Balancing the provision of infrastructure enhancements against their environmental cost

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• Provided there is a good understanding of the environmental resources and their sensitivity to disturbance, it is possible to devise a construction and/or compensation plan that more than offsets the immediate environmental impacts of construction.

• **Two** very different infrastructure development projects with different environmental constraints.

• **Thanet Offshore Wind Limited**
  • The EU Directive on renewable energy targets - 20% of energy from renewable sources by 2020
  • Annex I Habitats within the development site

• **London Gateway Port Limited**
  • Provision of a world class port facility in the Thames estuary
  • Special Protection Area SPA designated for the presence of internationally significant populations of over-wintering wading birds

• **Two** great solutions
Thanet Offshore Windfarm

- 100 Turbines
- The site covers an area of 35 km²
- Turbines installed on monopile foundations
- Approximately 500m apart along rows and 800m between rows
- 300 Mega Watts of Power
- Provides 200,000 homes with clean energy
- Operational since September 2010
Offshore Windfarms

• Turbine installations and cable laying associated with offshore windfarm construction involves a physical disturbance to the seabed

• Accurate mapping of sensitive habitats plays a critical role in the planning of these developments

YES – It is windy!
The Ross worm, *Sabellaria spinulosa*, is a small tube-dwelling polychaete worm that filters particulate matter from the water column.

Forms dense aggregations that develop into reef-like structures forming a complex habitat providing shelter for a variety of invertebrates which in turn provide ecosystem services to other invertebrates & fish.

Biogenic reefs formed by *Sabellaria* communities are classified as Annex I habitats under the EU Habitats Directive.

The long breeding period, long larval phase & relatively rapid initial growth in the first year after settlement results in a genus that has high recoverability.

The reef structures are spatially & temporally variable.
Side-scan Sonar signature

• SSS acquired to inform the engineering

• Textured signature typical of *Sabellaria* aggregations

• Leads to further investigation involving seabed imagery and grab sampling
Ground truthing revealed *Sabellaria spinulosa* reef
Patchiness

• The sequential results of these 3 interlinked disciplines demonstrated the spatial and temporal variability of the *Sabellaria* aggregations

• The seabed imagery showed that the occurrence of *Sabellaria* could be classified into the following groups:-
  - Patchy
  - Moderate
  - Dense

• Detailed mapping of the extent and quality of the Annex I Habitats enabled the construction to go ahead with individual turbines being positioned in such a way that damage to the most important parts of the reef was avoided
Trawl Damage of *Sabellaria* reef
TOWF as a Refuge for *Sabellaria spinulosa* aggregations

• TOWL has no restrictions on fishing activities within the site although it is likely that the fishing effort was reduced during the construction phase due to the nature of the works and presence of construction vessels

• Post-construction acoustic data from TOWF has, amongst other observations, demonstrated that recent trawl scars are limited to the area outside of the turbine array

• Further observations show that the high quality reef area has expanded within the array in terms of:-
  ❖ elevation
  ❖ growth
  ❖ colonisation
Summary of Mutual Benefits

• Development was allowed to continue, despite being located in a region containing potential Annex I Habitats

• As a result of the micro-positioning exercise, a Public Inquiry was not triggered

• A compensation package was not required

• Annex I Habitats were minimally affected by the construction

• Benefits for conservation and for ecosystem services

• I have not included the socio-economic benefits of the development
London Gateway Port Project

• Now let's turn to a very different infrastructure project and one that did require compensation for inevitable losses under the 'footprint' of the dredging and reclamation works involved in the construction of a major international container port in the lower Thames estuary.
Port Development

• Dredging and reclamation involve physical disturbance to the seabed

• Accurate mapping of sensitive habitats plays a critical role in the planning of these developments

• Proximity to designated conservation areas is very likely

• During the Public Inquiry, significant conditions were imposed to mitigate impacts of the development - before, during and after construction of the port

• A commitment was made to offset unavoidable environmental losses
The Dredge Plan

• ~100 km east to west

• Reclamation

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The Biological Environment
Conservation areas – designated for internationally significant populations of over-wintering wading birds

• Seasonal monitoring of bird food resources to assess:
  
  ❖ the carrying capacity of the mudflats
  
  ❖ the extent to which these resources are depleted at the point at which the over-wintering wildfowl depart
Bird Food

Corophiidae

Oligochaeta (*Tubificoides* sp.)

*Aphelochaeta* sp.

*Streblospio shrubsolii*

*Macoma balthica*

*Hediste diversicolor*
Mucking Flats – tonnes of bird food

• Carrying capacity depleted by 80% as the birds leave

• Were this reduction in carrying capacity to be exacerbated by accretion or erosion then the bird population may be food-stressed at the end of the winter feeding period

• It is for this reason that a compensation proposal was made

• Note that the seasonal trend in biomass of bird food has not been affected by the dredging & reclamation programme
Managed Realignment Areas

• To compensate for potential losses of bird feeding areas

• The first of these is known as Stanford Wharf Nature Reserve

• Ahead of and following the breach of Stanford Wharf, the following assessments were carried out:-

  ❖ Inter-annual and seasonal variability of ecosystem services provided to the birds by the Flats

  ❖ Bird counts during the over-wintering period

  ❖ Comparative statistics to assess the potential alterations as a result of the dredging & reclamation programme
Stanford Wharf Nature Reserve

• There has been a relatively rapid colonisation of the surface deposits by a variety of invertebrates that are significant as bird food.

• There are likely to be long-term changes in the invertebrate population of Stanford Wharf:
  - natural ‘ecological succession’
  - probable changes in accretion and erosion within the compensation site.
• The combined biomass values for Mucking Flats and the newly colonised deposits at Stanford Wharf significantly exceed the biomass required for compensation of the predicted loss of intertidal habitat

• The bird feeding resources within the compensation area provide additional carrying capacity

• Studies on the use of the whole area by wading birds suggest that both sites are important feeding areas

• Stanford Wharf supports a wide variety of juvenile fish species of economic and conservation significance

• Engaged in dialogue with Natural England to assess the extent to which Stanford Wharf may be added to the SPA
Summary of Mutual Benefits

• Development was allowed to continue, with a commitment to offsetting unavoidable environmental losses, despite being located in a designated conservation area.

• Reputational enhancement of the developer as a result of:
  - An increase in the provision of ecosystem services leading up the food chain to both birds and fish.
  - A possible adjunct to a designated conservation area.
  - A demonstration of Best Practice in environmental management leading to prestigious Awards.

• I have not included the socio-economic benefits of the development.
Thank You

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