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Governance context for coastal innovations in England: The case of Sandscaping in North Norfolk

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ABSTRACT

Coastal management in Europe is shifting toward soft coastal protection strategies to deal with flood risk and erosion. In the UK, a sand replenishment in North Norfolk is planned to take place in the coming years, inspired by the Dutch 'Sand engine': a large-scale sand replenishment executed in 2011. Besides being faced with technical challenges, the initiative requires fine-tuning to the local conditions. In this article we present a theory guided assessment of the governance context for Sandscaping in England. We focus upon North Norfolk, where Sandscaping was included as an option to protect the Bacton Gas Terminal from cliff erosion. Our aim is to contribute to further elaboration of Sandscaping potential along other locations in England. The lessons we draw about implementing Sandscaping initiatives have emerged from real project experience and could therefore be relevant in other coastal contexts.

1. Introduction

It is widely acknowledged that reliance on conventional 'hard' human-engineered infrastructure to manage water needs is capital intensive and often damaging to the ecosystems. Consequently, there is an emerging focus on 'green' infrastructure, soft engineering, ecological restoration and combined approaches are increasingly being used to manage coastlines (Palmer et al., 2015; Hill, 2015). A review of current coastal protection strategies in Europe (Pranzini et al., 2015; Pranzini and Williams, 2013) revealed that countries share a common trend toward replacement of hard defences with soft strategies, and the need for modern legislation and administrative solutions that enable integration in resource management. The trend is fuelled by the search for the added value of increasing costs of coastal defences. The legitimacy of investments appears to increase if they offer additional services to society besides flood risk reduction. One soft engineering approach that emerged as an alternative to hard infrastructure is 'Building with Nature' (Van Slobbe et al., 2013; de Vriend et al., 2015). The Dutch Sand engine is an example of applying Building with Nature for flood protection in coastal environments (de Vriend et al., 2015; Aarninkhof et al., 2012).

The Sand engine is a very large, locally concentrated sand nourishment of 21.5 million m^3, aiming to provide safety against flooding in combination with new spatial values (Stive et al., 2013). It was executed at Delfland coast in the Netherlands, between Rotterdam and the Hague, in 2011 (see Fig. 1). The design of the Sand engine integrates ecology, recreation, land use and other aspects of coastal management. Building with Nature projects like the Sand engine require a multidisciplinary approach (de Vriend et al., 2015) and their decision-making is no longer just a matter of coastal engineering, but one of integrated governance (Van Slobbe et al., 2013).

Since its implementation, the Sand engine has attracted the attention of coastal authorities worldwide. In the UK, there has been increased media interest in what flooded Britain can learn from the Dutch (Storr, 2014; Carrington, 2014; Van Klaveren, 2015; The Spectator, 2016). Against this background, the 'Sandscaping' initiative is an example of how the Dutch expertise could be applied to the British context. Sandscaping is inspired by the 'Building with Nature' approach, using the principles of the Sand engine in the Netherlands. As part of this effort, 19 high potential locations for Sandscaping were identified in England and Wales (The Crown

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Estate, 2015a; Flikweert, 2016).

In this paper, we aim to increase the understanding of the governance context for Sandscaping in England. We apply a Governance Assessment Tool (GAT) to identify the conditions that support or restrict the implementation of Sandscaping initiatives. We focus on Bacton Gas Terminal coastal defence scheme in North Norfolk, England, which is currently at the most advanced stage of decision-making among the 19 high potential locations identified. In this way, we aim to support the development of the Sandscaping concept further in England and to enable the transfer of the Sand engine concept to the UK. Based on the findings, we make recommendations on how to reduce restrictions and/or make use of opportunities present in the governance context. The lessons we draw about implementing Sandscaping initiatives have emerged from real (project) experience and could therefore be relevant in other coastal contexts. Alongside this practical contribution, our aim is to apply the GAT to coastal governance and thereby contribute to the literature on the governance of coastal areas. The central research question posed in this article is: what governance conditions in England prove supportive or restrictive for the implementation of Sandscaping in North Norfolk? Section 2 of the article introduces the Sand engine and Sandscaping concepts, section 3 sets out the theoretical framework and methodology used in this paper and section 4 details the coastal setting of Bacton and the reasons for selecting this case. The research results are presented in section 5, summarised and discussed in section 6 and final conclusions are drawn in section 7.

2. Sand engine and sandscaping

The idea of a large scale nourishment is to deposit a significant stock of sand in one location, which is then gradually redistributed across and along the shore by the wind and waves. By making use of natural processes to redistribute the sand, this approach aims to reduce the disturbance of local ecosystems (Aarninkhof et al., 2012). It is an alternative to 'hard' engineering (dams, reinforcement and acceptance of beach erosion) and defending the coast by recurring small-scale nourishments (Van Slobbe et al., 2013). The largest application of this concept so far is the Sand engine Delfland (Stive et al., 2013; de Vriend et al., 2015), executed in 2011 between Rotterdam and the Hague in the Netherlands (see Fig. 1).

According to the Ministerial decision of June 2010 the policy goals of the Sand engine were (Rijkswaterstaat, 2013):

- to stimulate natural dune growth for coastal safety, nature and recreation;
- knowledge development and innovation;
- create additional nature and recreation possibilities at the Delfland coast.

Although the existing experiments and pilot projects show that the Building with Nature approach works, mainstreaming it still meets a number of obstacles, and the Sand engine design cannot simply be copied to other locations (de Vriend et al., 2015). The design should rather comply with the local situation, and take into consideration the local societal, ecological and morphological dynamics. UK's Sandscaping is inspired by the Dutch Sand engine concept, but has its own distinct characteristics. In the Netherlands, the Sand engine is narrated as an (iconic) innovation in coastal management by the actors involved, but also considered a stage in the incremental process of coastal development in the broader Dutch coastal community (Bontje and Slinger, 2017). In the UK context, on the other hand, flexibility and adaptability of Sandscaping compared to hard defences, which means it can be useful for buying time so that communities can adapt to coastal change, is a key distinguishing feature.

A wide range of public and private partners have been exploring the concept of Sandscaping in the UK (The Crown Estate, 2015b; Arup, 2014). The partnership is working closely with local authorities, the Environment Agency, coastal infrastructure managers, the academic community and industry experts to develop evidence and reach informed conclusions (The Crown Estate, 2015b). The partnership is applying the principles established in the Sand Engine project and believes that this could offer effective coastal

Fig. 1. Sand engine as of 16 February 2016.
Source: Rijkswaterstaat/Jurriaan Brobbel.

management while unlocking multiple regeneration opportunities in British coastal communities. Applying a coastal innovation like the Sand engine in the UK context entails (The Crown Estate, 2015a; Flikweert, 2016):

- multi-functionality: an integrated solution that meets wider societal demands and generates socio-economic and environmental opportunities to help fund coastal management (multi-fundable);
- enabling adaptation to climate change and resilience of coastal land;
- place making: new resilient coastal environments that could lead to the regeneration of communities, the creation of habitats, and protection of strategic assets;
- nature-driven design: making the most of natural materials (marine sand and gravel) as well as natural processes.

So far the development of Sandscaping has focused on identifying potential locations of interest in the UK, technical baseline studies, workshops and meetings to discuss pilot project locations, feasibility studies for specific locations and initial meetings with decision makers and stakeholders about what Sandscaping could look like and how it could work.

3. Theoretical framework and methodology

The literature on coastal erosion and protection has acknowledged that 'management essentially embraces two distinctly differing disciplines that are very dissimilar in their practices: engineering and the socio-economic' (Pranzini et al., 2015, p. 445). The research that has focused on what is happening on the engineering end of the management spectrum has produced helpful typologies of protection strategies (e.g. Hill, 2015; Pranzini and Williams, 2013). Research on coastal management and governance in the UK has provided an overview of policy frameworks, key documents, guidelines and the available funding (Stojanovic and Barker, 2008; Moore and Davis, 2015), and has addressed stakeholder involvement (Fletcher, 2003; Tompkins et al., 2008) from an adaptive governance perspective (Day et al., 2015). There has been some work done on coastal management and planning in the context of climate change adaptation (Few et al., 2007; Jeuken et al., 2015) and on public policy and adaptive approaches to coastal change management (CH2M, 2015). Sandscaping as a recent initiative has triggered the publication of consultancy reports, but has not been widely researched so far. In this article, we address coastal protection from a governance perspective and provide a systematic theory guided assessment of the governance context for Sandscaping strategies in England.

The data sources for this research included observations, semi-structured interviews with key stakeholders and a literature study. Besides academic literature, the study included project documents, reports, policy papers and legislation. A list was drawn up of government institutions and stakeholders who participated in the preparation stage of the Bacton Gas terminal coastal defence scheme. To minimize bias in the presentation of coastal problems and solutions NGOs who were not directly involved in Bacton scheme but were aware of the Sandscaping initiative were also interviewed in generic sense. Our interviews and analysis were guided by the questions that are presented in Table 1. The interviews took place in May and June 2016 and covered the following organisations:

- Department for Environment, Food and Rural Affairs (DEFRA): UK government department responsible for flooding and coastal change
- Environment Agency (EA): flood and erosion management operating authority in England
- Natural England (NE): government's adviser for the natural environment in England
- Marine Management Organisation (MMO): licenses, regulates and plans marine activities in the seas around England and Wales
- The Crown Estate (TCE): the Monarch's property manager, owner of seabed, aggregates and approximately half of the beaches in England
- North Norfolk District Council (NNDC): local flood and erosion management operating authority
- Eastern Inshore Fisheries and Conservation Authority (Eastern IFCA): protection of the marine inshore environment and fisheries management in England
- Bacton terminal operating company (BTC)
- Royal Haskoning DHV UK Ltd: lead consultant in Bacton Gas terminal coastal protection scheme and wider Sandscaping initiative
- Royal Society for Protection of Birds (RSPB): environment NGO
- National Trust (NT): environment NGO

The methodology applied in our study is called the Governance Assessment Tool (GAT). The GAT methodology is practice-oriented in that it tries to assist policy makers in identifying the opportunities and threats for the realisation of the chosen policies and projects (Bressers et al., 2016). It enables the development of the concept of "governance" as a modification and extension of the concept of "policy"' (Bressers and Kuks, 2013, 6). The GAT is based on Contextual Interaction Theory (CIT) (Bressers and Kuks, 2004; Bressers, 2009; De Boer and Bressers, 2011; De Boer, 2012). CIT focuses on the context in which people work as being pivotal to the outcome of their interactions and divides this context into five descriptive-analytical dimensions and four qualities. The dimensions are (1) levels and scales; (2) actors and networks; (3) problem perceptions and goal ambitions; (4) strategies and instruments; (5) responsibilities and resources for implementation. The dimensions are complemented by four qualities: coherence, extent, flexibility and intensity (Bressers and Kuks, 2013). The GAT is made up of a 'matrix' model consisting of these five dimensions and four qualities. By analysing the five dimensions of governance according to the four qualities of the governance regime, one can attain a very pragmatic understanding of how different elements of governance interact and hence influence a particular implementation setting. Together, these dimensions and qualities shed light on the degree of supportiveness or restrictiveness of the governance context towards various initiatives such as Sandscaping.

In the GAT, the core governance quality "extent" refers to the completeness of the regime in terms of relevant aspects, such as actors or instruments. When the regime is incomplete, for instance because local authorities are not involved, while at a later stage their cooperation is needed, this might hamper the project realisation. "Coherence" relates to how the various elements of the regime strengthen or weaken each other. When for instance demands from different relevant sectors steer against each other stalemates might occur. "Flexibility" refers to whether different roads to the goals are allowed and supported so that the initiators can act according to the opportunities or threats that arise during the implementation. This quality is especially important in complex and long-term thus dynamic cases, where these opportunities and threats cannot be completely foreseen from the start. And finally, "intensity" is "the degree to which the regime elements urge changes in the status quo or in current developments" (De Boer and Bressers, 2011, p. 93). Without such pressure and resources the

Table 1
GAT supportive governance qualities (modified from Bressers et al., 2016).

	Supportive extent	Supportive coherence	Supportive flexibility	Supportive intensity
Levels and Scales	complete in reflecting what is relevant for the policy or project	activities of different levels recognised as mutually dependent, substantial degree of interaction between scales, coordination	relationships between levels and scales based on decentralisation of power, without upper levels withdrawing support, empowering rather controlling relations, trust	upper levels more deeply involved in the policy or project
Actors and Networks	complete in reflecting what is relevant for the policy or project	substantial degree of interaction in the policy network, productive interaction providing coordination capacity	giving leeway to each actor group to optimise its contribution to the whole programme while still viewing the whole programme as a joint effort	actors that are powerful in other domains are more deeply involved in the relevant policy network for the issue at stake
Problem perspectives and Goal ambitions	complete in reflecting what is relevant for the policy or project	one framework, coordination, deliberate choices in case of conflict, integration for productive deliberation on ambitions	the mixtures of problems/goals are allowed to be different in emphasis according to the opportunities of the context in the various concrete situations	the issue plays a large role in the public debate leading to a greater openness to try to push for development away from business-as-usual track
Strategies and Instruments	complete in reflecting what is relevant for the policy or project	one framework, coordination, deliberate choices in case of conflict, integration for productive deliberation on ambitions	combinations of instruments or mixes from different sources (private and public) may be used as well as indirect means	available instruments include interventionist types
Responsibilities and Resources	complete in reflecting what is relevant for the policy or project	assigned responsibilities create no competence struggles within on across institutions (coordination)	it is possible to pool the assigned responsibilities and resources from several policy fields without compromising accountability and transparency	the amount of allocated resources is sufficient to implement the measures needed for the intended change or project

realisation of new initiatives becomes unlikely.

The GAT has shown important strengths in the analysis of water projects implementation in the Netherlands (De Boer and Bressers, 2011), Canada (De Boer, 2012), North Western Europe (Bressers et al., 2016), Romania (Vinke de Kruijf et al., 2015) and Mexico (Casiano and De Boer 2015; Casiano and Bressers, 2015; Casiano et al., 2016; Casiano, 2017). For the purpose of this research, GAT was made operational for large scale sand replenishments based on the insights from Building with Nature research projects that focused on governance (Van den Hoek, 2014; Janssen Stephanie, 2015; Vikolainen et al., 2014) and the usability study by the Dutch infrastructure agency Rijkswaterstaat (Rijkswaterstaat, 2013, 2014).

The quality of the governance regime was assessed inductively based on the interviewees' answers and contrasted with the literature and documentation obtained. In line with the GAT methodology, governance circumstances in the 20 cells shown in Table 1 were assessed as supportive or restrictive depending on how easy or difficult they make the achievement of a Sandscaping solution in Bacton coastal defence scheme.

4. Bacton coastal setting and case selection

Flood risk across the UK has increased over recent decades and along with other parts of Europe, England has registered a series of catastrophic floods since 1998 (Werritty, 2006). The North Norfolk coastline spans 42 miles (68 km), of which 21 miles (34 km) are erodible cliffs between Kelling Hard and Cart Gap (NNDC, 2016), see Fig. 2.

The cliffs are made of soft deposits, mainly sand and soft clays, which are very vulnerable to erosion. Coastal erosion of the soft cliffs in North Norfolk is a natural process which has been going on for thousands of years. The erosion continued despite the placement of coastal protection in the form of groynes and revetments after the Second World War, and has progressed rapidly over recent years, notably as result of storm surges in November 2007 and December 2013 (Royal Haskoning DHV, 2016).

The Bacton Gas Terminal is located to the north of the village of Bacton, 20 km south-east of Cromer (Fig. 2). It is one of the three main gas terminals in the UK and receives gas from the North Sea extraction fields and from the continent. The Terminal is located in close proximity to the cliffs along the North Norfolk coastline. There is a number of pipelines beneath the beach that come onshore buried beneath the beach and then reach the terminal through vertical shafts constructed in the land behind the cliffs. Existing defences along the frontage and to the south-east of terminal comprise timber breastwork, groynes, rock armour, sheet piling and geotextile bags (Royal Haskoning DHV, 2016), see Fig. 3.

During the December 2013 storm, the cliff line receded by approximately 5–10 m at the toe of the cliff, with approximately 2–3 m at the top of the cliff, causing the cliffs to become unstable and putting the pipelines and the facility at risk (see Fig. 4).

The cliff frontage down drift of the Bacton Gas Terminal is also subject to coastal erosion. The communities of Bacton and Walcott villages along the coast and settlements further down drift are extremely vulnerable to erosion; their own coast protection measures are predicted to have a remaining effective lifespan of approximately seven years (Royal Haskoning DHV, 2016). Under the current Shoreline Management Plan (SMP), the existing defences will not be replaced once they reach the end of their life. The replacement is unlikely to be economically viable nor technically suitable, despite the erosion risk and the loss of assets to the community (AECOM, 2012). Following an initial feasibility study with the local authority, Sandscaping was included in option assessment for a scheme to protect the Bacton Gas Terminal from cliff erosion. The Terminal operators selected it as the preferred option because it was shown to be the most cost-effective option for erosion protection that would also mitigate any negative impacts on the beaches and associated communities down drift – an essential requirement on this strongly interactive coastline. It may

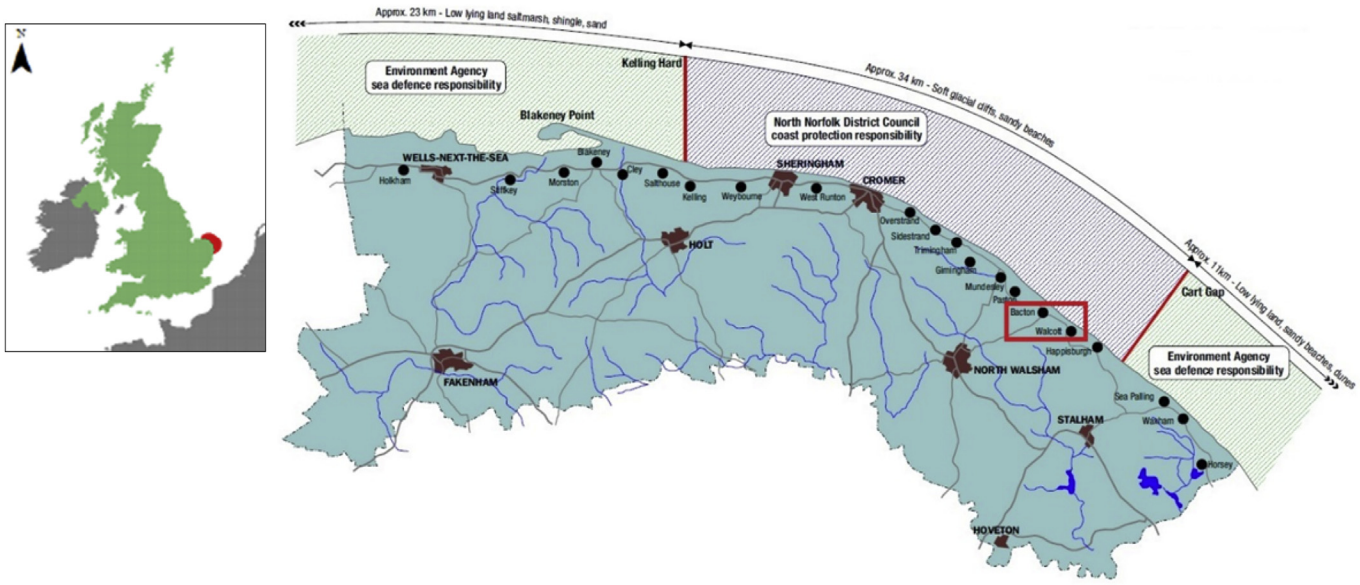

Fig. 2. North Norfolk District Council coastline map.
Source: NNDC 2016, Royal Haskoning DHV, 2016.

Fig. 3. Existing coastal defences at Bacton Gas Terminal.
Source: NNDC.

even be possible to extend the Terminal protection scheme (with public funding) to supply additional sediment down drift, improving the beaches for the communities of Bacton and Walcott and extending the life of the existing coastal defences. This will give the communities and the policy makers time to find a solution to the issue of community adaptation to coastal change. Without

Fig. 4. Damage at the coastal front of the Bacton Terminal.
Source: Bacton terminal operating company.

additional sediment supply down drift, the communities will have to move back, but there is currently no funding or policy (national or local) to support this. The Sandscaping solution will be fine-tuned through detailed design and Environmental Impact Assessment; it could be in the order of 2 million m^3 of sediment with a functional life around 20 years (Flikweert, 2016). Decision is expected around the first quarter of 2017 and execution is expected in 2018.

At the moment of case selection, the decision-making on the Bacton Gas terminal coastal protection scheme was at the most advanced stage compared to the rest of high potential locations identified by the Sandscaping initiative. In that sense it serves as a 'revelatory' case, since Sandscaping or beach replenishment at this scale has not been applied before in the UK or England. The single case study is therefore worth conducting because the descriptive information alone will be revelatory (Yin, 2003). In addition to this, previous work done by the North Norfolk District Council on coastal management issues is well documented in the literature and considered a flagship example which is nationally recognised (Milligan & O'Riordan, 2007; Walvin and Mickovski, 2015; Nicholls et al., 2015; Day et al., 2015).

5. Results

Below we will present the results of the assessment by discussing each dimension of governance and within those sections the assessment of each quality.

5.1. Levels and scales

5.1.1. Extent was assessed as neutral

The involvement of the national level (the EA and DEFRA) in coastal and flood erosion management projects often depends on whether the project applies for national funding (Flood and coastal erosion management Grant in Aid (GIA), administered by DEFRA through the EA). In practice, local authorities would always look for national funding. The case for national funding is based on 'benefits to the nation' and will sometimes fully fund a project, but more often only partly, and then local funding is needed. There are some examples where there is no national funding available, but it's still viable locally. In Bacton case, national level is involved because of its innovative and experimental nature, its funding application and the presence of nationally important gas infrastructure. Natural gas supply of national importance is what makes Bacon a national level project. However, as several interviewees mentioned, national level wasn't considering Bacton from the beginning and to get it involved was time consuming and required consistent effort. At the moment both ministerial and civil servant levels of government are involved in Bacton, but in the wake of the Brexit referendum there was a change of key national actors, which may confuse things. In cases other than Bacton, the national level may not be involved or its role may be limited to having a strategic overview. The majority of interviewees admitted that Bacton would not be viable on local or regional scale in North Norfolk, however this may be different in other locations in England. Many interviewees observed that increasing the volume of sediment would increase the opportunities, but would also increase the risks. For example, Eastern IFCA expressed their concerns about the issue of scale, and the effect a large scale Sandscaping would have on small-scale fishing activities.

5.1.2. Coherence was assessed as restrictive

Some coordination mechanisms between levels are present, such as Regional Flood and Coastal Committees (RFCCs, 11 in England) set up by the EA and voluntary Coastal groups (7 in England), linking key partners in coastal management. SMPs have also brought authorities together in practice. Nonetheless, most of decision-making about specific schemes takes place at the local level. For flood and erosion management, decision-making at local level means that people want a protection scheme and expect defences to be maintained. As observed by the interviewee from national level, there is a mismatch between aspirations of the local communities and the finite funds available at national level. National government is willing to contribute tax payers money as far as a project has value 'to the nation', and the existing mechanisms largely ensure that this money is appropriately divided on the basis of objective measures. Other interviewees reported that often times inefficient defences and dredging were being authorised for local political reasons or because private funds were available, even though long-term policy is to let go of defences. The literature also reports that the role, purpose and membership in Coastal groups is declining and their function in wider coordination in coastal matters is reduced (CH2M, 2015). There is no integrated approach between authorities and overall regional approach prevails, since the natural scale of issues (and therefore solutions) in England is regional.

5.1.3. Flexibility was assessed as supportive

The relationship between levels and scales is based on decentralisation of power, local government has freedoms and flexibilities under the Localism Act (Localism Act, 2011, c.20). The Act devolved more decision-making power relating to local public services, including the general power of competence, community rights, neighbourhood planning and housing, from central government, back into the hands of individuals, communities and councils (CH2M, 2015). There are firm ongoing discussions between local authorities that would like the EA's funding to just go to them, so that they can make local decisions – but this is strongly resisted. All in all it is possible to move up and down the scales, as the case in Bacton scheme that was up scaled to the national level. This

flexibility is also a must for schemes that are not viable on local or regional level. Upper levels, the EA and DEFRA, may provide support to the local level, such as funding and monitoring support, which is planned for Bacton subject to approval. However, this support varies per location, is decided on case-by-case basis and depends, among other things, on the level of flood risk in the area.

5.1.4. Intensity was assessed as restrictive

There is no push from the upper levels, who are focused on providing cost-efficient funding for flood and erosion management schemes and keeping a strategic overview of flooding sources, towards innovative or sustainable coastal management. The DEFRA representative observed that they could make a guidance to the EA to encourage the use of Sandscaping, but usually they don't interfere and put no constraints providing the benefits are realised. The main impulse for Sandscaping comes from TCE, who focus specifically on Sandscaping, while other stakeholders like the NE and NGOs have voiced reservations related to the impacts of Sandscaping. In this context, Sandscaping initiatives have to be picked up bottom-up, with support from TCE and local stakeholders, and tailor made for each location. Without deep involvement of upper levels in coastal issues the uptake of longer-term, sustainable schemes for the coast on local level is difficult. In a system where every decision is based on maximising value for money, there is preference for low-uncertainty schemes that predict a good return on short to medium term (i.e. the life of the scheme, 50–100 years). Sustainability and long term approaches in itself are strongly valued and supported, but the key challenge is in enabling radical innovation, which will always be risky, because money might be wasted.

5.2. Actors and networks

5.2.1. Extent was assessed as supportive

Broad stakeholder involvement and consultation are common for coastal planning and project development in England, although interviewees reported that in the Bacton case, community involvement takes place at a later stage than usual. There is an 'inner core' of stakeholders involved in Bacton, these are the BTC, EA, TCE, NNDC and Royal Haskoning DHV, and the 'outer core' of statutory stakeholders, with whom consultations took place between 2014 and early 2016: NE, MMO and Eastern IFCA. The representative of Eastern IFCA considered their involvement in Bacton a good practice example. Until now, NNDC has been updating the public through press releases and a meeting with representatives of the parish councils that took place in 2015. NNDC has experience with building trust and community engagement, which is acknowledged in the literature (Day et al., 2015). During the EIA phase, a full-scale consultation will take place, including local communities, local interest groups and local NGOs (Royal Haskoning DHV, 2016). In 2015 TCE hosted a workshop for a wide range of cross-sector bodies (over 120 delegates) to discuss and introduce the concept of Sandscaping and have an open discussion about the benefits and risks of high potential sites in England. During the interviews it was obvious that many interviewees were aware of Sandscaping or were present at the workshop.

5.2.2. Coherence was assessed as supportive

Although there are tensions because each organisation has its own interests, the cooperation among the actors is very good. Collaboration among the stakeholders of the inner core is formalised and for each contract there is a cost-sharing agreement, a wider agreement from public to private is implicit. The inner core of stakeholders reported that the project is viable because of all partners working together and BTC's active role. The local authority respondent mentioned that increased cooperation was an advantage of partnership funding, which requires the authorities to top up a government grant with contributions from potential beneficiaries of the scheme. The outer circle of stakeholders, such as NE, reported that a dialogue at early stages of proposal formulation is a common way of working for them, and that they prefer to work with the partners to find a solution for Bacton. The interaction of MMO with relevant stakeholders is coordinated through Marine Case Management System (MCSM) and is rather formalised. The NGOs, who were interviewed in generic sense, mentioned that they prefer to be involved as having a conversation and openness, and work with the developer to make sure proper compensation is in place. Even the NGO that was most critical about TCE's role in Sandscaping, reported that they may use the consenting processes to ensure key issues are addressed, but they would be unlikely to go to court.

5.2.3. Flexibility was assessed as supportive

The context makes it possible to include new actors when new topics appear important or even to shift the lead from one actor to another when there are pragmatic reason for it. For instance, the project partners agreed that if public funding would be available for the joint scheme, NNDC would formally take the lead role for procurement and design; and if there would be insufficient funding for the joint scheme, BTC would lead the terminal-only scheme and deliver the works. BTC expressed their willingness to trial Sandscaping, even on a smaller scale for the terminal-only scheme, as Sandscaping would deliver potential benefits to the communities. Therefore BTC rejected a traditional linear nourishment in favour of Sandscaping, which means they still view the project as a joint effort.

5.2.4. Intensity was assessed as neutral

There is a push to trial Sandscaping in the UK from TCE, who have been exploring the concept in partnership with industry experts and Royal Haskoning DHV since 2011. In Bacton, there is a clear coalition of NNDC, BTC, TCE and Royal Haskoning DHV, who are pushing for an innovative scheme or behavioural change. In this, BTC are clearly the problem owners; TCE is involved as land owner and manager interested in attractive land use and royalties for mineral extraction; and Royal Haskoning DHV is structuring the knowledge process, profiling their 'Dutchness', the Sand engine being the key example of Dutch innovation. Together, these actors may be powerful enough to make a behavioural change possible in Bacton, but a larger scale innovation, or even other Sandscaping locations may work differently. TCE sees its role as being a 'middleman' linking different organisations, doing 'enabling work', being positive and proactive throughout the process, but they have no influence on the consenting process nor on the regulators. Hence they are not able to enforce a behavioural change towards coastal innovation.

5.3. Problem perspectives and goal ambitions

5.3.1. Extent was assessed as restrictive

In the UK, there's a varied set of situations when it comes to flood risks and erosion rates, which make every coastal problem very local. Only 11 per cent of land is at risk of flooding from a rare extreme flood event (up to a 1 in 1000) and nearly 1 in 6 properties are at risk of flooding in England (Environment Agency, 2009). To manage the risk of flooding and erosion, SMPs provide a high-level policy direction to coastal change management. SMPs define one of four policy options (hold the line, advance the line, managed realignment or no active intervention) in the short, medium and long term (for 20, 50 and 100 years respectively). Many

interviewees highlighted that SMPs provided no adaptation solution for communities, no answer how to deal with existing properties, businesses and infrastructure in areas where medium and long-term policy option is managed realignment (like for example in Bacton, Walcott and Ostend) or no active intervention. Literature confirms that local acceptance of SMPs was an issue since the plans were invariably objected to where the long term policy allowed for the loss of existing development (CH2M, 2015, Day et al., 2015). SMPs consider the implications of policy options for nature conservation, landscape, historic environment and recreational use, but they were conceived as engineering plans and not as all-encompassing coastal zone management plans. In this context, the goals of Sandscaping have narrowed down to coastal protection, although initially TCE coined three goals: coastal protection, habitat enhancement and social elements (tourism, coastal regeneration). Similarly, the baselines for the Bacton Terminal-only scheme are the decreasing beach levels and national infrastructure at risk. Other problem perspectives (nature, tourism, coastal regeneration, research, etc.) do not receive equal attention at the moment and depend on the availability of funding. The interviewees could relate to the concept of Sandscaping more than to the Dutch Sand engine, which made one think of a car engine.

5.3.2. Coherence was assessed as restrictive

Since both the coastal processes and the spatial processes work at regional or local level, overall approach to coastal management in the UK is regional, not national. The territory of England and Wales is covered by a total of 22 SPMs, which were supposed to provide a single approach for the coast, but as the interviewees observed, this system faced many challenges. Where done well, the SMPs have been a good step toward Integrated Coastal Zone Management, because they were developed in partnership and considered multiple values. There's also been some effort to align the new marine plans which are currently being prepared by MMO with the existing SMPs. However, SMPs have not become a platform for productive deliberation, which takes account of planning, infrastructure, economy and the environment, as its difficult for local authorities to take a spatial planning lead on this. Evidence of SMPs not being used as effectively as they could be, was found both in the interviews and in the literature: new hard defences being placed in areas where this was not in line with future SMP policy and existing defences being reinstated after storm events due to local political pressure. As a result, "flood and coastal erosion management objectives are often overridden by extreme events, politics, social acceptance and funding" (CH2M, 2015, p.25.)

5.3.3. Flexibility was assessed as neutral

In principle, there are opportunities to re-assess project goals and goal definitions are flexible. Sandscaping potential for creating habitat and its benefits for environment and communities are acknowledged by the majority of interviewees, including NGOs and NE. Flexibility is there to propose a joint scheme alongside terminal-only scheme for Bacton, each having a different set of goals. Besides Sandscaping, there are many examples where additional goals were realised in coastal protection schemes, for instance managed realignment projects. However, in practice the realisation of these goals is somewhat limited by the funding rules used by DEFRA and big emphasis on quantification of benefits and outcomes. Multiple benefits of Sandscaping are hard to calculate and link to funding paths, so the project partners focus on what would help to attract more money and make the project possible. As a result, nature and tourism are seen as 'extra' and come after coastal protection.

5.3.4. Intensity was assessed as neutral

Effort has been done to push for development away from business-as-usual track and sustainable coastal management has played a role in the policy debate for at least 10 years. Between 2009 and 2011 DEFRA funded several Coastal Change Pathfinders projects around England, North Norfolk among them, with the purpose to road-test new and innovative approaches to coastal change. The Pathfinders have not yet led to national policy or guidelines (CH2M, 2015). Recently, a framework guidance document was released to illustrate how flood and coastal erosion risk management can work more with natural processes and listed a range of techniques for this (Environment Agency, 2014). The Working with Natural Processes currently focuses on fluvial and inland flooding, because of the recent floods, but is asking for Sandscaping case studies as well. The DEFRA representative reported that the government is keen to explore natural flood management and over the next few years there will be more emphasis on it. Despite the recent change of government in the UK there is still a very strong push. The important issue is to demonstrate that the natural approaches actually work, since in the UK it's difficult to invest under that uncertainty. In this context, coastal protection remains a biggest 'push' for Sandscaping, which is understood to fit with existing policy choice of holding the coastline. Many stakeholders referred to Sandscaping as a tool to facilitate transition from hold the line through managed realignment to no active intervention, and thus helping – 'buying time' – to adapt to coastal change.

5.4. Strategies and instruments

5.4.1. Extent was assessed as restrictive

There is an extensive regulatory and planning framework when it comes to coastal management in England. Main statutory instruments in the Bacton case include a license for offshore works issued by MMO under Marine and Coastal Access Act (MCAA), terrestrial planning permission issued by NNDC under Town and Country Planning Act (TCPA), assessment of impacts on protected zones, EIA, TCE extraction contract and royalties, obligations under IFCA byelaws, the EU directives and DEFRA Grant in Aid (GIA) funding rules. However, the instruments that could encourage the operating authorities to actively pursue sustainable coastal protection or adaptation strategies are either not statutory or missing. SMPs are key documents in planning policy, but they are neither legally binding nor linked to any budget. There is no legal standard for coastal protection in England, except the 1:1000 standard of River Thames tidal defence (0,1% risk of flooding in any one year). This standard is based on calculations made during the design of the Thames Barrier, constructed under the 1972 Thames Barrier and Flood Prevention Act (Lavery and Donovan, 2005). The Coastal Change Management Areas (CCMAs) offered by the National Planning Policy Framework to reduce risk from coastal change are voluntary and their uptake has not been uniform (CH2M, 2015). GIA is provided by DEFRA for four types of outcome measures: economic damages avoided, households moved from one category of flood risk to a lower category, households better protected from coastal erosion and statutory environmental obligations. As a DEFRA representative put it, Sandscaping that does not stop houses from flooding, but only stops erosion and creates habitat won't get a significant government contribution. In terms of technologies used to protect the coast, there is some experience with nourishments (beach parallel recharge schemes) and managed realignments, but mostly with structural defences. NGOs expressed their concern about Sandscaping being traded and projected as a solution in its own right, instead of looking at the problem first.

5.4.2. Coherence was assessed as neutral

There's some overlap in the intertidal zone between the MCAA and TCPA, whose boundaries extend up to the level of mean high and mean low water spring tides respectively. In addition to this, some contradiction was observed in the Bacton case between the requirements of Mundesley cliffs site of specific scientific interest (SSSI), which benefits from coastal erosion that exposes the geology of the cliff, and the coastal protection needs of the terminal front, which overlaps with SSSI and suffers from erosion. The interviewees mentioned that they would use the recently introduced Coastal Concordat approach, although they had not a lot of experience with it. The Concordat provides a framework to better coordinate the separate processes of consenting coastal developments in England. It can be applied to any applications for individual projects that span the intertidal area in estuaries and on the coast and require multiple consents including both a marine license and a planning permission from the local planning authority. All in all, the interviewees reported that the system was clear and developing, and although consent was complicated, it worked.

5.4.3. Flexibility was assessed as neutral

There are possibilities to combine instruments from different fields, e.g. link coastal protection to economic growth or innovation. Furthermore, TCE expressed willingness to open up a new licensed extraction site for Bacton, which would be an easier and cheaper source of sediment for the project. Some respondents described the GIA rules as strict and requiring case-by case interpretation. Testing and interpreting the GIA guidance took time and was considered a roller coaster of estimating how much grant the project could get, but was resolved in the end. From the government's point of view, the funds need to be targeted to areas of best benefit, best value for money, so it's a commercial business case. Extensive regulatory base makes new initiatives challenging, as the respondent from NE put it, 'whichever way you turn, there's a designated site, hence there will be impact'. For instance, a new extraction site is located within a protected area, which makes environmental scoping challenging. But the same respondent acknowledged that there's room for manoeuvre and to look for solutions, so you could 'work' a solution.

5.4.4. Intensity was assessed as restrictive

The available instruments do not include interventionist types, given that at many locations there is a managed realignment or no active intervention policy for the long term. DEFRA funding rules skew to flood and erosion risk management or habitat creation under the EU obligations based on outcome measures achieved. There is no outcome measure for adaptation or habitat creation outside statutory obligations. The CCMA approach could deliver sustainable coastal change solutions, but it is voluntary. Furthermore, case law stipulates that a statutory authority cannot be made liable in negligence for any damage sustained by a member of the public due to natural causes like flooding (case East Suffolk Rivers Catchment Board v Kent ([1940] UKHL 3, [1941] AC 74). Therefore, there is no interventionist pro-active strategy or instruments to manage coastal change in a positive and planned way, and neither is there funding for it. In practice coastal change will happen anyway, because it won't be affordable to continue to protect many areas.

5.5. Responsibilities and resources

5.5.1. Extent was assessed as restrictive

The responsibilities and resources for flood and coastal erosion management are clearly assigned. Responsibilities are delegated by the UK government to the EA, who are a flood management authority leading on 4 SMPs for low lying areas and to the local authorities, who carry out works and lead the remaining 18 SMPs for cliff dominated areas. In Bacton case, the responsible authority is NNDC, who take the lead on SMP 6 Kelling Hard to Lowestoft and have a role in the planning and welfare of the community. Other authorities, such as IFCA, MMO, NE, JNCC and TCE have clearly defined responsibilities. Special in the English context is the duty of TCE, while maintaining the Crown Estate as an estate in land, to maintain and enhance its value and the return obtained from it, but with due regard to the requirements of good management (The Crown Estate Act, 1961, 1 sub 3). Private stakeholders, like BTC, are responsible for their own coastal protection and have to obtain consent to execute works. Local authorities depend on funding approval, the representative of NNDC observed that GIA is a baseline for pursuing the project: the amount of funding available from the government defines whether a project is viable or not. The main restriction has to do with the authorities having permissive powers (powers to intervene) to decrease erosion or flooding in the UK, but no legal duty to do so. The EA and local authorities in England may choose to apply for government funding to provide coastal defences under the 1949 Coastal Protection Act. TCE as the land owner and manager has no protection responsibility, their ownership changes if the land is flooded. In this context, the scope of protecting the Bacton terminal and villages was agreed to be managed separately. BTC did not want to depend on the internal decision-making and funding approval processes, so the responsibilities are arranged differently for a joint and BTC-only scheme.

5.5.2. Coherence was assessed as neutral

Although some fragmentation is present, there are no competence struggles. There's an overlap of responsibilities in the intertidal zone between MMO who is responsible for the marine and NNDC for the terrestrial environment, which is addressed through the recently introduced Coastal Concordat approach. From the national point of view, there's a clear funding framework, which makes it transparent where money is spent, and partnership funding makes this spending fair. In contrast to the previous system, when a project would be either 0% or 100% government funded, partnership funding is based on the outcome measures realised, so the amount of grant is variable. On the local and project level there's a mixed set of responsibilities and resources. Land ownership along the English coasts varies, with approximately half of the beaches in TCE's hands (some of them leased) and the other half in the hands of local authorities. Furthermore, each location requires a different funding arrangement, since each site is very specific and will generate unique local benefits. Many coastal areas are scarcely populated and a few households located there won't qualify for a significant GIA contribution. The advantage of having to look for additional funding, as the local authority respondent observed, is increased cooperation among actors, even when the funding decision is negative. The downside is that it's hard work and there's not a lot of experience with this way of working.

5.5.3. Flexibility was assessed as supportive

There's considerable discretion to pool resources and people, which is also required for project realisation. Partnership funding allows for different types of resource combinations. For Bacton joint scheme, an additional 6,5 million GBP is required on top of a 20 million GBP initial contribution by BTC. Potential sources of funding are:

- GIA sourced from central government and administered through the EA (approx. 1,8 million GBP)

- RFCC extra funding from the levy paid by the local authorities that can be used to top up schemes (approx. 0,5 million GBP)
- Local Enterprise Partnership (LEP): government initiative to encourage regional economic growth through public-private partnerships, administered by the Department for Communities and Local Government
- Local authority (NNDC) contribution

Possible other sources include innovation funding from the government (although there's no clear funding stream for water management in England), the EU Horizon2020 and green infrastructure programmes. Furthermore, TCE expressed willingness to make the Sandscaping option be more commercially attractive for Bacton by opening up a new licensed area. This area would be a cheaper source of sediment for the scheme, thereby reducing total project costs. TCE reported that for other Sandscaping locations different arrangements may be possible. NE and NGOs had reservations about using their funds for Sandscaping; and NT in particular challenged the accountability and transparency of TCE arrangements on the grounds of TCE being a commercial organisation by law. As stipulated in the Crown Estate Act, TCE 'shall not sell, lease or otherwise dispose of any land of the Crown Estate, or any right or privilege over or in relation to any such land, except for the best consideration in money or money's worth which in their opinion can reasonably be obtained' (1961, 3 sub 1). According to NT, opportunities for TCE to be environmentally responsible and less solely focused on driving revenue for the Treasury are therefore limited.

5.5.4. Intensity was assessed as neutral

The government Foresight project on the future of flood and coastal defence, that reported in 2004 looking to 2030–2100 ahead, concluded that by 2020 about a billion GBP per year will be necessary for flood defence and coastal protection (The Government Office for Science, 2004). An average of 600 million GBP per year has been invested each year between 2005 and 2015, 710 million GBP in 2016, and 735 million GBP planned for 2017, according to DEFRA (2016). This is not as much as the Foresight suggested, but there's been an increase in recent years. In 2015, a 6-year settlement for flood and erosion funding totalling 2,3 billion GBP replaced yearly budgets. Several one-off additions took place after major flood events and an additional maintenance settlement until 2021 with was announced recently. As a result of partnership funding the number of projects funded by DEFRA increased and the amount of funding shifted. In the UK, coastal protection has to compete with other policy fields like health and education, and to make it stack up financially the partnership funding is set up to achieve a benefit cost ratio of at least 5:1 on government investment. If the ratio is less than that, there is less GIA available and the gap has to be filled by other sources. For a project like Bacton the GIA contribution is less than 10% and there's still a funding gap. Although funding shortages were reported by many interviewees, coastal protection and erosion management in the UK is also a complex, diverse and expensive problem for the government and local authorities to solve.

6. Discussion

In Table 2 below we summarise the findings for each governance dimension and quality. Below we elaborate our findings in more detail.

What follows from Table 2 is that governance circumstances are mixed. Main supportive dimension is Actors and Networks, and main supportive quality is Flexibility. The analysis shows that there is a good cooperation and a strong network of actors in the studied case and in coastal protection in general. The evidence of broad stakeholder involvement is that all interviewees were aware of Sandscaping and some interviewees quoted their involvement to be a best practice example. Furthermore, there is an open process and discussion when it comes to Sandscaping. Even the stakeholders that voiced critical noises admitted they were not in opposition. Further evidence of a close working relationship among the actors observed during field visits is the locations of several institutions in the same building (EA and NE) and former rival organisations admitting to work closer now (IFCA and MMO). There is a flexible division of responsibilities between BTC and NNDC, and BTC are willing to give back the ownership of the project to the community. Partnership funding approach to financing a project through multiple sources creates a structure where integrated approach can work, partnership is stimulated and multiple sources of funding are combined. For instance, one interviewee saw added value in informing his partners about a project even if the funding application was unsuccessful. Several respondents reported, however, that in practice this took a lot of time and was hard work. For Bacton, for example, it was a roller coaster of estimating how much grant in aid the partners could get. There are ample possibilities to upscale coastal protection schemes. In Bacton, the EA has strategic overview and provides support with monitoring. At the national

Table 2
Assessment results.

Dimension / Quality	Extent	Coherence	Flexibility	Intensity
Levels and Scales	Neutral (0)	Restrictive (-)	Supportive (+)	Restrictive (-)
Actors and Networks	Supportive (+)	Supportive (+)	Supportive (+)	Neutral (0)
Problem perspectives and Goal ambitions	Restrictive (-)	Restrictive (-)	Neutral (0)	Neutral (0)
Strategies and Instruments	Restrictive (-)	Neutral (0)	Neutral (0)	Restrictive (-)
Responsibilities and Resources	Restrictive (-)	Neutral (0)	Supportive (+)	Neutral (0)

level, both political and civil servant level are involved. If this was not the case, interviewees admitted that Bacton would not be viable.

Main restrictive dimensions are Problem perspectives and Goal ambitions, and Strategies and Instruments. Main restrictive qualities are Extent and Intensity. There's a varied set of coastal situations in England, making coastal flooding and erosion management a complex and expensive problem to solve, because coastal problems are very local. This explains why regional approach is preferred and means that each Sandscaping solution should be tailor-made to the location. On project level this costs a lot of time and effort, making it less efficient and more expensive solution than intended in the original Sand Motor. The analysis shows that applying Sandscaping is complicated by increased technical scrutiny and a commercial business case for spending Government funds on coastal projects. Similarly, the results in Bacton case are critical for future applications of the Sandscaping approach. The rules are strongly focused on optimising the return of investment on the short or medium term, making radical innovation in the UK coastal management difficult. Under these circumstances, traditional coastal defence approaches may and sometimes still are preferred. For instance, to DEFRA Sandscaping is a new technology, an untested approach, whereas seawalls are reliable, even though they require maintenance. Further restrictions have to do with the spirit of localism and the absence of top-down steering. The instruments that could encourage the operating authorities to actively pursue coastal protection or adaptation strategies are either not statutory or missing. Furthermore, for local authorities it's difficult to take the lead on SMPs. Under these circumstances, the uptake of Sandscaping depends a lot on local and regional circumstances, including political and reputational incentive of elected politicians. In the North Norfolk case, NNDC are aware that coastal change will happen and the seawall will continue to fail. Since adaptation is not included as a policy option in the SMP, nor is it funded, NNDC explore Sandscaping as the only alternative coastal protection strategy. According to NNDC, Sandscaping enables the discussion and allows time for the communities to adapt to coastal change. However, NNDC involvement in the scheme depends on the availability of funding, so responsibilities are arranged separately: there is a backup terminal-only scheme in case government funding would not be available for a joint scheme.

7. Conclusion and way forward

In this paper we asked the following question: what governance conditions England prove supportive or restrictive for the implementation of Sandscaping in North Norfolk? We found that the main supportive dimension is Actors and Networks, and the main supportive quality is Flexibility. Restrictions, on the other hand, outnumber the supportive elements and come from Problem perspectives and Goal ambitions, Strategies and Instruments, Extent and Intensity. Taken together, these conditions create a context that is restrictive for coastal innovations like Sandscaping in England. Whilst the governance circumstances were identified based on the case study research in North Norfolk, some or all of them probably apply to case study locations elsewhere in England. These circumstances also provide some basis to discuss a possible way forward for the governance of coastal innovations like Sandscaping in England.

Based on our research, we do not consider feasible to deal with the restrictions of the extent, which are engrained in the British context, for instance the extent of coastal problem (only 11% of land being at risk of flooding, or 1 in 6 properties, mostly in remote communities) and coastal authorities having permissive powers and no duty to protect the coast. Coastal protection is simply not an issue of national importance, and the scale of the issues is regional. Therefore, an overarching coordinated approach is just not realistic in the British context, although it may make things easier. The idea of introducing legal protection standards would not work either, as it would be an untenable commitment of politicians to make the required funding available. The alternative of a politically determined budget, combined with processes to optimise return on investment, seems appropriate – as long as everyone realises that the problem won't be controlled and adaptation is required.

To overcome the restrictions of the context, the supportive Actors and Networks dimension, in combination with flexibility provided, should be harnessed. Flexibility has the most positive assessment of the four qualities. It is a key quality when complex and dynamic governance situations make a fully planned development risky and a more adaptive management style inevitable. North Norfolk is a good example of this, where all project partners work together and private actor plays an active role, both civil service and ministerial level are involved in the case, different funding sources are combined, a new licensed extraction site is made possible by TCE and the division of responsibilities is flexible for a joint and terminal-only scheme.

In conclusion, a manager or policy maker implementing Sandscaping in the English context should be aware that:

- There's no national approach to coastal management and overall regional approach prevails;
- Sandscaping initiatives should be picked up bottom-up and tailor-made for each location;
- Goals of Sandscaping may vary depending on each specific location (coastal defence, nature, economic regeneration, research, etc.);
- SMPs cover the whole coast of England and Wales and are a good pragmatic starting point for integrated coastal management, although they are not being used as effectively as they could be;
- Coastal protection isn't essential enough from a national perspective to drive a pro-active, inverventionist strategy, and its spending always has to be balanced with other topics;
- The authorities have no legal duty to decrease erosion or flooding in the UK, but they do have statutory powers to do so, and a budget set to maximise return on tax payers' investment.

He or she should make use of:

- Flexibility provided by the context to upscale or downscale projects, depending on feasibility and chances for implementation;
- Existing network of cooperative stakeholders and established practices of community involvement, supportive role of TCE;
- Considerable discretion to pool resources and people for Sandscaping.

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