DEPARTMENT for ENVIRONMENT, FOOD and RURAL AFFAIRS **CSG 15**

Research and Development

Final Project Report

(Not to be used for LINK projects)

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Executive summary (maximum 2 sides A4)

The underlying objective of research on the Fluvial, Estuarine and Coastal Processes Theme is to be able to describe and quantify all the important processes that contribute to the evolution of fluvial, estuarine and coastal systems. This is required in order to enable the development of technically feasible, and environmentally acceptable, flood and coastal defence schemes and operations, and those which are sustainable in the long term. To achieve this objective, the research should encompass studies that aim to:

- obtain a better description of those important short-term, local processes which are not yet understood
- examine long-term, system-wide processes, about which very little is known at present
- quantify the important interactions between different processes
- determine the effects of human intervention on those processes
- parameterise the various processes and their interactions

Therefore the benefits of research on fluvial and coastal processes come from increasing our understanding of these processes and the way that these create flood and coastal defence problems. The benefits of studying long term interactions between processes and long term, system-wide, processes is a development of better policies for sustainable flood and coastal defence measures over a time scale of decades, rather than responding ad-hoc to hazard events as they occur. Such ad-hoc response is expensive and can result in the development of inappropriate policies when viewed from a longer time perspective. Thus the benefit here is cost reduction in terms of the capital costs of policies, plans and schemes, but also performance enhancement in matching more accurately - over a long time period - expenditure levels to the scale of flood and coast defence problems that are experienced in this country.

This report describes the work undertaken within the FECP Theme for the period April 2002 to October 2003.

Scientific report (maximum 20 sides A4)

Theme Management

The work of the Theme has been targeted on trying to establish a portfolio of research projects that has coherence and relates to the explicitly articulated needs of the community of users.

This has been accomplished with the support of the FECP Theme Advisory Group, made up of academic and industry experts and end-users, who have met twice during this period to discuss the current portfolio of projects within the Theme and the shaping of the future programme.

The deliberations of the TAG have been assisted by the development of four disciplinary Visions borne out of the 2001 Concerted Action Workshops co-ordinated through the Theme. These Visions are outlined briefly in the following.

Visions

In the summer of 2001, a series of Concerted Action Workshops brought together researchers, designers and managers concerned with the assessment and prediction of flood risks, and the mitigation of the impacts of flooding. The Workshops embraced Hydrology, Sediments and Habitats, and Coastal Management, for which they debated and defined research programmes and priorities.

In order to give shape to the research proposals that emerged from the Workshops, small groups of experts were commissioned to review the Workshop outputs and conclusions, and to create a broad Vision of desired objectives and the route by which that Vision might be attained through a structured programme of research and development. The purpose was to describe the "landscape" against which specific research projects and programmes can be constructed and prioritised, and their results can be seen to contribute to progress towards perceived needs.

Each group was led by a "Vision Champion" who has produced a succinct description of the Vision landscape as drawn by the Vision Group. These Visions have been published together with the supporting materials from the Concerted Action Workshops and are summarised below.

Hydrology Vision

The key components in the strategic research agenda for Hydrology are:

- provision of practical solutions to flood management problems,
- an acknowledgement of the need for compatibility with other river catchment functions (e.g. abstraction strategies and management plans),
- advances in hydrological science and related disciplines,
- consideration of public awareness and understanding.

Research and development associated with current practice is currently focused on the Flood Estimation Handbook, first generation Catchment Flood Management Plans and integrated approaches to flood forecasting and warning. In five to eight years' time the emphasis may be expected to move to continuous simulation in catchment planning and estimation of flood frequency, with increased use of modelling in real-time forecasting.

Rainfall and runoff are at the core of flood management tools. They demand an understanding of precipitation processes in space and time, appropriate to both operational and strategic requirements, and with particular attention to extreme value data and statistics. Information on climate change and/or variability is important, with climatic outputs needed at a scale in space and time that is suitable for hydrological application. Knowledge of the processes of water movement and flood generation on the land surface, through subsurface materials and in rivers, in all kinds of natural and man-made environments, remains at the core of hydrological understanding. Issues of water quality, ecology and habitat, and of interactions between water and sediments, are coming to the fore, and urban response under extreme rainfall demands more attention.

Parameter-sparse runoff methods are needed for broad-scale generalisation to ungauged sites, and there is a need to be able to relate data-poor sites to data-rich sites. There is an increasing use of whole-time-series methods, with integral 'antecedent condition' modelling, rather than flood-event-based approaches, and extreme value and joint probability statistical approaches are developing. The interface between hydrology and hydraulics to convert flood flows into water levels, and so define zones of inundation risk, is a key area.

Major areas of concern and application of knowledge in flood management can be expected to vary over time, but the present areas of concern are:

- clarification of the effect of land management changes on flooding,
- flood regime changes under climatic variability,
- degree of effectiveness and biological impacts of soft-engineered options,
- urban flood behaviour above current design levels.

In the medium term, these priorities may be expected to change as flood risk perceptions change. Improvement of generic methodological techniques are expected to make advances in:

- calibration/optimisation procedures,
- model coupling and model nesting,
- quantification of uncertainties, the combining of uncertainties, and the propagation of uncertainty through systems,
- detection of change and/or trends in flood-related variables,
- aggregation/disaggregation procedures for data and modelling capability,
- data assimilation, data mining and data capture techniques.

The demand for data is set to increase rapidly, fuelled by both the demand for increasingly high resolution capabilities, and the political and technical need to improve risk evaluation. There will need to be coherence in the design and implementation of data capture technologies, and reliability estimates will increasingly be seen as a standard data component. An over-arching IT system is sought, within which software, databases and decision support systems can reside, interact and transfer information by having common architectures and exchange protocols.

The translation of software methods from research code into software tools will rise and fall as procedures become market-ready. The revitalisation of the rainfall-runoff method may be expected to advance flood frequency estimation in some three years' time, and then continuous simulation hydrological approaches are likely to dominate software production.

Fluvial Sediments and Habitats Vision

The underlying objective is to provide the information needed to design and maintain sustainable and environmentally acceptable rivers, which fulfil their flood defence functions and provide opportunities to create or improve habitats.

The first priority is to assemble and disseminate information that is already available, as the basis for nationally consistent approaches. Guidance on geomorphology, environmentally acceptable flood defence design and best practice in river management and maintenance, primarily at reach scale, should be collated. From this work, an electronic tool kit could be developed, closely linked to the methodologies recommended in the Environment Agency Fluvial Design Manual.

In addition a "Habitat Management Manual" is proposed, to compile methods for managing river habitats under different morphological and management scenarios, to complement the Best Practice guidance on river maintenance. Only material which is relevant for users should be contained in these documents, and it is the overall design process that should be described, not just individual pieces of work.

New methods will be developed as needs are identified. For example, geomorphological and floodplain components should be developed to enhance the River Habitat Survey, to provide factual information and to help improve understanding of the links between sediments and habitat. This might be extended to include

analytical tools to identify and locate issues at a catchment scale, including a pilot study where an adaptive management strategy is carried out.

The interactions between sediment, vegetation and habitat are not well understood, and it is difficult to predict the impact of interventions such as dredging and weed cutting. Field trials are needed to study these processes in detail at reach level. The general objectives include:

- establishment of trial sites which are representative of river reaches where significant maintenance work is currently carried out,
- setting up monitoring systems for flow, sediment, vegetation and habitat,
- identifying the impact of flow variations by monitoring with no interventions,
- identifying the impacts of dredging, vegetation management and other maintenance activities.

The design of this investigative research should take account of how processes will be represented in subsequent modelling tools. Field investigations require a strong experimental design to accommodate the uncertainties in the frequency and magnitude of significant flood events.

The cost-effectiveness of investment in sediment and habitat management needs to be justified, and a basis of evaluation and justification is sought. Strategic planning for sediment and habitat at a catchment scale needs to be included in the tools for undertaking Catchment Flood Management Plans, which may lead to work on catchment sediment yield and catchment river morphology.

Research and development in this area should lead to:

- a framework for fluvial design contained in a Fluvial Design Manual,
- a method for providing a catchment overview of sediment and habitat issues,
- methodologies for catchment sediment yield, catchment geomorphology and impact on habitat,
- a component of the River Habitats Survey that provides information on geomorphology and floodplains,
- methodologies for sustainable river management at reach scale, including guidance on environmentally acceptable flood defence design and a standard Best Practice river maintenance manual,
- a better understanding of the benefits and costs of different approaches to river maintenance,
- a method for justifying environmentally sensitive work.

The programme of work should be flexible and respond to new needs as they arise, for example the possible impacts of climate change and the impact of renewable energy projects on rivers.

Coastal and Estuarine Sediments and Habitats Vision

The overall aim is to develop a much greater understanding of estuary and coastal processes, including hydrodynamic processes, so as to produce models and guides as tools for the management of fauna, flora and habitats. These should provide the means for flood defence design, maintenance and managed retreat in an economic, environmentally acceptable and sustainable way. The development of “economic” and “sustainable” flood defences that conserve, enhance and expand the natural environment requires an understanding of the interaction of marine and river hydraulics, sediment dynamics, ecology, fisheries and habitats, and should include water quality. Coasts and estuaries are complex and diverse areas that require not only an understanding of individual processes and habitats, but also of the way in which they interact.

The review and collation of previous research and existing experience is particularly important. Guidance based on existing information could comprise:

- suitability criteria for habitat restoration,
- criteria for the assessment of the ecological value of saltmarshes,
- experience and data from sites of coastline retreat and habitat mitigation.

As the Habitats Directive requires that areas of habitat loss be offset by new or restored equivalent habitats, it is essential to formulate quantitative measures that are practical and economical.

The outcomes and lessons from previous or current demonstration projects need to be assimilated before further research is started, but there is a need to improve the understanding of biological and physical

functions of systems in the context of the integrity of habitats, species distributions, retention of materials, etc. As a single demonstration project is unlikely to cover the range of relevant issues, a variety of such projects will be needed. The aims should include replication to enable statistical evaluation to improve future predictions. The effect of engineering works on restoration and management needs attention, starting with a paper review, but then by carrying out relatively small engineering works within a retreat site and monitoring their impact.

The use of dredged materials and waste to recharge coastal areas and raise levels should be investigated, particularly in relation to logistics and site selection, and the subsequent colonisation by faunal and floral communities. The scope should extend to the re-building of eroded areas or to increasing rates of accretion in stable inter-tidal areas, and might also include the use of coarse dredged material for temporary barriers that limit the impacts of waves on saltmarshes. This work should lead to production of a Design Guide. The use of more polluted dredgings, and the impact on biota and rates of re-colonisation might also be investigated, initially through literature review.

The extent of habitat variations due to climate change needs to be assessed. The causes and consequences of change need to be described systematically, and the inherent scales of variability quantified and assessed in different ecological and physical components. This should provide both site-specific and generic information, especially with regard to scales of variability and cause-and-effect mechanisms, and allow the separation of natural anthropogenic fluctuations, e.g. coastal squeeze due to climate change, from those due to isostatic rebound. Analysis of carrying systems, such as vegetation and sediment budgets, to support birds and fish is part of the long-term vision that ultimately might lead to the generic habitat models and sub-routines for full habitat management tools.

Sediment processes, and particularly the sedimentary role of mudflats and their biota should be reviewed. The underlying purpose is to establish the way and conditions under which inter-tidal areas play a major role in the establishment of saltmarsh. Given the changing nature of tidal morphology, an understanding of the functioning of inter-tidal areas within the sediment system is essential. They have importance as habitats, and in wave attenuation and as a source of sediment supply.

In developing a programme of research, it is recommended that a number of different locations are chosen and that the impacts of schemes and experiments are modelled using existing techniques. Generic model sub-routines, in particular those relating to biota and habitat, should be bolted onto existing models, so that as well as testing the generic models, practical tools are provided for those managing the selected estuaries.

Coastal Management Vision

The aims of the Coastal Vision are

- to set future research and development within a common conceptual approach to coastal management,
- to lead to significant improvements in cost effectiveness, performance and sustainability of coastal defence,
- to quantify the degree of certainty in predictive techniques for coastal engineering, science and management,
- to achieve a measurable improvement in the time horizons for these techniques.

Underlying these aims are more specific elements that will directly assist researchers and practitioners. The primary elements are:

- a real-time nationwide forecasting of coastal hydrodynamics (tides, surges and near-shore waves),
- an improved understanding of the limits on predicting morphological evolution,
- a better understanding of morphological stability, i.e. the natural and anthropogenic mechanisms that can cause an estuary or coastal cell to switch rapidly from one quasi-equilibrium regime to another,
- improved understanding of the influence of anthropogenic intervention and its interaction with its local environment over short, medium and long terms.

In addition there are cross-cutting issues that are catalysts for dissemination of good practice, data and the promotion of an active and dynamic professional community:

- the development of a 'one-stop-shop' for easily accessible, consistent and quality controlled coastal data, which might be a real centre or a virtual centre accessible over the internet,
- the development and implementation of a framework for the development, testing, control and use of 'open code' for all codes and models developed within the Flood and Coastal Defence research programme.

The hydrodynamics of tides, waves and surges are well enough understood to provide inputs of practical use to warning and emergency response procedures. While details of certain processes (notably wave breaking, run-up and over-topping, surge propagation in estuaries, and wave-surge-tide interactions) require further work for specific scientific understanding, early significant improvements in performance are more likely to come from effective integration of existing tools and procedures in a Total Quality Management environment.

The advent of a series of coastal and estuarine Management Plans and Strategy Plans has created a demand for tools that can predict the long-term evolution of coastlines and estuaries. A review of failings in the present generation of planning tools highlighted the widespread lack of predictions of future coastline evolution and the need to improve the understanding of long-term morphological processes. The dearth of morphological prediction techniques is yet to be addressed and is one area that deserves particular attention and effort.

The continuing improvement in computer speed and performance over recent decades has encouraged the view that the equations governing coastal processes could be solved at a sufficiently fine resolution and over a satisfactory interval of time to answer many of the engineering design and management issues. But this vision has yet to be attained.

Firstly, while more powerful computers allow us to solve the equations of motion at greater spatial detail, sub-gridscale turbulent motions remain unresolved. While various turbulence models have been proposed in the literature they involve greater computational effort and have not yet found widespread use in coastal engineering studies. Furthermore, introducing sediment transport formulae into the turbulence equations would be a non-trivial task while producing results of questionable value, given their uncertainties.

Secondly, although it is now possible to obtain numerical solutions over many time steps, the accuracy and sensitivity to initial and boundary conditions are questioned. It has yet to be established whether the predictive equations for coastal morphology exhibit the same 'chaotic' behaviour as the weather forecast equations.

Finally, once an adequate understanding of the natural processes has been achieved, there remains the issue of understanding and predicting the influence of anthropogenic activities on long-term coastal evolution.

These three points suggest that further incremental development of deterministic process models will lead to only limited improvement in forecast accuracy over the medium and longer term. On the other hand, the need for specific and accurate forecasts over the medium and long term has yet to be proven. If it is accepted that an estimation of trends and uncertainty only is required to develop flexible management strategies, then an exciting array of options becomes possible.

The research framework of the Vision prioritises projects under five areas.

- Performance of coastal structures, comprising beach scour, embankment performance, rock structures and wave interactions.
- Demonstration projects and dissemination, including site monitoring and guidance on predicting near-shore sediment transport.
- Beach morphological change, including the behaviour and processes of beaches, saltmarshes and mudflats.
- Managed realignment, including the effect of climate change on the shoreline and provision of guidance from monitored experience.
- Strategic coastal planning, including sediment budgets, near-shore wave climate, coastal responses and coast/estuary interactions.

The key coastal management issues comprise a multi-scale, multi-determinant problem for which there is currently no analytical or computational technique for prediction. The challenge for this research programme is to put in place the steps through which an improvement in understanding is achieved, sufficient to provide useful predictive capability for its end-users.

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Specific Commissioned Projects
Specific projects have been assessed, developed and contracts awarded in the general context of these strategic Visions. In particular, the following projects have been commissioned.

Understanding Beach Processes
Two preliminary scoping studies have been initiated to advance the understanding of beaches in relation to coastal defence. Posford Haskoning are leading a team investigating the relationship between foreshore erosion and the short- and long-term supplies and losses to adjacent beaches. HR Wallingford are identifying the generic elements and processes involved in the lowering of beaches caused by toe scour in front of coastal defence structures. Both these studies are to provide preliminary advice and guidance, and are expected to lead into more substantial research into the processes involved (see Projects FD 1915 and FD 1916 for more details).

Habitat Creation and Quality
A critical assessment of the factors contributing to the successful creation of coastal habitats is being undertaken by a team lead by CEFAS Lowestoft Laboratory. The project will draw on knowledge gained from existing managed realignment sites, and will result in an electronic decision tree to aid policy makers and managers concerned with managed retreat and restoration to evaluate prospective sites and identify which are most likely to be successful. ABPmer are leading a complementary exploration and development of practical measures and monitoring protocols that can be applied to evaluate the quality of intertidal and shoreline habitats. This will provide guidance for baseline measurements and ongoing observations, and the tools for evaluating mitigation schemes and assessing residual impacts. It will enable managers to take corrective action where habitat quality objectives are not being achieved, or to develop alternative objectives that better reflect the capacity or capability of the site (see Projects FD 1917 and Agency Project W5A(02)01[1] for more details).

Guidebook of Applied Fluvial Geomorphology
A new guidebook, collating and summarising over 10 years of R&D in fluvial geomorphology has been produced by Nottingham University in association with the University of Newcastle and Southampton University. The guidebook aims to

- foster a general interest in, and understanding of, geomorphology in the river environment,
- develop a realisation of the significance of considering geomorphological processes in river management applications,
- give an overview of the different methods of incorporating geomorphological science into river management, and
- provide guidance on when to seek expert geomorphological advice, and where to find it.

The guidebook has been developed from the explicit professional needs of Environment Agency staff, and the feedback from training courses lead by the University of Newcastle. It does not contain step-by-step instructions on how to perform geomorphological analyses and investigations, but it does include case studies to illustrate the application of assessment procedures, and should be a valuable source-book for anyone involved in the complex business of river management.

The final draft of the Guidebook has been delivered for Peer Review, and will be released later in 2003 (see Project FD1914 for more details).

Evaluation of the Mapping and Assessment of Urban and Suburban Areas
A key catchment descriptor in the use of Flood Estimation Handbook (FEH) procedures is URBEXT1990. This index describes the extent of catchment urban and suburban land cover, based on data taken from the CEH Land Cover Map of Great Britain (LCMGB). The LCMGB was derived principally from satellite imagery taken around 1990 and for some catchments will now give an inaccurate picture of the extent of built-up areas. Urban and suburban mapping from the Land Cover Map 2000 (LCM2000) should be evaluated since the initiative provides an opportunity for the indexing of catchment urbanisation to be brought up-to-date.

After Stage 1 of the project, a review shall be undertaken with the Project Officer to ascertain whether Stage 2 remains the most appropriate way of proceeding with this particular aspect of FEH updating in the light of any relevant developments at that time.

Stage 2 of the research programme will compute a new index URBEXT2000. These values will be disseminated to FEH users through the issue of a new FEH CD-ROM. This will also provide an opportunity to include recent advances to the DTM used to define catchment boundaries and drainage paths.

This new index describing catchment urbanisation will provide an important improvement to use of industry standard procedures for flood estimation in the UK (see Project FD1919 for more details).

Long term ecological monitoring of the managed realignment scheme at Tollesbury
This project aims:

- To monitor the natural colonisation of saltmarsh plants within the Tollesbury realignment site and compare this with changes on nearby saltmarshes.
- To monitor sediment accretion rates within the realignment site and on adjacent marshes. To measure changes in the strength and stability of the sediments.
- To monitor the colonisation of the Tollesbury site by intertidal invertebrates.

The research addresses the issues of long term change and saltmarsh development within managed realignment schemes. It is needed to improve our understanding of the biological and physical changes which follow realignment, the timescales involved in the establishment of saltmarsh on former agricultural soils, and the key factors controlling stable creek and marsh formation.

The research will inform future design of realignment schemes and assess the potential contributions of such schemes to coastal defence and meeting biodiversity targets. Data will be continuously available to Defra and, through them, could be used by agreed third parties. This should bring extra benefits to those involved in other realignment schemes (such as Washbanks where CEH are also involved in ecological monitoring) (see Project FD1922 for more details).

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Managed Projects
There are presently 19 projects being undertaken within the FECP Theme. These are:

- FD 1603 Appraisal of the FEH Statistical Procedures for Flood Frequency Estimation
- FD 1901 Development of Predictive Tools and Design Guidance for Mixed Beaches – Stage 2
- FD 1905 Estuary Process Research Project (EstProc)
- FD 1911 Freiston: Shore Managed Realignment
- FD 1912 SANDPIT: Effects of Offshore Dredging
- FD 1913 Re-vitalisation of FEH RFRO Rainfall Runoff
- FD 1914 Guidebook of Applied Fluvial Morphology
- FD 1915 Understanding and Predicting Beach Morphological Change Associated with the Erosion of Cohesive Foreshores
- FD 1916 Understanding the Lowering of Beaches in Front of Coastal Defence Structures
- FD 1917 Suitability Criteria for Habitat Creation
- FD 1918 Habitat Quality Measures and Monitoring Protocols (EA Ref: W5A(02)01[1])

- FD 1919 Evaluation of the Mapping and Assessment of Urban and Suburban Areas
- FD 1920 River Sediments and Habitats and the Impact of Maintenance Operations and Capital Works
- FD 1921 A Refined Geomorphological and Floodplain Module to the River Habitats Survey (EA Ref: W5A(02)01[2])
- FD 1922 Tollesbury Extension of Monitoring
- W5B(97)04 Shingle Beach Transport Models
- W5B(98)03 Evaluation of Breach Processes at Porlock Shingle Ridge
- W5B(98)04 Wave Attenuation Over Saltmarshes
- W5B-013 (0592) Pollution of Managed Realignment at Orplands and Tollesbury

These projects are managed by a designated Project Officer, who monitors the progress of the project in terms of its scientific direction, programme and dissemination opportunities. This includes reviewing and commenting on any outputs and regular liaison with the contractor. Project Officer reports for these projects can be found in the separate Theme Annual Report 2003/04. Contractor reports are also collated in this report and can also be found on the Defra website under the appropriate contract reference number.

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Proposed Projects

Through consultation with the TAG, other Themes and industry experts, several proposed projects have been defined within the Fluvial, Estuarine and Coastal Processes Theme. These are due for commissioning during 2003, depending on Defra's commissioning timetable. These projects are outlined below.

Impacts of Permeability on Beach Performance

This project aims to produce a review of existing knowledge of the impacts of permeability on mixed and shingle beach performance by:

- Examining the relative hydraulic performance of artificially mixed and naturally graded beach materials;
- Examining the implications of reductions in beach permeability, arising from placement of artificially mixed sediments (such as dredged aggregates) in beach recharge schemes, on the hydraulic performance of mixed and shingle beaches;
- Reviewing the performance of some recent beach recharge schemes with respect to permeability by considering profile response, grading and construction method;
- Examining alternative beach recharge and construction and aggregate production methods that may overcome the problems associated with artificial mixing, in a cost-effective manner.

Iit will produce recommendations for a framework of field and/or laboratory studies (possibly linked with demonstration schemes) to advance knowledge of the influence of permeability on beach performance.

Understanding Barrier Beaches

The objectives of this study will be to assemble and publish existing knowledge and operational experience of the performance of barrier beaches, identifying the dominant processes and areas of uncertainty or absence of definitive knowledge.

In particular, it will address the following: (a) threshold conditions for overwashing; (b) prediction of the profile development of the beach following the onset of overwashing; (c) processes that may result in natural rebuilding of the crest; (d) quantification of overtopping rates; (e) quantifiable modification of the crest and back barrier by overtopping and overwashing; and review field performance of a range of key sites.

The work will also establish, justify and prioritise a costed framework of field or laboratory or theoretical studies that will fill knowledge gaps so as to support better- informed and more effective management of barrier beaches.

Colonisation of Dredged Material Behind Breached Sea Defences

The general objective is to assess the colonisation by faunal and floral communities of dredged material used for raising levels behind breached sea defences, and thus to produce well-founded guidelines.

Subsidiary objectives include:

- to investigate logistics and site selection with respect to the viability of dredged material usage,
- to investigate the methods of placement of dredged material,
- to consider properties of material used for placement,
- to investigate the movement and consolidation of the placed mud and the management of drainage,
- to investigate the design and prediction of the placement level,
- to investigate the significance of drainage and channel design in plant colonisation and the influence of man made drainage systems present at some sites,
- to investigate the colonisation of placed material,
- to investigate the timing, rate and method of recharge of faunal and floral communities,
- to investigate the potential role of seeding and transplanting as well as colonisation by natural local sources,
- to investigate the morphological development over time and impact on biological processes at a managed retreat site where dredged material has been used,
- to investigate the potential impact of disturbance outside the site during construction.

The Impact of SUDS on Catchment Flood Response

The objectives for this work are:

- From existing and new field studies of principal SUDS structure types, develop descriptions of the hydrological processes involved to incorporate into urban catchment runoff response models.
- Assess urban catchment scale (2-5 km^2) impacts of broad scale use of SUDS, including continuous assessment of hydrological interactions and sensitivities (climate, soil moisture, etc).

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Theme Publications

During the period April 2002 to October 2003, there have been several significant outputs produced through the Fluvial, Estuarine and Coastal Processes Theme. These have included Theme-wide publications and project specific reports. The project specific reports are detailed in the individual project reports.

Mouchel, “A Vision For Coastal Research – Final Report for the Coastal Concerted Action”, Vision Champion – Dominic Reeve (University of Nottingham), September 2002.

Mouchel, “A Vision for Flood Hydrology Research – Final Report for the Flood Hydrology Concerted Action”, Vision Champion – Ann Calver (CEH-Wallingford), September 2002.

Mouchel, “A Vision for Fluvial Sediments and Habitats Research – Incorporating the Final Report from the Sediments and Habitats Concerted Action”, Vision Champion – David Ramsbottom (HR Wallingford), September 2002.

Mouchel, “A Vision for Estuarine and Coastal Sediments and Habitats Research – Incorporating the Final Report from the Sediments and Habitats Concerted Action”, Vision Champion – Chris Fleming (Halcrow), September 2002.

J. Rogers, “Defra/Agency Fluvial, Estuarine and Coastal Processes Theme – Project Portfolio”, January 2003.

J. Rogers “Defra/Agency Fluvial, Estuarine and Coastal Processes Theme – Annual Report 2002/03”, October 2003

M. Thorn, “Looking for the Great Leap Forward” and “Fluvial, Estuarine and Coastal Processes Theme Update”, Vision and Theme articles for Defra and the Environment Agency’s Flood and Coastal Defence Research News – Issue 3, October 2002.

M. Thorn, “News From The Processes Theme”, article for Defra and the Environment Agency’s Flood and Coastal Erosion Risk Management Research News – Issue 4, July 2003.

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