

# Review and formalisation of geomorphological concepts and approaches for estuaries

Technical Summary: FD2116

## Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

### Background to R&D project

The background to the project was defined by the two main objectives which were as follows:

- To review critically the current geomorphological understanding and concepts related to the medium (month-year) to long term (decadal) behaviour of estuaries, and,
- Through formalisation of Expert Geomorphological Assessment and Historic Trend Analysis, to provide a resource for the end user so that he/she can substantially increase the quality of their analysis.

The project has been completed as part of the joint Defra/Environment Agency R&D Programme, and within Phase 2 of the Estuaries Research Programme. The project team comprised experts from HR Wallingford and ABPmer, and Professor John Pethick.

### Results of R&D project

The results of the project are described in depth in a Technical Report which presents a framework for Expert Geomorphological Assessment (EGA), including the systematic development of conceptual models of estuarine systems which can form one basis for prediction.

The report discusses the relevant time and spatial scales to be considered, issues surrounding the formation of a conceptual model based on data and understanding, and the application of predictive models. Also a consistent and formalised approach to the use of geomorphological based methodologies in estuarine prediction has been established. This has the potential to benefit the quality and effectiveness of studies associated with flood defence and estuarine impact.

A range of tools exist with which to investigate estuary process and morphology, to support evaluation of impacts, as described for example by the EMPHASYS project in 2000 (FD1905). It is noted that the predictive approaches require careful analysis, validation and expert interpretation. In general two classes of approach have been taken to prediction: (1) the “bottom-up” or process-based approaches and (2) the “top-down” or systems approaches. Hybrid approaches also exist which combine aspects of (1) and (2).



The study has examined the use and application of assessment methodologies and tools that may be considered for use in EGA, building on the top-down methodologies investigated in the report "Modelling Estuary Morphology and Process" (EMPHASYS, 2000). The present project has drawn together information on the following methods and tools:

- Historical Trend Analysis (HTA); Sediment budget analysis and modelling; Estuary translation or Rollover model; Geological methods for estuarine studies; Regime theory and relationships; Entropy-based relationships; Tidal asymmetry analysis and relationships; Analytical methods and solutions; and, Intertidal profile form.

The project has summarised the use and application of these methods and tools in a consistent fashion. New scientific work has been undertaken as well as a collation of existing work.

## R&D Outputs and their Use

The main output is an extensive Technical Report which can be used by Defra and Environment Agency Staff, researchers and consultants involved in the assessment of estuary morphology and associated changes in form in space and time.

The application of the methods and tools described above has been illustrated using a variety of case studies and, where possible, guidance in the use of the particular assessment tools in terms of their applicability, data requirements, and outputs has been developed. Background scientific information and equations are provided for some approaches so that they can be implemented by others as part of the development of new and improved tools for assessment and prediction.

The applicability of the tools and methods has been summarised and information is provided to aid the selection of method(s) for application in different studies.

This R&D Technical Summary relates to R&D Project FD2116 and the following R&D output:

**R&D Technical Report FD2116/TR2 – Review and formalisation of geomorphological concepts and approaches for estuaries.** Published March 2007.

Publication Internal Status: Released Internally

External Status: Released to Public Domain

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The above outputs may be downloaded from the Defra/EA Joint R&D FCERM Programme website ([www.defra.gov.uk/envirom/fcd/research](http://www.defra.gov.uk/envirom/fcd/research)). Copies are also available via the Environment Agency's science publications catalogue (<http://publications.environment-agency.gov.uk/epages/eapublications.storefront>) on a print-on-demand basis.

PB 12527 / 12 TS

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