



Schedule 7 Research Project Specification

Eco-engineering: Greening coastal infrastructure

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1. SUMMARY

Over the past few years, academics worldwide have been researching and trialling innovative methods of adapting typical engineered coastal assets to boost biodiversity and quality in local ecosystems. It is recognised across academia that this “eco-engineering” is not common practice in industry, however, if implemented, there are signs that this could contribute heavily to the UK challenge of increasing grey infrastructure sustainability, particularly along our coastal regions.

The overall aim for this project is to produce a guide that will demonstrate the value and impact of eco-engineering, clarifying its role as part of an asset management strategy from an engineering, asset management and biodiversity perspective.

2. OBJECTIVES

Beyond the main aim, the objectives for this project are as follows:

- Outline various eco-engineering techniques utilised across the UK coastline, focusing on aspects such as design, asset life cycle, materials, drawing from information gathered over year of academic research and industry trials.
- Produce a set of case studies of eco-engineering schemes, outlining the benefits, concerns and lessons learned.
- Create recommendations for a range of typical scenarios, including how to create an attractive business case for an eco-engineering programme whilst maintaining financial sustainability.

3. BACKGROUND

Eco-engineering is the process of ‘greening the grey’, by adapting the design of grey infrastructure, e.g. flood and coastal protection assets, to incorporate innovative features that would create sustainability benefits to surrounding ecosystems and the assets themselves.

Utilising these ecological enhancement methods can maintain the effectiveness of the existing assets, whilst potentially creating synergies and collaborations between asset owners and stakeholders in ecosystem management. This idea has been termed ‘eco-engineering’ and has been the focus of academic research across the UK and Europe for many years. It has led to multiple large-scale projects investigating the viability of introducing such innovative approaches to flood protection on a wider scale. Two examples of these projects include the [Ecostructure](#) project, and the MARine INfrastructure EFFects ([MARINEFF](#)) project.

More examples of eco-engineering practices can be found in the Natural Environment Research Council (NERC) published report from 2017 - [Greening the Grey: a framework for integrated green grey infrastructure \(IGGI\)](#).

4. JUSTIFICATION

With UK government publishing their 25-year environment plan in 2018, containing goals of improving national water quality in coastal and marine regions, whilst protecting threatened species through achieving biodiversity targets, the topic of eco-engineering is of great relevance. The Environment Bill, introduced in January 2020, provided further evidence that eco-engineering could support the built environment industry to achieve biodiversity and sustainability targets, through their development into coastal infrastructure assets.

There is also a need to inform and realise the full potential of the various eco-engineering methods used, both from infrastructure asset management and biodiversity perspectives. Based off of survey results (Appendix 1) gathered at CIRIAs webinar, '[Boosting Britain's Biodiversity](#)', designers of coastal infrastructure require support to provide the necessary information to decision makers when arguing for the use of these eco-engineered designs over more traditional

approaches. This was attributed to a variety of factors that this guidance plans to address, such as a lack of knowledge in industry surrounding the cost-benefit and impact of each method.

5. TARGET AUDIENCE

Asset owners, engineers, marine ecologists and other stakeholders involved in the design, construction, management, planning, regulation and operation of coastal infrastructure. Geomorphological and eco-engineering experts and practitioners. The guide should be primarily targeted towards those, but should be readable by students and non-experts to widen the reach to politicians, local authority and academia.

6. SCOPE

CIRIA will develop a standalone high-level guidance document containing case studies covering a selection of eco-engineering methods. The guidance will build upon NERCs 2017 report referenced previously, providing context, evidence and recommendations on the application and design of eco-engineering assets.

Through discussing design, materials and design life-cycle aspects of these assets, the guide will provide evidence to support the development of business cases for incorporating eco-engineering methods into coastal management plans. It will outline considerations needed when preparing cases, highlighting factors influencing pricing, cost-effectiveness and affordability when comparing “grey” and “green” initiatives.

This CIRIA guide will demonstrate the value and impact of eco-engineering, clarifying its role as part of an asset management strategy from an engineering, asset management and biodiversity perspective.

Target audience will be able to use the guide to:

- Learn more about eco-engineering in a coastal context, the key principles behind it along with pros and cons, and how it can be utilised within coastal infrastructure
- Consider various eco-engineering methods that could be incorporated into their shoreline management plans (SMPs)
- Assist in the planning of business cases, by detailing key information that should be considered when proposing plans to decision-makers
- Reinforce eco-engineering as an initial option in future coastal protection schemes

7. RESEARCH CONTRACTOR RESPONSIBILITIES

CIRIA will appoint a research contractor to prepare guidance that collates information, knowledge and develops industry good practices and recommendations, taking into account the views of the project funders and a Project Steering Group. The research contractor shall do this by undertaking the following tasks:

- desk study and consultation with UK practitioners and organisations
- draft versions of the guidance report to be reviewed by the Project Steering Group
- participation in project steering group meetings (three to be held during course of the contract) and dissemination event(s)
- delivery of final Contractor’s Project Report
- preparation of project synopsis and summary presentation.

Note – The term “research contractor” will relate to the appointed contractor.

8. METHOD OF APPROACH

8.1. Project inception

CIRIA will hold a Funder's Meeting and establish a Project Steering Group (PSG) to advise on the focus of the project and content of the project outputs.

8.2 *Contractor selection*

CIRIA will welcome expressions of interest (EOIs) from organisations that wish to tender for the Research Contractor role. Dependant on quantity of EOIs, interested organisations may be required to complete a pre-qualification application, prior to invitation to tender. All tenders will be reviewed by a panel consisting of funders and industry experts, with the potential to be invited to a further interview. The methodology and approach for the development of the guidance will be agreed with the Research Contractor selected.

8.3 *Development of project report*

The Research Contractor will prepare four draft versions of the guidance that will be refined following review by the PSG. The final draft of the guidance (the Contractor's Project Report) will be submitted to CIRIA by the due date for completion.

8.4 *Dissemination*

Promotion of the published guidance will be made to CIRIA members and the wider industry via social media, press releases, member – e-newsletters (*Highlights* and *Member News*) and dissemination events arranged in conjunction with the CIRIA Network (www.ciria.org/network).

9. OUTPUTS

The findings of the project will be disseminated via the published guide and dissemination event(s).

9.1 *Project report*

The research contractor shall prepare drafts and a guidance document, this being the Contractor's Project Report, which shall be submitted to CIRIA by the due date for completion. The production of the guidance will be agreed by CIRIA, the PSG and the research contractor. The report will be structured around content shown in Table 1, but will be revised throughout the project by the Contractor and PSG.

9.2 *Project synopsis*

The research contractor shall produce a concise project synopsis (maximum of 4 pages), together with a summary PowerPoint presentation, which can also be used as a stand-alone documents to promote the project's findings and be made available to download from the CIRIA website.

9.3 *Dissemination seminar*

There will be a recorded dissemination seminar held in association with the CIRIA network (www.ciria.org/network) following the publication of the report in Q1/Q2 2024.

10. REPORT STRUCTURE

CIRIA proposes an outline structure of the guidance and suggested content prior to the appointment of a Research Contractor (**Table 1**). A detailed report structure and contents list is to be prepared by the Research Contractor.

Appendix 1 draws out information collected by a follow up survey from CIRIA's 2019 webinar 'Eco-engineering: Boosting Britain's biodiversity', which acted as the basis of the development of this proposal, and may prove useful when assessing initial scope.

Appendix 2 contains a summary of the first PSG funders meeting discussions on target audience, scope and general approach to the project.

Table 1 – Outline structure and suggested content

Possible structure indicating relative weight of each section.

Part	Ch.	Purpose	Approx % of document length (est)
A – Introduction	1 Context	<ul style="list-style-type: none"> a) Background, scope and purpose b) Geographical focus; more focus on intertidal zone, subtidal zone and estuaries, some open coast considerations. UK focus, but international examples can be included where needed. c) Target audience d) How to use the guide 	5
	2 Introduction	<ul style="list-style-type: none"> a) Introduction: How eco-engineering can benefit the construction industry, bringing together experts in asset management, biodiversity and geomorphology, to help achieve targets outlined in UK government environmental strategies, leading to a more sustainable future. b) Brief overview of the application of eco-engineering with indication of extent of use and maturity across different sectors. c) Brief overview of the eco-engineering landscape, highlighting uptake in industries from multiple perspectives. d) Drivers & opportunities e) Introduction to developing business cases, low-level pros & cons to promote funding of schemes 	10
B – High-level guidance	3 Techniques	<ul style="list-style-type: none"> a) What techniques are available? Detailed information on what techniques are available, including how mature, well-studied and adopted they are across industries. CIRIA to distribute survey to PSG initially to scope techniques available to assist on this. b) What technique should I use? Common uses of each, contextual questions that need to be considered when deciding (decision flowcharts etc.) c) Hard assets vs. hybrid approaches 	15
	4 Design	<ul style="list-style-type: none"> a) Evidence-based advice on how to design and implement these assets. b) Materials, concrete mix designs, impacts on techniques, pros/cons c) New-build, retrofitting and replacing d) Design lifecycle analysis, would longer-term solutions be more beneficial or short-term fixes? 	15
	5 Asset management	<ul style="list-style-type: none"> a) Effects (if any) on primary function of assets (e.g. flood protection). How to minimise impacts on effectiveness. b) Maintenance of assets, inspections, performance monitoring, renovating, removal – with consideration of biology. Minimising negative impact on local biology during each phase. c) Lifespan of eco-engineered assets, decommissioning, end-of-life considerations. 	15
	6 Environmental and natural processes	<ul style="list-style-type: none"> a) Detailed look into geomorphological aspect, the underlying science behind how to make these assets effective, and the impact they have on surrounding areas b) Key functions, detailed effects on biodiversity, water quality etc. Most likely techniques will share geomorphological effects to an extent – worth considering how this could be demonstrated visually to the reader. 	15
	7	<ul style="list-style-type: none"> a) Aspects to consider when developing a business case 	10

	Business case development	b) Factors that influence pricing, cost-effectiveness and affordability, comparisons against alternative “grey” methods c) How to encourage funding in general to these methods d) Value of practitioner/academic partnerships, benefits and opportunities that may arise	
	8 Case studies	e) Case studies should be produced for a range of techniques illustrating a range of applications. f) Cross referencing across document where relevant	10
C – Summary	9 Future work	a) Gaps in evidence and guidance b) Recommendations for further activity including: research / evidence needs, data analysis, data set availability, models etc.	5
	10 Conclusions	Conclusions	
	11 Summaries	Summary	
	12 Further reading	References, standards and useful information	

The apportionment of responsibilities is set out in Section 11 below.

11. PROGRAMME OF WORK

See **Table 2** for draft deliverables and a range of responsibilities for CIRIA and the Research Contractor. The draft project programme (Schedule 2) includes:

- Typical cycle between PSG meetings is 12-16 weeks
- 1st PSG meeting within 6 weeks of mobilisation (after Contractor is appointed) to review outline draft, followed by two more drafting and review periods
- Sign-off of the report may be followed by an independent peer-review, before handing over for CIRIA editing
- Editing and publication process is typically 10-12 weeks
- Launch of the publication in Q1/Q2 2024
- Assistance to CIRIA in organising and delivering a webinar on conclusion of the project
- An hour-long recorded webinar to coincide with launch date, containing a 20-minute summary presentation of the project output.

Table 2 – Draft deliverables and responsibilities

Month	Stage	Deliverables and responsibilities
-		Funders’ meeting/Finalise specification Objective: Agree scope of report, amend specification accordingly.
-	1	Contractors: Officially appointed by CIRIA
1 – 2	2	Development of outline report Objective: Design outline report based off of funders’ meeting scope and specification. Contractor Responsibility as Lead authors to draft outline report utilising existing knowledge and experience to produce an initial ‘shell’ of the guidance, containing headings/sub-headings along with short summaries of proposed text for each sub-section. CIRIA Responsible for arranging PSG meeting date and issuing outline draft to PSG for comment, subject to meeting satisfactory standard.
2	3	Project Steering Group meeting 1 – Outline Draft

		<p>Objective: Agree that outline report content accurately matches scope and specification, seek input from the PSG.</p> <p>Contractor Required to attend PSG and assist in the preparation of meeting papers. Responsible for auditing PSG comments before PSG meetings.</p> <p>CIRIA Responsible for arranging, facilitating and producing meeting minutes if required. Responsible for collating PSG review comments on draft.</p>
2 – 5	4	<p>Development of first full draft Objective: Design first full draft, completing all sections discussed in the outline draft as much as possible.</p> <p>Contractor Required to produce full draft, following feedback from outline report. All sections of text to be written and prepared for review.</p> <p>CIRIA Responsible for arranging PSG meeting date and issuing draft to PSG for comment, subject to meeting satisfactory standard.</p>
5	5	<p>Project Steering Group meeting 2 – Draft 1 Objective: Agree first full draft report content and seek input from the PSG.</p> <p>Contractor Required to attend PSG and assist in the preparation of meeting papers. Responsible for auditing PSG comments before PSG meetings.</p> <p>CIRIA Responsible for arranging, facilitating and producing meeting minutes if required. Responsible for collating PSG review comments on draft.</p>
5 – 9	6	<p>Development of second full draft Objective: Address comments from previous iteration, developing new sections if needed.</p> <p>Contractor Responsible for drafting report 2 based on consensus gathered in PSG1.</p> <p>CIRIA Responsible for arranging PSG meeting date and issuing draft to PSG for comment, subject to meeting satisfactory standard.</p>
9	7	<p>Project Steering Group meeting 3 – Draft 2 Objective: Review second draft report and seek responses from the PSG.</p> <p>Contractor Required to attend PSG and assist in the preparation of meeting papers. Responsible for auditing PSG comments before PSG meetings.</p> <p>CIRIA Responsible for arranging, facilitating and producing meeting minutes if required. Responsible for collating PSG review comments.</p>
9 – 11	8	<p>Development of final draft Objective: Address comments from previous iteration.</p> <p>Contractor Responsible for development of final draft, based on consensus reached in previous PSG meeting.</p> <p>CIRIA Responsible for arranging PSG meeting date and issuing draft to PSG for comment, subject to meeting satisfactory standard.</p>
11	9	<p>Project Steering Group meeting 4 – Final Draft - Sign-off meeting Objective: Review final draft report and sign-off to progress to CIRIA editing/publishing stages.</p> <p>Contractor Responsible for finalising report in accordance with CIRIA Style Guide and issuing a final audit of PSG comments following the sign-off meeting.</p>

		<p>CIRIA Responsible for arranging, facilitating and producing meeting minutes if required. Responsible for collating PSG review comments and circulating report for PSG sign-off ahead of publication.</p>
11 – 13	10	<p>Handover final report to CIRIA for editing Objective: Provide CIRIA with the final report for editing, prepare the report for publication.</p> <p>Contractor Responsible for addressing changes suggested from PSG feedback from final draft sign-off meeting, passing the finalised document to CIRIA and assisting throughout the editing process. Responsible for responding to independent peer-review comments (if peer-reviewed) and CIRIA's editing/layout queries.</p> <p>CIRIA Responsible for appointing an external reviewer if needed; co-ordinating / managing the editing and publication process.</p>
13 – 15	11	<p>Publication and dissemination Objective: Publish the guidance and host dissemination event.</p> <p>Contractor Responsible for developing a report synopsis and summary PowerPoint presentation, to be presented at a dissemination activity (live event or webinar - TBC). Responsible for assisting in CIRIA marketing activities to promote the upcoming guidance.</p> <p>CIRIA Responsible for publishing the guidance, arranging a dissemination activity and managing marketing/promotion.</p>

12. PRODUCTION AND HANDOVER OF PROJECT REPORT

CIRIA attaches great importance to the early dissemination of the results of its projects and therefore requires project reports to be produced in the form of the intended publication. When the report is intended to be a guidance document, attention is given to presenting it in an effective manner. The research contractor will be required to supply a selection of photographs and illustrations as appropriate, in consultation with the PSG, for illustrating the reports and for subsequent promotion where appropriate.

The requirements for producing the high-level guidance and factsheet are set out in [CIRIA's Style Guide – preparing work for publication](#) (Schedule 9a). This provides guidance on acceptable formats and layouts for the report as well as taking into account requirements of spellings and hyphenations as detailed within the [CIRIA dictionary](#) (Schedule 9b).

13. MANAGEMENT OF THE RESEARCH PROJECT

The project will be managed by CIRIA with the support of a PSG, who will meet at least three times during the development of the guidance. The role of the PSG will be to advise CIRIA and, thereby, the research contractor on the technical sufficiency and progress of the work. The approval by the PSG of the final draft will be required prior to its submission to CIRIA as a completed task.

For each PSG meeting during the project, the research contractor shall carry out the tasks and provide the information listed in Clauses 13.1 and 13.2.

13.1 Attendance at PSG meetings

CIRIA will arrange meetings of the PSG through Microsoft Teams with the research contractor attending in order to:

- present a report on the progress of the work
- receive, note and take action on comments received from members of the PSG.

To achieve the effective input of the PSG drafts for comment should be circulated through CIRIA a minimum of 28 days before any meeting.

13.2 Progress and interim reports

The research contractor shall submit to CIRIA's Project Manager regular progress reports detailing the status of components of the work that should contain:

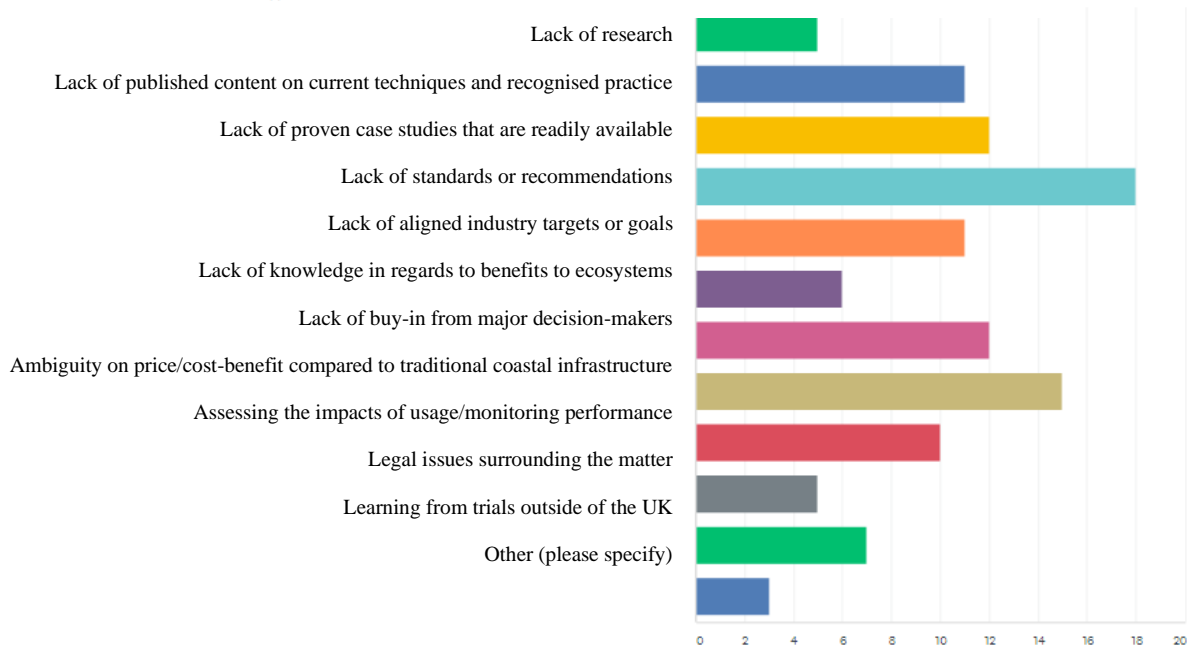
- time inputs of staff assigned to the project (in man days)
- progress statements in terms of degree of completion of components of the work, such as:
 - proportion of drafting of proposed chapters etc.
 - assessment of the progress in relation to contract completion time and expenditure
 - proposed programme for the next month
 - proposed actions to achieve contract completion dates if progress has fallen behind targets.

In the event of any problem experienced by the research contractor in terms of the programme and timetable for completion, they shall submit an interim report to CIRIA, drawing attention to the problem and proposing methods to solve it. CIRIA if unable to find an acceptable solution will consult the chairman of the PSG and together with the research contractor agree how to resolve the problem.

Appendix 1 – Survey completed by members of the eco-engineering industry, narrowing the focus of the guidance. This will be consulted during the scoping stages.

What would you say, are the key challenges that the UK is facing in regards to utilising eco-engineering in new-build infrastructure along the UK coastline?

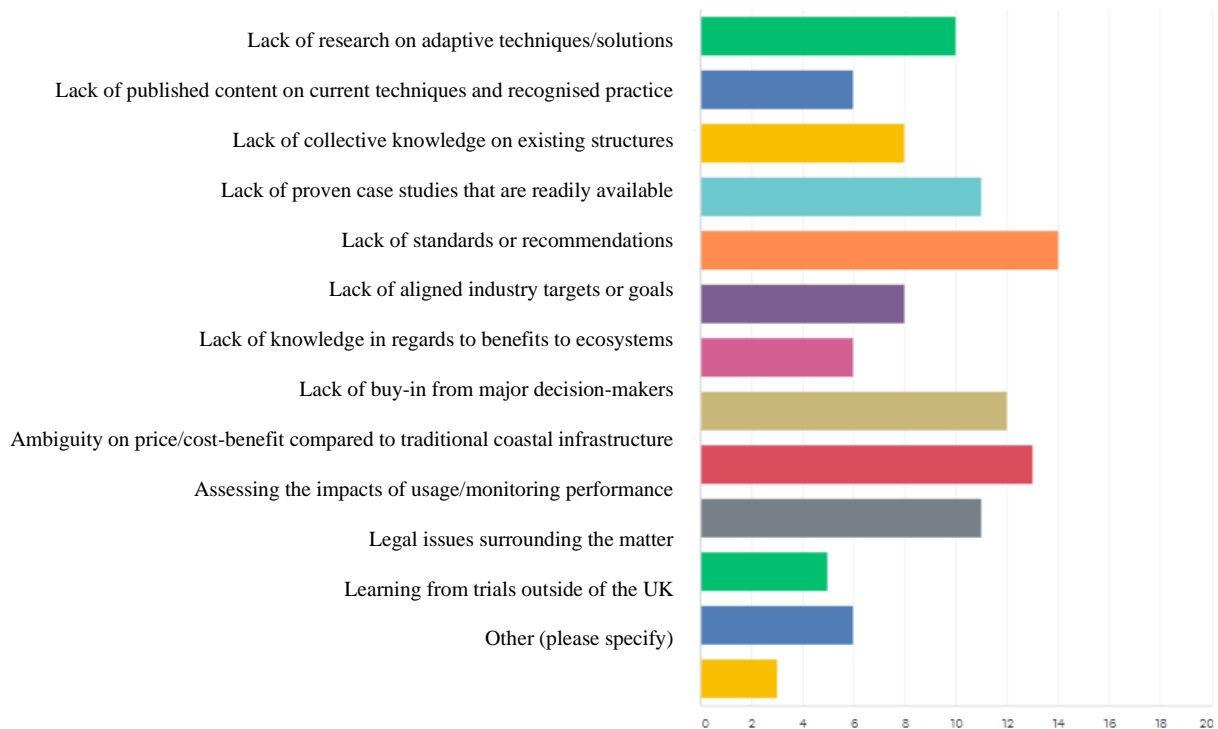
Answered: 28 Skipped: 1



**Summary of 'Other' - Lack of 'joined up' thinking, development and planning with coastal stakeholders, lack of general awareness from all stakeholders.*

What would you say, are the key challenges that the UK is facing in regards to utilising eco-engineering in existing infrastructure along the UK coastline?

Answered: 28 Skipped: 1



**Summary of 'Other' - Mismatch of targets (interests) between major coastal stakeholders both public and private, lack of funding for maintenance of existing structures.*

Appendix 2 – Summary notes from scoping sessions – 9th & 16th November 2022

Attendance and introductions

James Addison, National Policy Manager at the Environment Agency – Works within asset engineering department at the EA for the UK. Has 20+ years of experience at EA and Local Authority dealing with coastal schemes. Interested in how this guide can inform development of standards moving forward.

Jess Bone, Research Assistant at Bournemouth University & MARINEFF – Worked on the MARINEFF project since its inception and has been responsible for the UK duties alongside the University of Southampton.

Simon Burchett, Technical Director at WSP – Worked on habitat creation management alignment schemes and starting to do enhancements of coastal protection works.

Tracy McKen, Managing Flood Risk Team at Scottish Government – Recent starter, leading representative on the steering group on behalf of Scottish Government.

Professor Larissa Naylor, University of Glasgow – Working in this space since 2005, led on CIRIAs ‘Greening the Grey’ report in 2017, worked as an academic and in industry as a consultant.

Stuart Newby, Framework Manager at VolkerStevin – Manages framework in their relationship with the Environment Agency for works in Northwest and Southeast UK. Involved in range of coastal works including those at Southsea. Able to link back into EA supplier partners and Volker business both in UK, Europe and supply chain partners.

Phil Ramsey, Programme Director at Kier – Framework Director for Kier in their relationship with the Environment Agency for works in Southwest UK, project ties in with a number of ongoing schemes e.g. eco reef blocks in Newlyn.

Harrison Short, Project Engineer at Arc Marine – Background in marine construction and contracting, specialise in nature inclusive design for marine construction and infrastructure, various products available as examples. Interested to see the direction of industry and how Arc Marine can assist.

Claire Squires, Principal Environmental Scientist at Mott MacDonald – Experience at consultancies overseas and in the UK as well as at EA working on Thames estuary improvements and other coastal asset schemes. Previous work has involved encouraging organisations to deviate from the norm with asset management with the use of nature-based solutions. Interested in how the guide can be used to collate knowledge and experience into one place and encourage knowledge-sharing.

Jack Young, Project Manager, CIRIA

It was noted that a chairperson will be required for future meetings, and that role is available should anyone wish to volunteer for this position. Further information on chair duties and expectations can be discussed separately.

Project Steering Group (PSG) Terms of Reference

A simplified run through of the PSG Terms of Reference was provided, no comments were made in response to this.

Project specification and scope

Audience

Asset owners, engineers, marine ecologists and other stakeholders involved in the design, construction, management, planning, regulation and operation of coastal infrastructure and shoreline management plans (SMPs). Geomorphological and eco-engineering experts and practitioners, those involved with achieving biodiversity net gain.

The guide should be primarily targeted towards those, but should be readable by students and non-experts to widen the reach to politicians, local authority and academia. It was noted that the target audience may widen following discussions during the drafting stages.

It is expected that the audience will be able to use the guide to:

- Learn more about eco-engineering in a coastal context, the key principles behind it along with pros and cons, and how it can be utilised within coastal infrastructure.
- Consider various eco-engineering methods that could be incorporated into their shoreline management plans (SMPs).
- Assist in the planning of business cases, by detailing key information that should be considered when proposing plans to decision-makers.
- Reinforce eco-engineering as an initial option in future coastal protection schemes.

Balance of chapters/content

The current suggestion of balance throughout the guide was considered to be acceptable at this stage, but it was noted that this may develop during the drafting process.

Types of assets, techniques and general comments regarding content

- What geographical zones should we be considering? What are the range of habitat or sediment types that are going to be considered here? Noted that the following should be considered for now, and nothing ruled out at this stage.
 - o Intertidal and subtidal
 - o Estuaries
 - o Open coast
- 2011 guidance was for hard assets and 2017 guidance focused on greening assets that needed to remain primarily grey but included some hybrid approaches. Are we strictly focusing on hard assets or including hybrid approaches?
 - o Definitely gaps in guidance on hard assets in the UK, should be considered
 - o CIRIA to circulate short survey to allow for PSG to submit list of known techniques that should be covered within the guide (name of technique, short description, maturity)
 - o Helps to inform author team and gives better idea of structure for guide
- How much focus will be on 'old' techniques?
 - o Signposting will likely be a solution to avoid repetition
- Value of practitioner/academic partnerships should be explored
 - o Benefits and opportunities this presents
 - o Have to ensure to avoid bias/advertisement of groups/products in this sense
- Materials
 - o Concrete mix designs, recommendations for various techniques and how this can influence techniques or viability of methods
- Geomorphology should be a key section in the guide
 - o Detailed effects on surrounding ecosystems and considerations that are needed
 - o Noted that a number of techniques will share geomorphological impacts to a degree
- Carbon should be mentioned as a consideration
 - o Noted that the guide will not go in depth regarding carbon, but will be acknowledged and possibly discussed through referencing external material
- Design lifecycle analysis should be considered, especially when evaluating long-term vs. short-term solutions, as it may influence preferred options
 - o Decommissioning of eco-engineered assets
 - o Approach to end-of-life stages
- Asset maintenance in consideration of local biology/ecosystems, how to minimize impact when carrying out works
- Maintaining awareness of upcoming publications and guidance in the sector

- Noted that [Ecostructure](#), [SARCC](#) and [MARINEFF](#) are publishing documents reflecting each of their initiatives and outcomes
- United States' Army Corps of Engineers (USACE) published [an international guide on using Natural and Nature Based Features](#) (NNBF) to reduce flood and coastal erosion risks – chapter 14 should be considered when discussing techniques, may prove a useful reference
- Worth keeping an eye on to identify signposting opportunities and future collaboration when marketing the guide
- Business case development
 - Important to clarify how to encourage funding in general, outlining the general pros/cons at the beginning to grab readers attention
 - Noted that a section on 'how to use the guide' may prove useful, given the range of audience.
 - Ensure guide is as readable as possible, to widen reach across industry to non-experts.

Techniques and case studies – various formats/approaches possible

- Techniques – how are they represented throughout the guide
 - Keep structure suggested in specification – chapters discuss each technique in turn before moving on to next chapter
 - Easier for people to focus on chapters that best appeal to them (e.g. designers/manufacturers etc.)
 - Preferred option
 - Discuss each technique in full one by one, covering all aspects of the chapters proposed for each (design, materials, asset management, env process, geomorphology etc.)
 - Benefits users wanting to focus on techniques, but undoubtedly there will be overlap between techniques in certain sections.
 - Least preferred option
- Case studies
 - Spread out in short-form throughout the guide to support points/chapters, then showcased in long-form in a separate chapter/appendices (preferred choice that has worked well in other CIRIA guides).
 - Only referred to in main body of guide with full case study as an appendices (2nd choice)
 - Short case studies only used to support points/chapters, no longer versions or dedicated chapter (least favoured)