

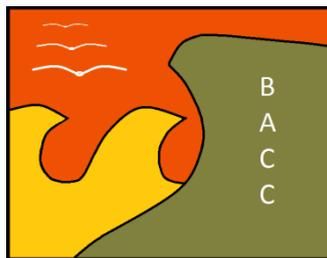
Evaluation of the proposed AMEP Regulated Tidal Exchange at Cherry Cobb Sands

For

**Mr Stephen Kirkwood
Sands House**

By

**Roger Morris
Bright Angel Coastal Consultants Ltd**



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Tidal Exchange at Cherry Cobb Sands**

Client: Mr Stephen Kirkwood
D J Kirkwood & Son
Sands House
Cherry Cobb Sands Road
Burstwick
Hull
North Humberside
HU12 9JX

Prepared by Roger Morris

Bright Angel Coastal Consultants Ltd.

7 Vine Street

Stamford

Lincolnshire

PE9 1QE

01780-753419

brightangel.coastal@googlemail.com

www.bacoastal.co.uk

1. Introduction

- 1.1. This analysis has been prepared in response to additional information provided by Able UK in the form of reports by Black and Veatch and the University of Hull. These reports present information on a possible design for a Regulated Tidal Exchange at the proposed Cherry Cobb Sands Managed Realignment Site.
- 1.2. It must be borne in mind that the documentation supplied by Able UK relates to a conceptual approach that has not (as far as I am aware) been agreed with either Natural England or the RSPB. It has arrived during the inquiry process for the AMEP proposals and cannot be regarded as a firm undertaking that the outcomes can be delivered.
- 1.3. Black and Veatch concede that their original design for managed realignment will not deliver the required compensation package and that this new design is a response to recommendations by the RSPB expert team. They also highlight the limited information available on the evolution of Regulated Tidal Exchange in estuaries with a high sediment load.
- 1.4. A conceptual design is provided in which three compartments for Regulated Tidal Exchange appear to be supplied with tidal water through a breach at the eastern end of the managed realignment site. This design is accompanied by an extensive report of sedimentation within Paull Holme Strays managed realignment site. Whilst there are parallels between these two sites, it is suggested in this analysis that closer attention should be paid to the process of warping that was formerly employed around the Humber Estuary to improve soil fertility.

2. Agricultural use of sediment in the Humber Estuary

- 2.1. The Humber Estuary is characterised by the number of major drains that lead inland, often as almost straight canals. They are labelled on maps as 'warping drains' and give the landscape its characteristic signposts with names such as Swinefleet Warping Drain, Earl Beuchamps Warping Drain and Metham Warping Drain.
- 2.2. Warping was commonplace around the Humber Estuary at the end of the 18th Century and there are numerous references to the practice in the literature of the time. For example, an entry in the Isaac Leatham's *General view of the agriculture of the East Riding of Yorkshire and on the Ainsty of the City of York, with observations on the means of its improvement* published in 1794 reports that that the soils between Hull and Spurn were 'mostly warp'. Thus, the Cherry Cobb Sands managed realignment site lies within an area where warping was an established practice [however, it should be noted that the processes of laying down sediments within the estuary itself were also referred to as 'warp' in some accounts]. Annex 31.3 of Able UK's documentation reports that the soils at the Cherry Cobb Sands possible compensation site has a layer of warped soil approximately 1.5 metres deep and specifically notes that warping is an anthropogenic process.



- 2.3. Warping was known to lead to the deposition of large volumes of soil. For example, an entry in the British Farmer's magazine of 1845 advises that warps of between 1 and 3 feet may be achieved. Meanwhile, Loudon (1826¹) describes practices along the Humber and reports that *"What the nature of the land to be warped, is not of the smallest consequence: a bog, clay, sand, peat are all eligible: as the warp raises it in one summer from six to sixteen inches thick; and in the hollows or low places, two, three, or four feet, so as to leave the whole piece level."* This is clearly possible in the vicinity of Cherry Cobb Sands where 1.5 metres (4.85 feet) of warp is reported Annex 31.3 of Able UK's documentation.
- 2.4. Each of these entries relates to a process in which tidal water is impounded before being released via a major channel back into the estuary. This bears remarkable resemblance to the design of the proposed Regulated Tidal Exchange at Cherry Cobb Sands and points to the likelihood of similar processes taking place.

3. Similarities between Regulated Tidal Exchange and Warping

- 3.1. Warping was undertaken using a major drain whose design allowed tidal water to be conveyed rapidly to a field where it was impounded using a series of sluices and banks. This process meant that sediment-laden water was retained within a particular field, allowing it to deposit its sediment before being released back into the estuary. Guidance on the design of such conduits is provided in several sources, one of which even suggests that these drains may also be used for navigation by barges up to 80 tons displacement.
- 3.2. As the estuary waters contained a mixture of sediments, the heaviest particles (sands and gravels) were laid down closest to the sluices and the lightest fractions tended to be deposited furthest away. This meant that the rates of sedimentation were generally greater closest to the sluices, at least during the earliest stages of the process. Moreover, the nature of the soils would have become finer the further they were from the sluices.
- 3.3. Warping was clearly a very effective mechanism for levelling land, as described by Loudon (1826), and this could be controlled according to the level of land required. It generally took place during the summer months when the land was more prone to desiccation, thus allowing the warp to de-water and start to 'mature' or 'ripen'.
- 3.4. Regulated Tidal Exchange differs in several respects, but these are unlikely to give any assurance that a similar outcome will not occur.
- 3.4.1. Firstly, the arrangement of the sluices is such that water will drain more rapidly than during warping. This means that in some localised areas there will be scour, especially in the vicinity of the sluices. This means that the topography of the Regulated Tidal Exchange will differ from a warped site.

¹ Loudon, J.C., 1826. *An encyclopaedia of agriculture*. A. & R. Spottiswoode, London. 1226pp.



- 3.4.2. Unlike warping, Regulated Tidal Exchange needs to be exposed regularly to tidal influences, quoted by Black and Veatch at 450 inundations per year. This means that there are potentially far more occasions when the process of warping is facilitated within the RTE basins.
- 3.5. As the managed realignment site adjacent to the Regulated Tidal Exchange fills with sediment, it can be anticipated that the channel through the site will be maintained to some degree by the flushing effects of the Regulated Tidal Exchange, but these effects will diminish as warping reduces the volume in the basins. Bearing in mind Black and Veatch base their sedimentation calculations on the behaviour of Paull Holme Strays managed realignment site, the assumption that this offers an adequate model appears to require additional testing. Sediment within settling basins formed by Regulated Tidal Exchange will behave differently, not least because there is less scope for re-suspension because wind-driven waves will be limited by the size of the basins.
- 3.6. Rates of sedimentation within warping basins would have been very variable and dependent upon a variety of factors, including the location within the estuary, levels of suspended sediment at any particular time of year, and the distance separating the warping basin from the estuary.

4. Relevance of warping to Regulated Tidal Exchange

- 4.1. The process of warping will yield different soil conditions in different parts of the estuary, with sandier substrates in the outer estuary and finer clays towards its freshwater end. This is because sediment loads in the upper (freshwater) end of the estuary are influenced by flocculation of the finest particles caused by changing water chemistry as saline and fresh water meet. In the case of Cherry Cobb Sands the warp can be expected to be largely sandy as is reported in Annex 31.3 of Able UK's documentation.
- 4.2. Warping is generally only practised in locations where there are high levels of suspended sediment or at times of year when suspended sediment levels are high (fertility in the Nile valley would have been maintained by similar but less controlled processes). Consequently, the development of a Regulated Tidal Exchange in an estuary where warping was so extensively practised might be regarded as unwise, as the site in question can be expected to warp up rapidly.
- 4.3. Any predictions of rates of sedimentation are subject to great uncertainty and consequently it is not possible to offer a realistic timeframe for the life of a Regulated Tidal Exchange (RTE) within the Humber Estuary. It can be shown that sedimentation will occur on each occasion that tidal water is allowed into the RTE basin. However, levels of deposition will be dependent upon the levels of suspended sediment in the water column. Suspended sediment levels are greatly increased during periods of high winds that cause bigger waves to remobilise sediment from foreshores around the estuary. Consequently, it may be anticipated that more sediment will be imported during winter periods when mudflats will need to be regularly exposed in order to maintain bird feeding grounds.



4.4. This means that whilst it is possible that employing Regulated Tidal Exchange may prolong the life of a realignment site as mudflat for an indeterminate period, this cannot be assured. What is more, the extent to which useful mudflat (to feeding Black-tailed Godwits) will be retained is very uncertain. As the RTE basins fill with sediment increasingly limited areas of muddy habitat will exist and this may be expected to further limit the numbers of birds that can be supported. Consequently, Regulated Tidal Exchange cannot be regarded as a viable way of *permanently* offsetting the loss of functionality on the mudflats at the AMEP site within the Humber Estuary.

5. Interpretation in relation to the Habitats Directive

5.1. These proposals are conceptual and involve a number of unknowns:

- Sedimentation rates within the realignment and the Regulated Tidal Exchange?
- How long will the realignment and Regulated Tidal Exchange continue to support mudflat?
- Will Black-tailed Godwits actually use the Regulated Tidal Exchange as a feeding site, and for how long during the life of the site?

5.2. Each of these questions draws attention to the European Court Judgment concerning cockling in the Waddensee case [European Court of Justice Case C-127/02] in which it was determined that consent should not be granted in the face of uncertainties about the outcome of the proposed solution.

5.3. One solution to this approach is for the AMEP proposals to be permitted to go ahead only once the compensatory measures have been proven to be effective (i.e. after a period of several years during which it is possible to monitor sedimentation rates and determine the life expectancy of the site). The other is to explore alternative solutions elsewhere in the UK where suspended sediment levels are much lower. The former approach is unlikely to be economically viable, whereas the latter involves policy decisions by both the Conservation Advisors and the NGOs.

5.4. At this stage, it appears that there is sufficient doubt about the efficacy of the proposed offsetting measures, as well as about the nature of the actual measures that will be undertaken, that this application for consent is not compliant with the provisions of the Habitats Directive or its transposition into UK law.

5.5. The range of uncertainties arising from both the design and operation of any offsetting for loss of habitat due to the AMEP proposals also means that granting consent would leave the UK Government highly exposed in the European courts. It should be borne in mind that the UK taxpayer shouldered the costs of mistakes relating to consent for Lappel Bank and Fagbury Flats. This amounted to around £8m for a relatively simple offsetting package.



5.6. Comparatively speaking, consenting the AMEP proposals would leave the UK taxpayer more exposed in terms of costs. This is because of the huge uncertainty about how loss of habitat for Black-tailed Godwit can be re-created. It also raises the question whether there is a level playing field where other port developers have established a package of measures that were agreed and committed to in a legal agreement before consent was sought.

