ice
Institution of Civil Engineers

Membership

Examiners Report Spring 2025

Exam to Assess Master Level Learning

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Background

This report is compiled by the ICE Further Learning Examinations Panel. The Examination tests whether BEng graduates (including Hong Kong graduates) have gained through further learning an academic standard of learning and critical thinking equivalent to MEng candidates.

The ICE is required by the Engineering Council to assess academic standards achieved in candidate's technical knowledge alongside management, sustainable development and other syllabus areas covered by the Case-Study Exam. Candidates are required to submit a Part A Technical Statement in advance of the Part B Case-Study Exam. Parts A and B are marked by the same two Script Markers.

The ICE thanks those chartered members who volunteered to mark submitted scripts, and members of the Further Learning Examination Panel who developed the syllabus and learning materials, set the examination, moderated the marking and considered appeals.

Spring Examination 2025

The exam case-study was based on the construction of the Hollym, Myers Lane Wastewater Treatment Works, Yorkshire UK which won the ICE Edmund Hambly Medal 2023. The case study was based on the submission documentation of that award.

107 candidates sat the exam and there were 15 Part A resubmissions. As some candidates sat only Part A or Part B, having previously passed the one Part, it is prudent to breakdown the analysis of pass rates***. Prior to marking, anti-plagiarism analysis revealed 11 Part B papers required further investigation. In five cases clear evidence of plagiarism was evident and the candidates were failed***. Pass marks for Part A were discounted where cheating in Part B was evident.

	Total Marked	Pass	Fail	% Pass
Part A Further Learning Technical Report	92	50	42	54%
Part B Case Study Examination	107	44	63	41%
Overall	107	37	70	35%
Part A Resubmission	15	11	4	73%

Candidates must be able to apply advanced knowledge in the real-life Part B scenario. This requires experience and further learning. Only 3 candidates who failed Part A were able to pass Part B. This suggests that some take the exam too early and without sufficient experience or further learning.

Marking takes account of both the answers to the question, and knowledge across the exam

syllabus. The most common feedback given to failed candidates is failure to demonstrate syllabus knowledge. Those candidates who study the Online Training Modules or do better in the Part B Exam. Learning by studying the online materials, or the "ICE Companion to Engineering Management" textbook are more likely to pass.

Each paper is marked by two trained Script Markers. In cases where Markers disagree on pass/fail marks an independent Moderation Panel reviews marking before awarding a pass or fail mark.

An experienced External Examiner advises the Further Learning Examinations Panel on the standard of the exam and the questions set, and audits consistency. The standard of the Part B paper and the questions asked was verified in advance of exam day. The External Examiner reviewed marks awarded and confirmed confidence in the consistency of marking.

Reflection

It is regrettable that a number of candidates were ***disqualified*** for plagiarism. Anti-plagiarism software detects cheating and markers are trained to spot collusion or plagiarism. Some candidates are copying text used by friends or colleagues who passed previous exams. The software we use detects text from previous papers, Copying another's work is plagiarism and is not acceptable. Other candidates were found to have copied large sections of text from websites without referencing the source. Some of this copying is obvious because of the volume of material pasted in. The "ICE Further Learning Exam Guidance" explains the seriousness of both plagiarism and collusion.

As they are exposed to the working environment, newly graduated engineers tend to advance their technical knowledge first. It is only when they have proven their technical ability that employers provide opportunity for management and leadership experience. It is logical that candidates may be able to Pass Part A of the further learning exam before being ready for Part B. The breadth of the Part B syllabus demands study to top-up experiential learning. It was evident from some Part A Technical Submissions that candidates had not yet gained sufficient experience to demonstrate masters level academic learning in technical areas. Part B candidates failed because they had not learnt sufficiently across the syllabus.

ICE members wishing to take the Chartered Professional Review, and who do not yet hold an approved Masters level academic qualification, can bridge the gap between their bachelors level qualification and the required standard by:

1. Undertaking a MEng Course (normally one year) and passing associated examinations;
2. Learning through work experience over at least five years and undertaking an Experiential Learning Assessment; or
3. Supplementing learning gained through work experience with a course of study before sitting the ICE Further Learning Examination.

Future candidates who wish to sit the Further Learning Exam earlier than might be the case for the Experiential Learning Route, should consider studying the Online Training Modules developed specifically for the exam, and/or studying the ICE Companion to Engineering Management, which has been compiled specifically to help candidates prepare for the exam.

Candidates who fail the exam will be disappointed and may wish to re-sit at the earliest opportunity. The exam is, however, a test of whether candidates are able to demonstrate and

apply an MEng level of learning gained through further study and practice. Candidates should consider whether they need to undertake further study in some syllabus areas before resitting the exam.

Rationale behind Part A and Part B

The Engineering Council defines Learning Outcomes to be achieved through academic study. The Exam assesses whether Master level learning outcomes have been achieved.

The ***Part A Further Learning Technical Report*** requires candidates to demonstrate how they have continued to learn post qualification to achieve Masters level technical learning outcomes. The submission comprises: "*A 500-word Technical Statement and supporting Appendix based on one or more appropriate project(s) or activities that demonstrate Masters level technical knowledge in a civil engineering context. It should demonstrate a candidates ability to integrate prior knowledge and understanding of the discipline and engineering practice with the development of advanced level knowledge and understanding, to solve a substantial range of engineering problems, some of them complex or non-routine.*"

The Further Learning Technical Statement is not simply a report describing a candidates work on recent projects. The purpose is to demonstrate academic learning gained since graduating, and to evidence how a candidate has applied knowledge in an innovative way to overcome a particular challenge. It is a test of academic learning alongside practical experience.

A good statement may describe a computational technique (calculations or modelling) that the candidate has applied or adapted to solve a particular problem. It is important to describe the candidate's personal contribution to the work of a team. Writing in the first person helps articulate personal contributions to the team. For example:

An engineer supervising piling operations may explain how unexpected ground conditions and underground structures at one corner of the site caused them to question the validity of the piling design. Drawing on previous structural design experience and CPD courses undertaken on finite element software, they were able to use this software to consider alternative solutions. Calculations and software outputs might be appended.

A drainage engineer might explain how a lack of flooding during an intense rainfall event had caused them to question the validity of modelling outputs. By commissioning CCTV surveys and observing overland flows during heavy rain they were able to recalibrate the model by applying further CPD learning gained on Micro-Drainage software courses, and by learning from experienced colleagues. Modelling outputs could be appended.

It important that candidates understand the purpose of the ***Part B Case-Study Exam***, which is to demonstrate that Masters level learning outcomes have been achieved across the syllabus. Whilst ICE has provided online further learning modules and the ICE Companion to Engineering Management, the examination is not a test of that knowledge alone. Candidates will be expected to draw on experiential learning developed over their career, knowledge gained through CPD, and to apply that learning through critical thinking in relation to a specific scenario.

The exam syllabus aligns closely with the attributes required for the Chartered Professional Review:

- Procurement, Contracts & Project Management
- Project Appraisal & Financial Management
- Sustainable Development
- Management & Leadership
- Health, Safety, Welfare & Risk Assessment

Candidates are required to apply their learning to an unfamiliar case-study. At the start of the

examination candidates should read the scenario and each of the questions carefully. The questions are often connected and together afford the candidate opportunity to demonstrate a broad knowledge. They should plan how to answer each question whilst covering the syllabus breadth and should demonstrate critical thinking when applying their knowledge. Writing three paragraphs of learned knowledge will not gain marks unless it applies directly to the question and scenario.

A seven-hour examination provides time to plan, to consider case-study implications, and to demonstrate syllabus knowledge, learning and critical thinking.

Moderation Panel Report

It is encouraging to see that the standard of both Part A and Part B submissions is steadily improving. Several excellent papers were marked. At the same time, some submissions were disappointing and evidenced a failure to adequately prepare. The following strengths and weaknesses were seen:

Part A Technical Submissions

Good Features

- Written in the first-person – I did this;
- Project worked on; challenge overcome; analysis undertaken; limitations; learning applied;
- Advanced application of engineering principles clearly evident;
- Appendices that are easily read;
- Candidate initials on drawings & calcs.

Poor Features

- English difficult to understand;
- Use of "we" casts doubt on whether this is the candidates own work;
- No advanced application of engineering principles evident;
- Appendices cramped and difficult to read;
- Candidate initials missing from drawings or calculation sheets cast doubt on authenticity.

Part B Case Study Exam

Good Features

- Case study understood and addressed;
- Each part of the question answered;
- Use of sub-headings aligned with question;
- Written in the first person – "This is how I would manage this project";
- Knowledge from across the syllabus that is specifically relevant (question & scenario)
- Referencing that is relevant;
- Critical thinking and advanced knowledge;
- Confident, knowledgeable and articulate;
- Good planning and time management.

Poor Features

- Case study not understood & often ignored;
- Parts of question not answered;
- Long, complex, meandering paragraphs;
- Written in the third person and often with long sections of unattributed pasted in text;
- Pasted text (eg NEC or UNSDGs) which is peripheral and fails to answer the question;
- Weak understanding of syllabus elements;
- Lack of referencing;
- Lack of critical thinking & shallow knowledge;
- Poor time management.

The question posed by the Part B exam are not complicated and can be answered by a BEng candidate. Without further learning, the answers are generally superficial and lack critical thinking. Such candidates fail to demonstrate further learning across the syllabus. It is usually clear which candidates have failed to study the syllabus. As an example, in response to the element of Q5 referring to sustainability, a pass requires more than a sentence or two about a selection of UNSDGs. Aspects such as an Environmental Impact Assessment, carbon accounting, waste management and triple bottom line reporting are important elements of the syllabus and are part of a good answer to this question.

The application of further learning and critical thinking in applying it to the challenge set out in the scenario was demonstrated by a number of candidates that achieved good pass marks:

In response to **Q1**, many candidates failed to demonstrate sufficient knowledge of procurement. If candidates have not gained experience of procurement, they need to study Module 1 of the syllabus. One candidate able to demonstrate an understanding of procurement used clear sub-headings to describe a logical approach i.e. Problem identification and goal setting; Evaluating two main options (described); Option evaluation; Stakeholder identification & engagement; and Recommendation of the best options. Their approach to Option Evaluation was scenario specific, demonstrated critical thinking and evidenced breadth of knowledge across the syllabus:

"To determine the most viable alternative, a multi-criteria assessment framework will be used to compare the technical, financial, environmental, and social viability of each alternative.

Technically, ground investigation will examine soil stability at the potential inland location. Hydraulic simulation and geotechnical modeling will be employed to test the effectiveness of the sewage flow along with ensuring that the new plant will treat wastewater. Resilience surveys on climate will be carried out as well to analyze the risk posed by flooding hazards and determine whether or not the inland location will provide adequate space for expansion needs in the future.

Cost-benefit analysis will quantify the costs, benefits, risks, and uncertainties to ascertain the economic and financial viability of the options. The analysis will compare the capital outlay and operating costs over the project lifecycle to determine the least expensive and most financially viable option. The regulatory compliance costs, particularly the storm overflow regulation upgrade, will also be included in the financial analysis for a proper evaluation.

As far as environmental and social sustainability, there will be an Environmental Impact Assessment to determine potential impacts on local water courses, biodiversity, and air quality. There will be an assessment of carbon emissions to ensure that the project meets PAS 2080 levels of sustainability and minimizes its environmental footprint. In addition, land use and community effects studies will be conducted to address concerns raised by local residents, business people, and farmers regarding the relocation of the treatment plant.."

In response to **Q2**, another candidate discusses a range of procurement options before concluding . *"The Two-Stage Design and Build method is best suited for the Withernsea STW project. This approach allows for early supplier engagement, enabling input from key stakeholders and specialists during the design phase. Early involvement helps to de-risk coastal erosion concerns by incorporating expert advice and mitigation strategies into the design. Additionally, the Two-Stage D&B approach accelerates delivery by allowing preliminary works to commence while the detailed design is being finalized. This method strikes a balance between cost certainty, flexibility, and risk management, making it the most advantageous option for the successful execution of the project. It can ensuring seamless integration of the nominated supplier's equipment into the overall construction and project design. A clear pathway for procurement and delivery must be established, and the responsibilities of all parties involved must be well-defined.* This demonstrates critical thinking and knowledge of procurement. A discussion of the benefit of NEC contracts in managing risk and fostering collaboration follows. The candidate goes on to discuss the two-stage D&B approach more fully:

"In the Stage 1 Early Contractor Engagement/Involvement (ECI), appointing the Aero-Fac through a Pre-Construction Services Agreement (PCSA), which allows the supplier of this technology to collaborate with the design team, and the client to refine design, costs, and construction methodology, and secures specialist equipment and expertise, avoids delays and supply chain risks, and ensures seamless integration with the overall project design. Moreover, ECI allows for value engineering and early risk mitigation, ensuring that potential issues are addressed before construction begins.

In the Stage 2 Main Contract Award, the final contract sum is agreed upon before moving into construction. This ensures that costs are locked in and budget overruns are minimized. Begin contractor selection based on experience with water infrastructure and reservoirs. This ensures that the selected contractor has the necessary expertise to deliver the project successfully. The contractor takes full responsibility for delivery, including the Aero-Fac installation, ensuring seamless integration with the overall project design, which also reduced the risk of client. This approach ensures that the contractor is accountable for the project's success and has an incentive to address potential risks proactively."

In answering **Q3** many candidates failed to differentiate management and leadership. One strong answer concluded "*The STW project presents several significant challenges, including coastal erosion, environmental concerns, social impact, technical complexities, and corruption risks. As the Construction Manager, it is essential to implement effective management and leadership interventions to address these challenges and deliver the expected outcomes. By focusing on detailed planning, risk management, stakeholder engagement, quality control, leadership, technology, safety, and anti-corruption measures, we can ensure the successful completion of the project while minimizing its impact on the local community and environment. Additionally leveraging KPIs, BIM and CDE will further enhance project management efficiency and effectiveness..*" A second strong response began by discussing environmental, social, technical and ethical challenges spedific to the scenario before discussing management and leadership interventions. Management interventions included *"...Develop a detailed Project Execution Plan (PEP) that outlines the scope, objectives, timelines, resources, and risk management strategies. Use advanced project management software to track progress and adjust plans as needed..." and "...Establish strict quality control and assurance processes to ensure that all construction activities meet the required standards. Conduct regular inspections and audits to verify compliance with technical specifications and regulatory requirements. KPIs can be used to monitor quality metrics, such as defect rates and rework frequence, ensuring that the project meets the highest standards..."* Leadership interventions included *"Foster a collaborative and supportive work environment. Encourage open communication and teamwork among the construction team. Provide leadership training and development opportunities to enhance the skills and capabilities of team members. KPIs can be used to track team performance and identify areas for improvement."*

A strong response to **Q4** demonstrated a clear understanding of the H&S responsibilities of the design Project Manager, and Construction Manager:
"The Design Project Manager plays a critical role in reducing risks during the design phase. First, the design must comply with all relevant regulations, including the Reservoirs Act 1975, and integrate safe systems of work. By following the ERIC principles (Eliminate, Reduce, Inform, Control), the Design Project Manager can minimize hazards during design. For example, the design should eliminate unnecessary risks by incorporating inherently safer features, such as stable slopes and materials that reduce the need for risky construction practices. The use of impermeable geomembranes must be specified in a way that ensures ease of installation with consideration of safety. Furthermore, the design team shall conduct a risk assessment to identify potential hazards, such as working near an eroding coastline and handling heavy equipment."
"The Construction Manager must implement effective health and safety management plans on-site. Given the coastal location and weather-related challenges, site-specific risk assessments should be conducted to address hazards such as working in adverse weather, handling geomembrane installations, and operating heavy machinery. They shall identify and assess the main health and safety risks in the project. Common risks include falls, getting caught in or between objects, manual material handling, noise, air contaminants, inappropriate machine guarding, equipment malfunctions of breakdowns. Conducting thorough risk assessments and hazard identification processes will help in understanding the specific risks present at the Withernsea STW site.
Clear site rules and protocols must be established, including PPE requirements, emergency

procedures, and fall prevention measures, especially during tasks that involve working at height or near steep embankments. A permit-to-work system should be enforced for high-risk activities, such as geomembrane welding and heavy lifting operations, ensuring that only authorized personnel with appropriate training are involved. This assessment should inform method statements and permit-to-work systems to guide safe execution.
Comprehensive safety training is essential for all workers on the construction site. This includes site induction training, regular safety briefings, and specific training for high-risk activities. Training should cover the proper use of personal protective equipment (PPE), safe manual handling techniques, and emergency procedures. Raising awareness about the importance of health and safety will help create a culture where safety is a top priority.
The construction manager can conduct risk assessment using both qualitative and quantitative techniques—such as HAZOP with risk index, Fault Tree Analysis, and Event Tree Analysis and Failure Mode & Effect Analysis to identify and evaluate potential hazards including those posed by accelerated coastal erosion, adverse weather during installation, and the challenges inherent in deploying Aero-Fac..”

Script Markers commented that candidates found **Q5** to be the most challenging. There were, however, a number of strong answers including the following:
“*Ensuring that sustainability goals are measurable, enforceable, and aligned with industry’s best practices is a key priority. I will implement ISO 14001 (Environmental Management Systems) to establish a structured approach to monitoring environmental impact reduction, waste management, and emissions tracking. To drive sustainability compliance, I will embed carbon reduction targets, lifecycle cost assessments, and supply chain accountability requirements within contract performance reviews.*
To demonstrate value for money, I will ensure transparent reporting, independent auditing, and public accountability measures are embedded within the governance framework. Engaging with local communities, businesses, and regulatory authorities will be essential to address public concerns about noise, traffic, and environmental impact. I will also implement a real-time project performance reporting system to foster transparency and build trust with stakeholders.
To maintain strong governance oversight, I will establish a governance board comprising representatives from client leadership, regulatory authorities, and supply chain partners. This board will regularly review cost forecasts, sustainability targets, and contractual compliance, ensuring that project performance aligns with industry’s best practices. Regular audits and benchmarking against industry standards will further drive continuous improvement and reinforce the project’s financial and sustainability objectives..”

“As the client project director, I shall adopt some governance processes to ensure value for money for our customers while meeting the company’s sustainability goals. Effective governance frameworks will align the project with strategic objectives, promote accountability, and ensure transparency in decision-making. A combination of robust monitoring, stakeholder engagement, and adherence to sustainability principles will be critical to achieving these outcomes.
”Governance framework that aligns with corporate objectives and incorporates recognized standards like PRINCE2 and SMART for project management can be used included identify the Specific, measurable, achievable, relevant and time-bound of the project. The framework would ensure clear lines of accountability, authority, and alignment across all stakeholders, enabling decision-making at appropriate levels and fostering efficient project delivery. Critical decision gates would be established at key project milestones, ensuring thorough review and validation before moving forward.

Appendix A contains example Answer Plans provided to Script Markers to illustrate how each question might be answered. These are example frameworks of how a question might be

answered by drawing on further learning from across the syllabus. They are NOT comprehensive or exhaustive, and it is not expected that candidates will answer in a similar way. There is no critical discussion which Markers will expect to see in a candidate's essay.

Marks are not deducted if an answer varies from this guidance, indeed some candidates provide better answers. The example Answer Plans may provide future candidates with ideas as to how the questions in Withernsea STW Case Study might be answered. The coloured squares relate to syllabus modules:

M1 Procurement, Contracts and Project Management;

M2 Management and Leadership;

M3 Project Appraisal and Financial Management;

M4 Health, Safety, Welfare and Risk Assessment; and

M5 Sustainable Development.

Appendix A

1. Describe how, as feasibility stage Project Manager, you and your team will identify and evaluate Withernsea STW options to recommend the most advantageous solution.

EXAMPLE ANSWER PLAN

a) Project Manager role (feasibility):
- Discuss with client scope and objectives of brief (time, cost, expected outcomes), design life assumption etc and any known stakeholder concerns/expectations M1
- Agree monitoring/reporting arrangements including target date for final recommendation M1
- Build the team: Agree with Project Director assigning of available resources with necessary skills (wastewater treatment, coastal erosion, sea defence etc) to satisfy client brief M2
- Develop ISO9001 Project Implementation Plan (PIP) resource and delivery schedule M1
- Manage resources and lead feasibility stage M2
- Brief the team, set clear objectives, mentor and support individuals M2
- Monitor PIP delivery & manage resources to stay on track. Report progress as agreed M1

b) Identify Withernsea STW options:
- Research/analyse client information re existing STW & coastal erosion/defence. M3
- Desktop study: local geology, environmental constraints, stakeholder concerns (media) M3
- Effect of sea level rise, bathing water quality, and potential effect on tourism indicate environmental, social and economic sustainability will be key assessment criteria M5
- Whole team brainstorming: sea defence options; treatment options; do nothing M3

c) Evaluate options:
- Determine objective evaluation criteria:
  - CAPEX (including land purchase & compensation) M3
  - OPEX (discounted cash flow over design life) M3
  - Economic/social/environmental impacts M5
  - Quantified risk analysis M3
  - Comparison of H&S risks M4
  - Carbon accounting M5
  - Will it deliver clients expected outcome targets? M3
  - Cost Benefit Analysis M3
- Agree evaluation criteria with client prior to analysis (adjust if necessary) M1
- Analyse each option against evaluation criteria M3

d) Present most advantageous solution:
- Compile Draft Feasibility Report providing:
  - description of each option
  - discussion of pros & cons including stakeholder & environmental impacts
  - tabular comparison of options against evaluation criteria
  - Cost/Benefit ranking of options M3
  - Analyse objective evaluation scores & subjective pros & cons to recommend solution that is most advantageous to the client M1
- Present draft report verbally to client, answer questions and provide clarification M1
- Amend & finalise report. Submit to client for decision M1
- Team de-brief meeting: agree lessons learnt & disseminate learning for future projects M2

2. As Project Manager for design, discuss procurement of the works shown in Figure 3, given the clients wish to use a nominated supplier for specialist plant (Aero-Fac). Advise the client accordingly.

EXAMPLE ANSWER PLAN

a) Project Manager role (design & procurement):
- Discuss with client scope and objectives of brief M1
- Foster collaborative approach to design (early contractor involvement (ECI) with nominated Aero-Fac supplier and contractors with specialist experience eg reservoir lining M1
- Engage with stakeholders to understand concerns and provide regular information M2
- Develop ISO9001 Project Implementation Plan (PIP) resource and delivery schedule M1
- Provide for Gateway design approvals to comply with Reservoirs Act 1975 M1
- Manage resources and lead design/procurement team (see Q1) M2

b) Procurement for reservoir construction M1
- Discuss main elements of the works including excavation of the reservoirs, construction of earthworks, reservoir lining, plant rooms and secure perimeter fencing to prevent public access (operational H&S) M1 M4
- Pre-tender competition/evaluation of contractors with experience of successfully completing similar works, particularly in reservoir construction M1
- Supervising Reservoir Engineer to vet competence of appointed contractors M1
- Discussion of NEC4 to facilitate collaboration and ECI design input M1

c) Procurement for supply and installation of specialist equipment M1
- Contractual risk allocation if the main contractor procures nominated supplier M1
- Due diligence by visiting existing sites, interviewing clients & analysing performance data M3
- Implications of risk transfer for the client in procuring two contractors M1
- Implications of negotiating contract terms with nominated supplier as sole bidder M1

d) Negotiated contract with Nominated Supplier leading construction
- Discussion of Gurney Environmental as nominated supplier being Main Contractor and sub-contracting reservoir construction M1
- NEC Option C: Target contract with activity schedule M1
- Negotiated target cost (Gurney Environmental) with schedule of pain/gain performance M1
- Schedule KPIs to incentivise Main Contractor through option X20 and use option X12 to define targets for sub-contractors M1

e) Advise the client:
- Compile/[present a report setting out procurement options (above). Recommend:
  - Gurney Environmental to be appointed as Main Contractor with negotiated Target Cost.

3. As Construction Manager, discuss the main challenges you may face at Withernsea, and the management & leadership interventions you would use to deliver expected outcomes.

EXAMPLE ANSWER PLAN

a) Challenges to be faced

Challenge	Description
1 Complex team	A number of companies with differing cultures & aims for this job M2
2 Time constraint	Target completion agreed with client and bound into contract M1
3 Budget	Target cost agreed with client and bound into contract M1
4 Sustainability	Minimise environmental/social/economic impacts. Optimise benefits M5
5 Health/safety/welfare	Minimise risk during construction. Provide for future safe operation M4
6 Stakeholder needs	Minimise impacts on stakeholders & avoid reputational damage M2
7 Innovative design	Largest installation of its kind in UK - challenge of the unknown

b) Management (about process - making sure operations are performed as expected) M2

Challenge	Management Interventions
1 Complex team	Daily briefings / weekly reports. Share information & report KPIs M2 M3
2 Time constraint	Daily program updates & lean construction to improve efficiency M1
3 Budget	Earned Value Analysis to project outturn. Value engineering M3
4 Sustainability	Environmental management plan; use of local labour & suppliers M5
5 Health/safety/welfare	H&S Management Plan/ safe methods of working/ toolbox talks M4
6 Stakeholder needs	Stakeholder management plan, regular comms, timely response M2
7 Innovative design	Learn from similar installations & publish papers to extend learning

c) Leadership (about people - setting direction, inspiring, and motivating the team.) M2

Challenge	Leadership Initiative
1 Complex team	Single vision based on client outcomes – collaborative culture M2
2 Time constraint	Instil common can-do culture & encourage innovation M2
3 Budget	Celebrate value engineering successes to motivate cost saving M3
4 Sustainability	Set clear UNSDG based goals for whole delivery team M5
5 Health/safety/welfare	Zero Harm culture. Look after each other. "Red Card" unsafe work M4
6 Stakeholder needs	Visible leadership & commitment to listen & respond to concerns M2
7 Innovative design	Empower the team to set new standard & continually improve M2

d) Delivering expected outcomes

- Management & leadership interventions focussed on delivering client defined outcomes. M2
- NEC Option C: Target contract & option X20 KPI schedule with outcome focus M1
- Monthly reporting of performance with Action Plan to address any areas of concern. M1
- Provide early warning of compensation events should conditions change. M1

4. How should the design Project Manager, and Construction Manager, address the main health and safety risks in this project to ensure everyone goes home safe and well each day?

EXAMPLE ANSWER PLAN

a) Health & Safety Risks. M4

Plant movement risk to workers	Working in trenches (inlet/outfall works)
Working at height on control structures	Falling/drowning in open water
Heavy lifting	Inundation by the sea (decommissioning STW)
Confined space working (control room)	Electrical & mechanical equipment
Site welfare in remote location	Handling hazardous materials
Exposing operational staff to polluted water	Unauthorised access to the site by the public

b) Health & Safety in Design (design Project Manager) M4

- ref ICE Guidance for design risk management
- Leadership to embed zero harm as an organisational culture for design and construction M2
- Develop ISO49001 Health & Safety Management Plan
- Consider risks notified to designer by client including details of existing STW
- Open H&S File to be maintained throughout project lifecycle
- Ensure designers have sufficient knowledge & competence to assess & manage risk
- Involve whole team in identifying potential hazards
- Consider hazards affecting construction, operation & maintenance and decommissioning
- Assess risk for each identified hazard by scoring likelihood and impact (high to low)
- Use qualitative & quantitative risk assessment techniques to assess risk & prioritise hazards
- Apply principals of prevention (ERIC acronym)

Eliminate: Can the identified risk be eliminated so far as is reasonably practicable	**Reduce:** if it cannot be eliminated, can the identified risk be reduced
Inform: Notify others of significant risks (client, other designers, contractors)	**Control:** What actions to control risks that could not be eliminated/reduced?

- Ensure drawings/BIM model and Safety File detail significant residual risks for the benefit of contractors and subsequently for operational management and maintenance

c) Managing Health, Safety and Welfare on Site (Construction Manager M4

- Further develop the H&S File passed on by designer
- Assess risk for each of each identified hazard by scoring likelihood and impact
- Use qualitative & quantitative risk assessment techniques to assess risk & prioritise hazards
- Apply the principals of prevention (ERIC) outlined above, noting that during construction the "I" should prompt actions to **Isolate** known risks (e.g. using barriers to prevent access)
- Provide adequate welfare facilities on site and provide workforce health advice
- Embed safety culture through training and empowering staff to look after each other and report near misses. They should be allowed to stop any work that causes concern.
- Safe methods of working should be developed for all activities
- Use "Toolbox Talks" to verbally brief workers on hazards and safe method of working
- Issue appropriate PPE to protect workers from any known residual risk.
- Empower workforce to undertake site-based risk assessment before commencing work
- Measure Leading (preventative) & lagging (incident) NEC4 option X20 KPIs M1 M3
- Ensure drawings/BIM model and Safety File detail significant residual risks for the benefit of operational management of the site, maintenance and eventual decommissioning.

5. As the client Project Director, discuss the governance processes you will adopt to demonstrate value for money for your customers and that your company's sustainability goals are achieved.

EXAMPLE ANSWER PLAN

a) Role of Project Director
- Accountable to the client Board for ensuring the project delivers agreed outcomes. M2 M3
- Responsible for commissioning works that deliver value for money & sustainability outcomes

b) Governance processes
- Govern the project using Prince2 methodology that emphasises organisation & control. M3
- Project Director to represent the client/executive on the Project Board M2 M3
- Customer representation (Project Board) will provide scrutiny & transparency M3
- Break the project into a number of contracts and exercise governance control on each:

Environmental Impact Assessment (EIA) (Investigate impacts on nature) M5	Social Impact Assessment (SIA) (Investigate local community impacts) M5
Technical Feasibility Report (TFR) (investigate technical solutions)	Due Diligence Report (DDR) (Investigate efficacy of innovative solutions)
Design Services Contract	Wastewater Treatment Site Contract
Inlet & Outfall Pipelines Contract	Existing STW Decommissioning Contract

- The option of Auto-Fac as a first for the client and largest of its kind in the UK would prompt further due diligence by visiting existing installations to see it in operation, interviewing clients to check manufacturer claims, and commissioning CAPEX, OPEX, CO2 analysis etc. M3 M5
- Require Hold-Points in Project Plans to verify outcome forecasts before proceeding. M3

c) Demonstrating value for money
- Value for money is a product of economy (in procurement), efficiency (of production) and effectiveness (in achieving outcomes). Money is wasted if outcomes are not achieved. M3
- Customers expect to see that money paid for services is spent wisely & effectively. M3
- Project Board to scrutinise Cost Benefit Analyses (CAPEX and OPEX) for Feasibility Report options, and Auto-Fac Due Diligence, before approving design and construction M3
- Project Board to require monthly Earned Value Analysis to check CAPEX remains on track, and Action Plans to set out corrective actions to keep expenditure on track. M3

d) Achieving sustainability goals (UNSDG) M5
- The EIA will provide an ecosystem baseline from which to develop SDG15 life on land goals
- The SIA will provide a baseline for targeting SDG8 job creation & SDG11 resilience goals
- TFR & DDR data will inform clean water & sanitation SDG6 & climate action SDG13 targets
- Triple Bottom Line Accounting goals should form part of the schedule of KPIs to incentivise Main Contractor performance for each of the construction contracts through NEC4 option X20 and option X12 to define targets for sub-contractors
- Require ISO14001 Environmental Management Plans to systematically address targets
- Require Site Waste Management Plans to systematically manage all waste streams
- Project Board to require monthly KPI report to check sustainability targets remain on track, and Action Plans to set out corrective actions to keep performance on track

Our vision

Civil engineers at the heart of society, delivering sustainable development through knowledge, skills and professional expertise.

Core purpose

- **To develop and qualify professionals engaged in civil engineering**
- **To exchange knowledge and best practice for the creation of a sustainable and built environment**
- **To promote our contribution to society worldwide**

Diversity statement

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