meetings
» maintains relationships with others practising in the dam safety engineering area (eg NZSOLD members etc)
» attends and participates in employer provided dam related training
» maintains currency with relevant standards, guidelines and codes.

Active involvement is essential, and applicants need to show that they have a high level of networking with other professional engineers working in dams engineering.

Potential Impact Classification

Recognised Engineer Element 1 Competencies and Performance Indicators apply to both PIC and DSAP categories. No further specific PIC Competencies or Performance Indicators are required.

Dam Safety Assurance Programme

Recognised Engineer Element 1 Competencies and Performance Indicators apply to both PIC and DSAP categories. No further specific DSAP Competencies or Performance Indicators are required.

Professional Engineering: Part 2 – Managing Engineering Work

Competence standard description

» Exercise sound professional engineering judgement.
» Be responsible for making decisions on part or all of one or more complex engineering activities.
» Manage part or all of one or more complex engineering activities in accordance with good engineering management practice.
» Identify, assess, and manage engineering risk.

Performance indicators

» Demonstrates the ability to identify alternative options.
» Demonstrates the ability to choose between options and justify decisions.
» Peers recognise the applicant's ability to exercise sound professional engineering judgement.
» Takes accountability for the applicant's outputs and for those who they're responsible for.
» Accepts responsibility for the applicant's engineering activities.
» Plans, schedules, and organises projects to deliver specified outcomes.
» Applies appropriate quality assurance techniques.
» Manages resources, including personnel, finance, and physical resources.
» Manages conflicting demands and expectations.
» Identifies risks.
» Develops risk management policies, procedures, and protocols to manage safety and hazards.
» Manages risks through 'elimination, minimisation and avoidance' techniques.

General practice field guidelines

» Undertake complex and multi-criteria analysis as a part of exercising engineering judgement.
» Takes a holistic approach in the development and implementation of engineering solutions, respecting other professional and individual inputs and demonstrating a balanced process to achieve desired outcomes.
» Makes decisions using technical, economic, social, environmental etc criteria when there is a choice of options (eg what factors were taken into account in making the decision? What impact did those factors have? What were the benefits/ compromises in making the decision?).
» Feedback and learning from one's peers (eg positive peer review of work).
» Demonstrate effective self-management skills (including: undertaking professional development' setting own goals; practising effective time management; and recording professional development activities).
» Undertake and accept responsibility for higher levels of engineering activity, eg preparing and presenting submissions, estimates, project funding requests, annual planning activities and reports to client and senior management.
» Be responsible for and conduct public and stakeholder consultation and meetings.
» Project Management responsibility for a group of smaller projects and engineering activities or a significant part of a larger project.
» Undertake site management activities such as being the Project Manager for the Engineer/Client/Contractor.
» Evidence of training in risk management.
» Knowledge of (not necessarily the use of) specialist software used for risk management.
» Consider risks within alternative designs/timings/solutions/options.
» Considers financial risk and/or potential liability to company.

Competencies and performance indicators

Element 2 CPEng competencies apply similarly to Recognised Engineer competencies. Additional PIC and DSAP competencies and performance indicators are provided below.

Potential Impact Classification

- Sound judgment assessing Population at Risk (PAR) and Potential Loss of Life (PLL) from hypothetical dam-break.
- Sound judgment assessing potential community, heritage, cultural, critical and major infrastructure and natural environment damages from hypothetical dam-break.
- Understands wider impacts and consequences from potential dam failures and appropriately consider relevant uncertainty and sensitivity associated with selecting a PIC.
- Demonstrates clear understanding of the regulatory and consequential differences between Low, Medium and High PICs.

Dam Safety Assurance Programme

- Understanding of the elements of a Dam Safety Management System (DSMS) as outlined Module 5, Table 4.1 of the New Zealand Dam Safety Guidelines (NZDSG) and how the DSAP aligns within the DSMS.
- Experience and knowledge with DSAP procedures. This will include aspects related to:
  - operation and maintenance
  - surveillance
  - appurtenant structures and gate and valve systems
  - intermediate dam safety reviews
  - comprehensive dam safety reviews
  - emergency preparedness.
- Identifying and managing dam safety issues.
- Defining and reviewing dam surveillance programmes.
- Managing dam safety reviews, both IDSRs and CDSRs
- Performs dam IDSRs and CDSRs over a range of PIC ratings and dam types.
- Understands risk management strategies for dams and demonstrates sound dam risk decision making.
- Performs and reviews Failure Modes and Effects Analysis (FMEA) for dams.
- Management of dam safety issues, including prioritising and developing response actions.
- Outlining and leading dam safety deficiency investigations.
- Understanding the principles and objectives of emergency preparedness. This includes the preparation and review of Emergency Action Plans (EAPs) and the participation in emergency planning, training and response relating to dams.

Professional Engineering : Part 3 – Professional Acumen

Competence standard description

- Conduct their professional engineering activities to an ethical standard at least equivalent to the Code of Ethical Conduct.
- Recognise the reasonably foreseeable social, cultural, and environmental effects of professional engineering activities generally.
- Communicate clearly to other engineers and others they are likely to deal with in the course of their professional engineering activities.

Performance indicators

- Demonstrates an understanding of the Code of Ethical Conduct
  - Take reasonable steps to safeguard health and safety.
  - Have regard to effects on environment.
  - Report adverse consequences.
  - Act competently.
  - Behave appropriately.
  - Inform others of consequences of not following advice.
  - Maintain confidentiality.
  - Report breach of Code.
- Behaves in accordance with the Code of Ethical Conduct even in difficult circumstances (this includes demonstrating an awareness of limits of capability acting with integrity and honesty and demonstrating self-management).
- Considers and, where needed, takes into account health and safety compliance issues and impact(s) on those affected by engineering activities.
- Considers and takes into account possible social, cultural and environmental impacts and consults where appropriate.
- Considers Te Tiriti o Waitangi implications and consults accordingly.
- Recognises impact and long-term effects of engineering activities on the environment.
- Recognises foreseeable effects and where practicable seeks to reduce adverse effects.
- Uses oral and written communication to meet the needs and expectations of their audience.
- Communicates using a range of media suitable to the audience and context.
- Treats people with respect.
- Develops empathy and uses active listening skills when communicating with others.
- Operates effectively as a team member.

General practice field guidelines

- Evidence of exercising judgement on own competence – outline actions taken when confronted with work outside own area of competence.
- Evidence of managing conflicts of interest and description of actions taken to resolve.
- Evidence of quality assurance procedures and risk management methodologies used in professional engineering practise.
- Evidence of addressing needs of key stakeholders (Iwi, historic places, archaeology, etc – consultation, and possibility for alternative design to reflect needs and aspiration of those affected).
- Evidence of life-cycle considerations in engineering designs – wastage, buildability, materials used, energy consumption and maintenance requirements during operational life, end-of-life issues (disposal and demolition).
- Identify the need for sustainable solutions to engineering and construction activities.
- Evidence of actions taken to address health and safety and environmental implications of projects during and after construction/implementation.
- Effective communication.
- Preparing, interpreting and presenting information, issuing clear and accurate instructions, interpreting instructions, and selecting appropriate methods of communication for a variety of audiences (eg one-to-one and group communication, technical and
  non-technical audiences).
- Evidence of acceptance by peers by attendance and active participation in meetings, workplace activities, training courses etc where candidate presents points-of-view and debates the topic or issue.
- Evidence of leadership.

Recognised engineer competencies and performance indicators

- Awareness of potential life safety risks, social, cultural and environmental impacts related to dam safety.
- Awareness of dangerous, earthquake prone and flood prone dams' definitions, importance and notification requirements.
- Ability to communicate dam safety topics effectively in writing and orally.
  Examples of evidence for effective communication include:
  - technical papers related to dams and dam safety.
  - production of clearly understood reports and documentation relating to the safety evaluation of dams, such as IDSRs, CDSRs, EAPs, surveillance plans, and operations and maintenance plans
  - participation in teams for dam engineering work, including collaboration on dam safety issues identification, dam safety deficiency management, Failure Modes and Effects Analysis workshops, acting as a peer reviewer, etc
  - communications with non-technical people (lobby groups, community leaders, etc)
  - responses to requests or pressure to work outside one's area of competence
  - having no financial interest in the dam of concern or other conflicts of interest.

Potential Impact Classification

- Ensuring the consequence assessment and Potential Impact Classification are prepared to the appropriate level of detail.
- The appropriate methods for estimating Population at Risk and Potential Loss of Life are used.
- The consequences on individuals, communities, heritage, cultural and the environment, are appropriately considered.

Dam Safety Assurance Programme

- Consider DSAP appropriateness to dam nature and classification (initial certification).
- Compliance with dam safety assurance programme audited and documented.
- Identification of dam safety issues and management of dam safety deficiencies.
- End of life issues relevant to old or deficient dams.

Professional Engineering: Part 4 – Developing Technical Solutions

Competence standard description

» Define, investigate and analyse complex engineering problems in accordance with good practice for professional engineering.

» Design or develop solutions to complex engineering problems in accordance with good practice for professional engineering.

Performance indicators

» Identifies and defines the scope of the problem.

» Investigates and analyses relevant information using quantitative and qualitative techniques.

» Tests analysis for correctness of results.

» Conducts any necessary research and reaches substantiated conclusions.

» Identifies needs, requirements, constraints, and performance criteria.

» Develops concepts and recommendations that were tested against engineering principles.

» Consults with stakeholders.

» Evaluates options and selects solution that best matched needs, requirements, and criteria.

» Plans and implements effective, efficient, and practical systems or solutions.

» Evaluates outcomes.

General practice field guidelines

» Evidence demonstrates knowledge of technical fundamentals (including initial specification and brief in terms of client perceptions, use of engineering design standards and specifications) to scope a complex engineering problem.

» Examples of methodologies used for analysis, prediction, and choice outside those encompassed by standard codes (including preparing functional design requirements, addressing design concepts, and determining possible design constraints).

» Evidence of experiments conducted, prototypes built, or simulations performed to test analyses.

» Evidence of literature searches, use of network of peers to gather information on approaches to problem solving.

» Evidence of personal responsibility taken in a project or significant task from the end of an investigation phase showing design solutions developed which resulted in all objectives being met. To indicate the level of complexity, describe involvement in detail. This can be over a range of similar projects/tasks, or one overall project/task with multiple components.

Competencies and performance indicators

Dam safety engineering competence at a broad level – breadth is more important than depth in this case. Broad dam safety engineering competence is most likely developed after involvement in a diverse range of dams, dam safety studies and preparation/review of dam safety documents. Such broad dam safety competence requires a minimum of four years dam safety practice in the past 10 years.

Potential Impact Classification

- Preparation and review of dam consequence assessments.
- Definition of itinerant Population at Risk in a broad range of scenarios and statistical simulations of these scenarios.
- Understanding of detailed justifications of Potential Loss of Life using appropriate methods.
- Understanding when the Assessed Damage Level (ie damages to property, infrastructure, heritage, cultural and environment) is complex and the 'engineer's discretion' is exceeded requiring more detailed assessments.

Dam Safety Assurance Programme

- Experience and knowledge with DSAP procedures as appropriate to each dam system's unique nature and context.
- Dam and reservoir operations and maintenance.
- Familiarity with specifying surveillance requirements, alarm levels, performance evaluation and response actions.
- Procedures for evaluation and response to surveillance data and dam safety issues.
- Assessment/review of dam performance.
- Failure Modes and Effects Analysis procedures.
- Safety review procedures.
- Familiarity with identifying, inspecting and maintaining appurtenant structures.
- Familiarity with inspection, testing and maintenance of gate and valve systems having dam safety and reservoir safety functions.
- Familiarity with emergency action plans and preparedness activities, including consulting with local authorities, Civil Defence Emergency Management Group and emergency services.
- Procedures for identifying and managing dam safety issues.
- Dam safety deficiency investigation procedures.
- Dam safety risk management.

Appendix 2: How we define complexity

You'll need to show you can carry out engineering work at a particular level of complexity.

Problem	Activity
Chartered Member and CPEng	
Complex engineering problems Problems that include some or all of the following: » Wide-ranging or conflicting technical, engineering, and other related issues » No obvious solution, which means an original method of analysis is needed » Can't be resolved without in-depth engineering knowledge » Issues not often experienced » Aren't covered by the standards and codes of practice for professional engineering » Diverse groups of stakeholders with a wide range of needs » Significant consequences in a range of contexts	**Complex engineering problems** Activities or projects that include some or all of the following: » Diverse resources, eg people, money, equipment, materials and technologies » Resolving critical problems that occur when a variety of technical, engineering and other related issues interact » New materials, techniques or processes, or the innovative use of existing materials, techniques or processes » Significant consequences in a range of contexts

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