

## **National Coastal Change Assessment 2: Enhancing the evidence base and our ability to adapt**

### **Background:**

The CREW-funded National Coastal Change Assessment (NCCA) has revolutionised the evidence base of coastal change. The entire 21,000 km of the Scottish coastline has been categorised and 3,800 km of potentially erodible 'soft' coast identified and investigated to quantify historic and recent mobility. Of the soft coast, 23% has experienced significant change. Looking forward, past rates have been projected to 2050 to identify likely areas of erosion and the assets (roads, rail, housing etc.) that may be vulnerable. Results are available at [www.dynamiccoast.com](http://www.dynamiccoast.com) and the NCCA reports are available via the website.

Whilst the NCCA is a significant step forwards in understanding coastal erosion in Scotland, the steering committee recognised that its results are:

- Indicative: due to data accuracy and the stochastic nature of coastal erosion
- Partial: considers only those areas subject to past erosion and excludes those that may erode for the first time in the future
- Conservative: does not consider accelerations in erosion due to climate change
- Two-dimensional: reflects planimetric changes only with change inferred for the whole beach from movements of Mean High Water Springs (MHWS). Contrasting this, three dimensional techniques reflect volumetric changes across the intertidal, upper beach and hinterland allowing sediment exchange between sections of the beach to be better quantified to support more informed adaptation.

This subsequent project seeks to enhance the evidence base developed by NCCA and where possible, address the above limitations to help appreciate if, and how much, we may be underestimating future erosion and erosion enhanced flood risks.

### **Impact:**

The outputs of this project will help to:

- Support the delivery of the Adaptation Sub-Committee of the Climate Change Committee report by informing the evidence and knowledge gaps on erosion and flooding that currently hinder implementation
- Lead by example in climate change mitigation and adaptation along our coast, which is particularly exposed to climate risks.
- Meet Scotland's obligations under multiple aspects of the Climate Change Adaptation Programme, Flood Risk Management Act, Community Resilience Strategy, Scottish Planning Policy, National Marine Plan, Historic Environment Scotland's Climate Change Action Plan, Land Use Strategy and Scottish Biodiversity Strategy.

**Objectives, Anticipated Approach, and Outputs required:**

| Objectives  | Anticipated Approach  | Outputs (→ format)   |
|---|---|--|
| <b>Work stream 1 (5 months or 20%)</b>  |   |  |
| <p><b>1a. Erosion enhanced flooding:</b><br/>Identify natural features the removal of which may increase flood or erosion risk.</p> | <p>1. Develop semi-automated terrain analysis to appreciate the metrics of natural coastal defence features (incl. size, extent, height etc). DTMs will be provided.</p> <p>2. Output key metrics into a database (format to be agreed by steering committee)</p> <p>3. Undertake an initial topographic analysis to appreciate low-lying areas behind dynamic/soft coasts</p> <p>4. Output key metrics into a database (format to be agreed by steering committee)</p> | <ul style="list-style-type: none"> <li>• Methodology to identify features and which may be most vulnerable to erosion</li> </ul> <p>→ Methodology Report and GIS data</p> <ul style="list-style-type: none"> <li>• Spatial Database of natural defence<sup>a</sup> features for coastal erosion and flooding (flooding elements should be informed by SEPA regarding Sect. 19 of <a href="#">FRM Act</a>). It is anticipated that the NCCA data will inform prioritisation of coastline where this is appropriate (e.g. hard high coast in lesser detail, soft low coast in more). This should include <ul style="list-style-type: none"> <li>○ locations where these natural features may be vulnerable to erosion due to climate change</li> <li>○ locations of natural features where their removal would increase flood or erosion risk</li> <li>○ Proximity of assets</li> </ul> </li> </ul> <p>→ Methodology &amp; Results Report &amp; GIS data</p> |
| <p>1b. Identify where <b>beach lowering</b> at defences may increase flood risk</p>   | <p>1. Use expert judgement to identify sites where beach lowering may increase flood risk.</p>  | <ul style="list-style-type: none"> <li>• At &lt; 10 sites undertake analysis of coastal erosion against coastal defence data, to appreciate where beach lowering may influence defences and flood protection. Sites will be agreed in discussion with the steering committee</li> </ul> <ul style="list-style-type: none"> <li>• → Methodology Report, Results Report and GIS data</li> </ul>  |

| Objectives  | Anticipated Approach  | Outputs  |
|---|---|--|
| <b>Work stream 2</b>  |   | <b>(5 months or 20%)</b>   |
| <p><b>Climate change increased erosion risk:</b><br/>Consider erosion implications and erosion enhanced flood risk</p>  | <ol style="list-style-type: none"> <li>1. Consider the implications of forthcoming climate change scenarios and Coastal Flood Boundary Figures.</li> <li>2. Repeat NCCA vulnerability assessment<sup>b</sup> results via two possible climate change scenarios (to be agreed by steering committee) for short, medium and long-term implications</li> <li>3. Incorporate newly available data (incl. MoD, Waste Water Network)</li> </ol>                 | <ul style="list-style-type: none"> <li>• Appreciate the implications of the climate change scenarios (i.e. anticipated UKCP18 and Coastal Flood Boundary Condition figures. Both expected early 2018). This should consider if / what multiplier is appropriate within existing areas of erosion and if / how to expand erosion into adjacent areas which have been stable or experienced accretion previously. This should include methodology development, production of shapefiles and summary of results and implications.</li> <li>• Discussion paper on the implications of this work stream for the most suitable sites for adaptation (taking account of assets at risk and opportunity for adaptation).</li> </ul> <p>→ Methodology Report, Results Report and GIS data</p> |
| <b>Work stream 3</b>  |   | <b>(2 months or 10%)</b>   |
| <p><b>Enhance change analysis:</b><br/>Develop methodologies to improve understanding of dynamism (i.e. including relationship between MHWS and vegetation edge</p> | <ol style="list-style-type: none"> <li>1. Time lapse vegetation edge analysis (up to 5 time periods) at up to 10 key sites (as agreed with Steering Committee).</li> <li>2. Anticipated approach via unsupervised classification of aerial image to extract vegetation edge.</li> <li>3. Update existing AGOL mobile-device web maps for site use / checking / updating surveys.</li> <li>4. Provide guidance on how to use the mobile device.</li> </ol> | <ul style="list-style-type: none"> <li>• Methodology developed to supplement comparisons with MHWS using vegetation edge changes.</li> <li>• Targeted vegetation edge analysis within current and archive aerial imagery<sup>c</sup>.</li> <li>• Enhance existing <a href="#">ArcCollector maps</a> for smartphone.</li> <li>• Guidance on how to use app (via guidance note, YouTube video etc.).</li> </ul> <p>→ Methodology Report, Results Report, GIS data and Video Guidance.</p>  |

| Objectives   | Anticipated Approach  | Outputs   |
|--|---|---|
| <b>Work stream 4 (7 months 30%)</b>  |   |   |
| <p><b>Mitigation and Adaptation:</b><br/>Develop Mitigation, Adaptation &amp; Resilience Plans at key sites.</p> <p>(e.g. will include St Andrews, may include: Skara Brae, Parts of Tiree, Montrose, Golspie Links)</p> | <ol style="list-style-type: none"> <li>1. Identify up to five pilot sites to suit a range of cross sector interests</li> <li>2. Undertake 3D appraisals of past change and asset locations</li> <li>3. Undertake future change appraisals at pilot sites and assess local vulnerability</li> <li>4. Develop Mitigation Adaptation Plans (essentially a specific management plan) to reduce future risk at these sites, based on analysis (above) and stakeholder / community engagement.</li> </ol> | <ul style="list-style-type: none"> <li>• Time-series 3D volumetric change analyses at up to five key sites compared with asset data, informing local detailed risk appraisals to develop mitigation and adaptation plans. These exemplars are then available to be replicated elsewhere.</li> <li>• Audience specific outputs to enhance understanding and uptake within partners and communities.</li> <li>• Mitigation &amp; Adaptation Plans should include at least one Cultural Heritage site, one natural heritage site and another (i.e. infrastructure and/or housing).</li> </ul> <p>→ Methodology Report, Mitigation Adaptation Plans, Summary of community engagement workshop discussions, GIS data and Web-based results</p> |
| <b>Work stream 5 (less than 1/2 month or 5%)</b>   |   |   |
| <p><b>Increase adaptation awareness:</b><br/>Provide data analysis support to SG staff to identify adaptation and collaboration opportunities to assist organisation uptake of adaptation</p>                            | <ol style="list-style-type: none"> <li>1. Extract partner-specific results from NCCA</li> <li>2. Review coincident assets and opportunities</li> </ol>  | <ul style="list-style-type: none"> <li>• Provide partner-specific data clarifying results from NCCA &amp; above work streams (i.e. identification of at risk assets for each partner etc.).</li> <li>• Update existing review of coincident assets and opportunities to aid cross-sector implementation.</li> </ul> <p>→ Brief Methodology Report, Results Report and GIS data</p>  |
| <b>Work stream 6 (4 months or 15%)</b>   |   |   |
| <p><b>Social vulnerability to coastal erosion:</b><br/>consider vulnerability of communities</p>   | <ol style="list-style-type: none"> <li>1. Review methodology for Flood Risk Disadvantage mapping and literature on coastal erosion<sup>d</sup>.</li> <li>2. Develop social vulnerability indices for coastal erosion</li> <li>3. Use existing data<sup>d</sup> to map coastal erosion disadvantage</li> <li>4. Juxtapose against NCCA &amp; Work Stream 2</li> </ol>  | <ul style="list-style-type: none"> <li>• Investigate and report on the societal vulnerability of NCCA results</li> <li>• Disadvantage mapping for coastal erosion for Scotland.</li> </ul> <p>→ Methodology Report, Results Report and GIS data</p>   |

**Intellectual Property:** The Intellectual Property for this work will be owned by the Scottish Government.

**Key dates:**

1. Project start: Start November 2017
2. Project start up meeting: Start November 2017
3. Final reporting: End November 2019

**Meetings:**

Contractors should plan for meetings:

With project manager – every 2 weeks – by phone

With steering group – every 2 months – by VC / Skype

With steering group – every 6 months – in person at SNH/SG office

Please also detail the number of on-site visits expected for work stream 4 and other dissemination events (for academic as well as Local Authorities & partners).

**Maximum funding available (excluding VAT which is not payable)**

£214,000

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<sup>a</sup> Natural defence features are defined by SEPA (e.g. Sand dunes/machair, Intertidal areas, saltmarsh and mudflats, Shingle banks, Beaches, Sand bars/spits)

<sup>b</sup> The NCCA Vulnerability Assessment is an intersect between the areas of anticipated erosion and asset data (roads, railways, buildings and designated sites). For a full description please see NCCA Methodology Report.

<sup>c</sup> Data is likely to be made available via HES / RCAHMS. Acquisition costs are to be funded separately and should be excluded from your bid.

<sup>d</sup> Data includes: NCCA (reports available [here](#)), NCCA2 Work stream 2 and Fitton, (2015) A national coastal erosion risk assessment for Scotland. PhD thesis, University of Glasgow. [Summary available](#).