Defra/Environment Agency
Flood and Coastal Defence R&D Programme

Position Review of Data and Information Issues within Flood and Coastal Defence

R & D Project Record FD2314/PR

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Position Review of Data and Information Issues within Flood and Coastal Defence

R&D Technical Report FD2314/PR

Authors:
Jonathan McCue, Keiran Millard, Peter von Lany and Mike Clark.

Publishing organisation
Defra – Flood Management Division,
Ergon House, Horseferry Road,
London SW1P 2AL.
Tel: 020 7238 6178
Fax: 020 7238 6187
www.defra.gov.uk/environ/fcd

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Statement of Use

This Project record contains the results of a study to put forward a position statement on issues related to the use, capture and dissemination of data and information relating to flood management within Defra and the Environment Agency (Agency). The study is written for Agency/Defra staff though will be of use for other key stakeholders involved in managing, storing or producing information of relevance to the planning and management of flood and coastal defences in England and Wales.

Keywords
Data and Information, flooding, role and responsibilities, audit, storage, metadata.

Research Contractor
Jonathan McCue, Principal Coastal Consultant, Atkins, Thomson House, Birchwood Science Park, Warrington, WA3 6AT. email: jonathan.mccue@atkinsglobal.com

Defra Project Officer
Dr Suresh Surendran, Risk Analyst, Environmental Policy, Kings Meadow House, Kings Meadow Road, Reading, RG1 8DQ email: suresh.surendran@environment-agency.gov.uk

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Abbreviations used within the report

BAP	Biodiversity Action Plan
BODC	British Oceanographic Data Centre
BRIMS	British Radioactive waste Inventory Management System
CASI	Canadian Aeronautics Space Institute
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFD	Coastal Flood Defence
CFMP	Catchment Flood Management Plan
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EIA	Environmental Impact Assessment
FCM	Flood and Coastal Defence
FCM	Flood Coastal Defence
GIS	Geographic Information Systems
GOOS	Global Ocean Observing System
GPS	Global Positioning System
HRW	H R Wallingford
ICZM	Integrated Coastal Zone Management
IFM	Indicative Floodplain Mapping
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange program
LA	Local Authority
LiDAR	Light induced Detection And Ranging
MDSF	Modelling and Decision Support Framework
NEECA	National Engineering and Environmental Consultancy Agreement
NERC	Natural Environment Research Council
NFCMD	National Flood and Coastal Defence Database
OS	Ordnance Survey
POL	Proudman Oceanographic Laboratory
R&D	Research and Development
RASP	Risk Assessment of flood and coastal Defence for Strategic Planning
RHS	River Habitat Survey
ROAME	Rationale and Objectives; procedures for project Appraisal and arrangements for Monitoring progress and Evaluation
SAR	Synthetic Aperture Radar
SEA	Strategic Environmental Assessment
SMP	Shoreline Management Plan
WFD	Water Framework Directive
XML	Extensible Mark-up Language

EXECUTIVE SUMMARY

This study has arisen from a previous Defra/Agency research (Overview of Data Management Issues in Flood and Coastal Defence -W5G-007). Its looks at data as a central item with the purpose to understand the efficiency of current data and information practices and what opportunities exist to improve the flood and coastal defence process through better data management. Focussing specifically on flood issues (fluvial, estuarine and coastal), the output of the project is to determine where limitations can be matched with quick fixes and improved uptake of ongoing research and initiatives.

This report represents a non-contracted deliverable to the Client. It should be used as an internal document only. The purpose of this report is to provide the following information:

- Overview and write up of outcomes of the 24 April 2003 Workshop (see Appendix A - Project Flyer and Questionnaire).
- Initial listing of relevant initiatives/projects/research being reviewed within the study for update and comment.
- Demonstrate the approach to complete the draft Position Papers to achieve the objectives of the study. Include the findings of this exercise (see section 5 of this report).
- Workshop 2 findings (27 January 2004).

The project has used a range of consultation techniques to facilitate debate on this important issue. Details are included with Appendix D on how the 38th Defra River and Coastal Management Conference in Keele (16-19 July 2003) was used to gather views.

The work presented in this PR represents the reflection and views of the Project team at the time of writing (April to August 2003).

1 INTRODUCTION

1.1 Background to the Project

Atkins were commissioned in 2002 to prepare a scoping study to investigate and document the systems in place (within the flood and coastal defence industry) to collect data and process information within the Agency, other governmental bodies and the public sector. That study recommended further research was required.

The joint Defra and Agency Research & Development (R&D) programme subsequently agreed to fund a research project (FD2314) under the Risk Evaluation and Understanding of Uncertainty Theme, to report on the current position on data and information issues in Flood and Coastal Management (FCM).

The scope of the project is to understand within the FCM industry, current data information and management initiatives of relevance to fluvial and coastal flood issues and identify where contemporary data and information management practices limit progress. From this, the aim is to identify "quick wins", or if appropriate, research that is required to target any deficiencies. These may be related to:

- The information itself (are the required parameters being measured?).
- The management of information (who does what?).
- Information policy and procedures (are the best practice guidelines being followed).
- Information technology (is the right technology being used?).

Information regarding these deficiencies is provided from documentation on existing FCM practices, on going contracts in other Research Themes and consultations. Information on opportunities for improvement is provided from these same sources and from analysis of European research and best practice in FCM. The finding of this work, adheres to the contract for FD2314 and presents six draft position papers on the following subjects:

1. **A Data Needs**: identify data needs for policy, planning and operational purposes and review against data availability.

2. **B Data Accessibility**: examine ways of improving data accessibility, including the use of the Internet, standardisation of archives and the development of "lead data centres" where an organisation is charged with maintaining a specific database.

3. **C Data Acquisition**: encourage co-operative effort so that the cost of data acquisition can be shared (e.g. between engineers and scientists, and engineers and environmentalists), which will lead to better flood and coastal defence solutions.

4. **D Knowledge Management**: evaluate the benefits of data collections and develop appropriate techniques for more widespread application of value of information techniques.

5. **E Involvement of Stakeholders in Data Collection**: investigate the greater involvement of stakeholders, such as riparian owners, in data acquisition in order to make use of a low-cost untapped resource, and to promote awareness of flood defence issues in the wider community.

6. **F New Technology**: develop and encourage the application of new technology and new techniques for monitoring, data handling, archiving, dissemination and presentation where appropriate.

A series of six Milestones were set for the study. These are as follows:

- Milestone 1 – Inception Meeting (confirm Key Expert Adviser Team – cross cutting exercise – agree format of Workshop/Information Gathering exercise).
- Milestone 2 – Complete generic Workshop / Information Gathering exercise (cross cutting exercise).
- Milestone 3 – Completion of 6 Draft Position Papers.
- Milestone 4 – Synthesis of Findings on 6 Position Papers.
- Milestone 5 – Submission of Final Integrated Draft Report and Workshop.
- Milestone 6 – Submission of Final Integrated Report.

Milestone 1 marked the completion of the project initiation and start up planning phase. Milestone 2 represents a status report on the initial data-gathering component for the project. Milestone 6 includes three final deliverables:

- Technical Report 1 (TR).
- Project Record (PR – this report).
- Technical Summary (TS).

1.2 Purpose of this Report (PR)

This report represents a non-contracted deliverable to the Client. It should be used as an internal document only. The purpose of this report is to provide the following information:

- Overview and write up of outcomes of the 24 April 2003 Workshop (see Appendix A - Project Flyer and Questionnaire).

- Initial listing of relevant initiatives/projects/research being reviewed within the study for update and comment.

- Demonstrate the approach to complete the draft Position Papers to achieve the objectives of the study. Include the findings of this exercise (see section 5 of this report).

- Workshop 2 findings (27 January 2004).

The project has used a range of consultation techniques to facilitate debate on this important issue. Details are included with Appendix D on how the 38th Defra River and Coastal Management Conference in Keele (16-19 July 2003) was used to gather views. The replies from which can also be found in Appendix D.

The work presented in this PR represents the reflection and views of the Project team at the time of writing (April to August 2003).

2 WORKSHOP 1 (Milestone 2)

2.1 Milestone 2 Objectives

A key component to ensure completion of Milestone 2 was the initiation of a Workshop event (Workshop 1), programmed early in the study, to assist in determining the priority areas for analysis and discussion for the topics of the six position papers set out in the CSG7 form. The event was used to evaluate existing work and where possible, to establish the format of the Final Technical Report. Following Workshop 1, research team members undertook a selective programme of telephone interviews and meetings with key FCM stakeholders.

The objectives for this phase (completion of Milestone 2) was:

- To set the level of output expectancy for the project (avoiding duplication of effort).
- Review problems/successes of current data initiatives within the data management community.
- Identify gaps in data currently held and hence future data requirements.
- Determine availability, systems management and quality management for the data held and required.
- Raise concerns/opportunities with information management in the FCM industry.

2.2 Workshop 1 Agenda

The Workshop was held at the Environment Agency (EA), Reading on 24th April 2003. Team members from Atkins, EA, Defra, HR Wallingford (HRW), Halcrow, and Almon Clark Associates were present. The agenda for the day is set out below:

10:30	Welcome and Introduction *(Jonathan McCue, Atkins).*
10:40	Background to the Project *(Ian Meadowcroft, EA –Risk Theme Leader).*
10:50	Objectives of the Projects and Initial Questionnaire Analysis *(Jonathan McCue).*
11:10	Existing Audit on Data and Information Projects/Initiatives *(Keiran Millard, HR Wallingford).*
11:30	Invitee Presentations on Data Projects *(various).*
12:00	Lunch *(initiation of break out groups).*

12:30 Break out Groups Sessions start to discuss key theme areas *(3 facilitator groups covering 2 objective areas each).*

14.15 Coffee.

14:30 Convene Facilitators and report back findings.

15:00 End of Workshop.

2.3 Workshop 1 Overview

The event was introduced by Jonathan McCue (Atkins Project Manager). Ian Meadowcroft (EA) provided an overview of the background to the study.

An analysis of questionnaire responses (questionnaires were despatched to attendees 3 weeks prior to the event) was presented. Further elaboration on the findings took place during an afternoon breakout session (a complete inventory of questionnaire replies are presented in Appendix A).

Following a presentation by Keiran Millard (HR Wallingford) on the auditing of data initiatives, invited speakers were asked to provide 5 minute presentations on various data related projects and initiatives. These are outlined below:

- Beth Greenaway (Defra Science Directorate) and Jule Harries (IACMST, CEFAS)- Coastal, marine and flooding and management initiatives by Defra.
- David Tredor (EA) - Flood Defence IT Delivery Plan.
- Bill Rodham (Strategic Planning Engineer, EA) - Flood Defence (FD) Data Management Strategy.
- Mike Clarke (Almon Clark Associates) - The INSPIRE Objective.
- John Goudie (Defra) – NFCMD.
- Claire Brown (ABP Marine Environmental - Experiences from the Estuary Research) Data Collection Project FD2110.
- Keiran Millard (HR Wallingford) - Consultants View of Data Management within FCM.
- Mike Thorn (Process Theme) – future projects.

One-page information return sheets were issued at the end of the workshop. These were analysed and assisted in the creation of the 'Appendix B: Relevant Additional Contacts' table.

2.4 Workshop 1 Report

The workshop raised the issue of data management and information into a diverse community of researchers, data managers and practitioners. Some new ideas were presented and real issues facing the industry captured. The presentation of the way forward met the objectives of the research.

The research needs to set clear filters on what initiatives are to be reviewed and importantly, it must be a high level report that is forward looking, and not become focused on "now" issues, e.g. lack of a basic dataset for a particular application.

Findings of the Workshop are outlined below:

2.4.1 Objective 1 – Data Needs

The questions posed in the questionnaire for "Data Needs" were as follows:

- What are the most pressing data needs for current and emerging initiatives?
- In which of the above is the potential "value" of data significantly constrained in its usefulness by uncertainty, inadequacy, restricted availability, or non-availability of data?

Workshop 1 Response

Clarification was sought on whether the question itself was misleading as it could imply that there was a bottom up approach to this themed area. There was general consensus that it is difficult to determine data value and data needs in absolute terms. Instead, more focused attention is required to suggest ways to identify data needs. Some suggestions included:

- Identifying those areas where current high level decision making and strategic planning is constrained in its effectiveness by inadequate data/information and understanding (e.g. some Catchment Flood Management Plan (CFMP) Inception Reports have drawn attention to the uncertainty that is attached to indicative standards of protection for existing flood defences and the fact that this is undermining confidence in related policy decisions);
- Attention needed to assist future decisions, which are driven by emerging drivers (e.g. moves towards risk based decision making or Directives such as the Water Framework Directive -WFD).
- Identify those areas where the understanding of the flood generating process is restricted by the lack of data (e.g. impact of geomorphological activity, changes in land management practices etc).
- Identify those areas where the understanding of the flood impacts is restricted by lack of data (e.g. impacts of floods on the health, safety and financial security of people and the interaction between flooding and the environment such as the benefits and dis-benefits of fluvial and coastal flooding to ecosystems and habitats);
- Identifying those areas where the understanding of the performance of flood defence systems is restricted by lack of data (e.g. on failure mechanisms and failure rates, key factors affecting performance etc).

Once data needs have been identified in particular decision-making, process and performance, they need to be recorded to follow the whole cycle of business management processes undertaken in the Agency.

There needs to be a logical process to determine the priority of different data needs, as well as a better definition of what encompasses data needs. There are difficulties in implementing this approach as users have different perceptions of value and value in absolute terms is difficult (if not impossible) to measure easily. A practical approach may be to use the current and emerging initiatives (e.g. Foresight Programmes, CFMPs, SMP's, FCM Strategy Plans, Modelling and Decision Support Framework (MDSF), Risk Assessment of flood and coastal defence Strategic Planning (RASP) etc) as indicators of what the FCM community generally regard as important issues. Confident decision-making and sound analysis in these areas will require adequate and reliable data.

Elaboration is required on the cost effectiveness of data and on the need for some data presently collected. This raised the issue that inadequate data/information reduces the level of understanding, the precision of analysis and the confidence in decision-making.

One way to determine data needs is to identify what data is required to fulfil best practice guidelines. An example for this might be better flood plain topography data (e.g. Light induced Detection and Ranging - LiDAR for floodplains; better indicative standards of protection for existing flood defences (e.g. for CFMPs); better flood defence system failure data (for RASP) etc.

It was agreed that an inventory of the data sets at different planning levels was required, so that gaps can be identified (e.g. catchment scale or broad scale modelling data; river or coastal system scale; local scale). This is because data at different scales often have different origins and this uncertainty needs to be understood to ensure analysis and decision making at various scales are internally consistent. (i.e. adequate "data tiering").

Conclusion

The Agency is using process mapping in order to streamline its service and to provide guidance to its teams. The process maps currently being used in the Agency seem a sensible approach to map onto the data needs uncertainties and gaps. Data used for business management often relies on imperfect and uncertain data sets, which means that the decisions made are subject to uncertainty. Therefore, the workshop identified that work needs to be more clearly presented to match the whole business cycle, from research, decision making, performance assessments, to maintenance monitoring.

Implementation of research findings may be hampered if data needs from this stakeholder group are not evaluated. The research community need to be involved and engaged as much as possible in this process.

An "uncertainty audit" of all data used in managing the FCM business would be a powerful driver for improvements in, and development of, data management in this sector. Some of the issues brought about by the audit are as follows;

- Data needs related to the information it generates at the FCM member level – this is an iterative process.
- Data collected has a cost – but what is the value to the wider industry? (needs to be agreed by both users and decision makers).
- What needs to be captured/generated needs to be determined up front within the industry as a whole.
- A review of data needs from the research community is required.
- Possible benefit in grouping data in the standard risk model components of source, pathway and receptor.

2.4.2 Objective 2 – Data Accessibility

The questions posed in the questionnaire regarding "Data Accessibility" were as follows:

- Identify ways where data accessibility within FCM and other related industry may be improved.
- Suggest examples of good practice examples where necessary.

Workshop 1 Response

Data is often presented in a form without any details on where it comes from, its accuracy/quality or what the restrictions on its use are. In many cases, it might be necessary to obtain permission from the originators of the data sets. Often this is not simple and can create a delay in a project. This issue has been advised in the MDSF process via the provision of metadata.

Accessing data sets can create delays where there is a convoluted supply chain to obtain the data. It would be much more convenient to have a single source from which all data sets can be obtained which would effectively be a "data clearing house" (e.g. EA Twerton model preparation for MDSF). This may be used as an example of best practice if appropriate.

Another problem with data accessibility is not different data formats, but data that arrives in an undocumented format.

Knowing who is developing new data sets was also considered useful. This applies especially to the "people"; social and environmental data needed for flood risk assessments and integrated flood defence planning. It could also apply to those looking at future change (e.g. Foresight scenarios, demographic change, climate change etc).

Conclusion

The main findings of this break out group are set out below:

- "'Knowledge of Data' – who is best to articulate this?
- Audit/traceability of data needs to be improved.

- Conditions for use code of practice would be beneficial for the industry to adhere to.
- Good to agree on a standard typology so erase jargon and to ensure all users/providers use a similar language.
- Need to differentiate between data acquisition and data capture.

Need to mention archiving protocols and systems and how that has a big impact on data accessibility.

2.4.3 Objective 3 - Data Acquisition

The questions posed in the questionnaire regarding "Data Acquisition" were as follows:

- Identify ways how data acquisition within the FCM and other related industries could be improved?
- Provide examples of any project (current or future) dealing with data acquisition (brought about by current national and European R&D Initiatives) that occur outside the FCM industry that would benefit this research.

Workshop 1 Response

The group re-emphasised the need to distinguish the difference between the business need and the general background data from which to assess progress. The research project needs to ensure that the common denominators between data projects are in place, and if not, why this is the case and what can be done to ensure that assessment is carried out (each business sets its own standard etc).

A hierarchical approach to data knowledge and acquisition could be encouraged, such as that being advocated through the Shoreline Management Regional Monitoring exercise (A Bradbury 2002). This builds on existing best practice and is driven by key variables. The model for this may be one to adhere to.

A screening process for data acquisition was recommended, though more information from the Agency is required on this. A review of data acquisition was also mentioned (a dynamic system that is receptive to change over varying timescales as well as changing "drivers" within the FCM industry).

Appreciation of how technology will change over time is required and how this may influence future acquisition methods etc. To this end, a path of how current and future data needs are to be acquired, both now and in the future, should be presented. In addition an appreciation of future data needs is paramount to this exercise.

All participants agreed that the project should seek to identify "opportunities for quick wins" where possible. A short-term phased approach is needed (e.g. remote sensing issues of cost/storage). In addition, joint initiatives with key

data bodies (such as EN) could be explored to identify how co-ordinated data collection can save money for both organizations.

Incorporating the level of defence and uncertainty elements associated with this needs to be improved. Periodic reviews of data are required along with a broad understanding of sensitivity issues.

A risk based approach to data acquisition needs to be better spelled out. It was suggested that a clear communication pathway is set up for users on who to approach to attain appropriate standards etc.

Regional Centres of Expertise were discussed. This would help the "intelligent client" and the researcher to know where to go to and who to talk to for required data. A Communication diagram would help this cause.

The project specification clearly states that some big wins are possible if data collection exercises are planned and processed systematically. To achieve this, the knowledge of those bodies that have a shared interest either in the area or in some of the data is required. Considerable cost savings are possible if a more co-ordinated approach is followed between environmental groups with and without the Agency and Flood Defence practitioners. This needs to be explored so that institutional strengthening of the data management protocols and practices can be developed within all relevant bodies in the subsequent research.

Conclusion

The main findings of this break out group are set out below:

- Assess future role of "Regional Centres" of Expertise.
- Need to recommend the adoption of a phased approach to data acquisition.
- Introduce 'Uncertainty' into data acquisition planning.
- Establish a "Route Map" for where to acquire data.
- Consider new data collection technologies.
- Common data standards would be a major way forward.
- Acceptance of the "collect once use often" philosophy.
- Automation methodologies should be pursued where possible.
- Establish the potential for joint data acquisition and processing with environmental organisations.

2.4.4 Objective 4 – Knowledge Management

The questions posed in the questionnaire regarding "Knowledge Management" were as follows:

- Provide data collection or storage techniques/tools (current or future) that would increase the "value" of information generated/compiled within the FCM industry.

- Suggest three incentives (current or future) that would improve participation by the wider community in providing data for flood defence issues.
- What are the main risks associated with these?

2.4.4.1 Workshop 1 Response

There was uncertainty over whether this objective is addressing the dissemination of data or knowledge issue. One positive way forward would be the establishment of a User Data Needs link-back in projects or initiatives.

There are some significant gaps in knowledge management. RASP shows that there are deficiencies in standards of protection of defences. However, it is necessary to ensure a high-level view is taken, and not concentrate on current problems. This has historically been raised as an issue though not addressed sufficiently. Consequently, this research project needs to be forward thinking.

There was concern that this project overlapped with NFCMD, which is likely to become the centralised database. Importantly, it was stressed that this research project has a wide scope, and will only provide an assessment of the current situation and ideas for a possible ways forward, seeking quick wins where possible. It was agreed that centralised databases, such as that being developed for NFCMD are essential.

This project will address the major communication problems that are apparent within the industry. Parts of the industry are guilty of assuming that the wider community has knowledge of data and data requirements and that all make assumptions about knowing what's going on which may not be valid.

Funding and resources are key issues and a skills shortage is apparent. With limited resources the question is how does the industry deliver? This will need to be addressed within the research project.

Incentives are needed to get groups working together. The real issue is how you make it all work together (it is not the technology or the tools that matter). This Position Paper needs to attempt to present how the industry gets from where we are now to where we want to be.

Conclusion

The main findings of this break out group are set out below:

- Centralised databases are good ways forward.
- Limited resources – how do we deliver an effective system with this constraint?
- Skill shortages – what capacity is needed to improve this issue?
- Coordination of data activities.
- Make the science of knowledge management understandable.

2.4.5 Objective 5 - Involvement of Stakeholders in Data Collection

The question posed in the questionnaire regarding "Involvement of Stakeholders" was as follows:

- How should customers be involved in data collection/ dissemination/storage?

Workshop 1 Response

The workshop noted that there are constraints in data management, but in order to allocate more funds the real value of having this data collected, processed and accessible has to be established.

Few examples of community involvement in data collection have been presented within the FCM industry. There are more examples present within other more community-based aspects of coastal management (e.g. beach quality).

A screening process is vital in any broad stakeholder involvement. It was also stressed that any initiative such as stakeholder participation is NOT free as the process requires good management (which comes at a cost).

It was agreed that model specifications are paramount if one is to use stakeholders in data collection/analysis process. (e.g. for coastal local authorities in beach monitoring). Ensuring consistency and quality is vital if this is to be taken forward.

Incentive schemes need to be reviewed. This is a main issue in data maintenance and updating. Contracts may need to be set up as a matter of course to ensure compliance to an agreed specification.

The identification of "quick wins" was stressed and examples where this can be implemented as part of this research work clearly identified.

Conclusion

The main findings of this break out group are set out below:

- What should be the role of the Industry (e.g.: communication advice)?
- Using stakeholders in the process does not mean the process is free.
- Yes, there is a role. But it needs managing effectively.
- Keep advice practical where possible (look for "quick wins".).
- Use of the flood forum's as a group to test the potential use of external stakeholders.
- A short synopsis on how knowledge management applies/assists would be useful to raise the level of understanding in the industry of all these issues.

2.4.6 Objective 6 – New Technology

The question posed in the questionnaire regarding "New Technology" was as follows:

- Suggest new technology techniques that would improve monitoring, data handling, archiving, dissemination and data presentation within the industry.

Workshop 1 Response

Discussion was focussed towards whether there was general harmonisation towards a Geographic Information System (GIS). ESRI and MapInfo are now interoperable. All agreed that increased use of the Internet is very important and will continue, and interestingly, the use of the web has decreased access time to EA data considerably.

The research project should appraise the current marine remote sensing methods, such as those being operated through the insurance industry (Norwich Union) and the Agency (DTM techniques and InterMap remote sensing). The latter will have 1 metre vertical resolution later this year.

It was agreed that new technology is less important than enhanced organisation with respect to data collection. Data and technology should support the whole PROCESS from start to finish.

Techniques for further interrogation include Galileo and other satellite systems which may bring many benefits to FCM related projects.

The issue of data collection strategies was discussed and how there is a need to have these in place up front to help review the options of changing technologies over time. Initially, money should be invested into logging who has got what. It would be worth initiating such an exercise as early as possible.

Archiving data is also equally important. This is not done effectively (not a priority) by the Agency because of resources. Historical trend data over longer periods (Foresight looks at 50-100 years) may be of key importance to risk assessment and planning. There is a national need for this.

A key part of this project should be the provision of a discovery meta-dataset.

Finally, incentives are critical to ensure that organisations have long-term interests in managing datasets.

2.4.6.1 Conclusion

The main findings of this break out group are set out below:

- Internet as a tool should be used more efficiently.
- Archiving of data needs a new efficient strategy associated with it.
- GIS harmonising & integration is important.
- Remote sensing – terrestrial & marine techniques need to be exploited more efficiently.

Technology should support the whole process from start to finish, whilst projects/initiatives need to plan for changing technological advances in the short to medium term where possible.

2.4.7 Workshop Summary

Figure 2.1 is presented to show a summary of the questionnaire and workshops responses outlined above.

DISCUSSION POINTS ON OBJECTIVE 1

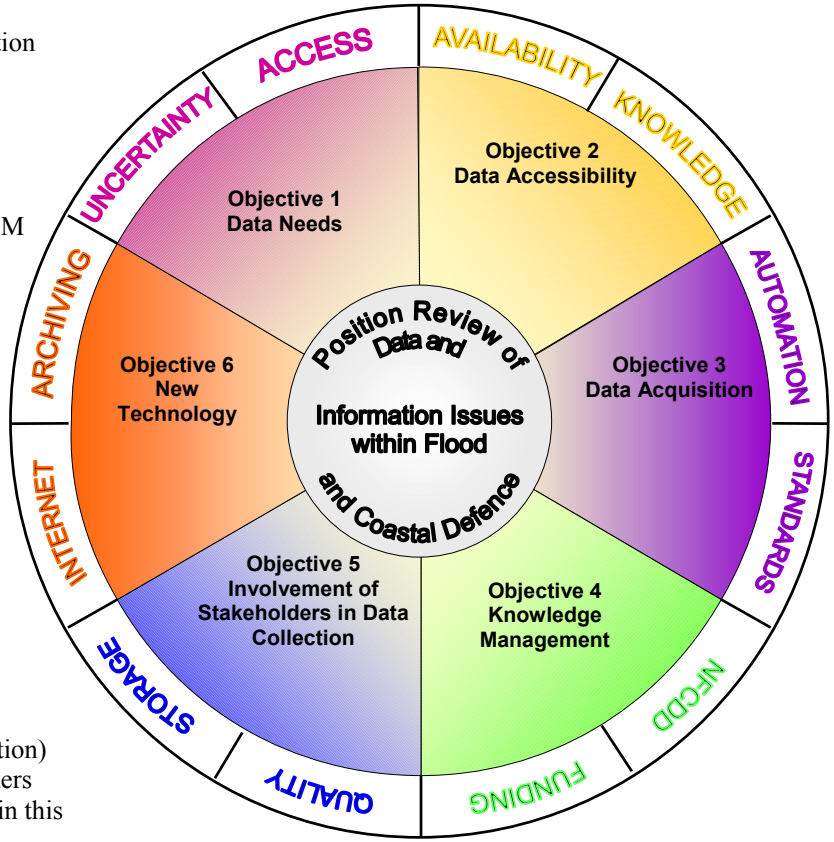
- Data needs relate to information generated
- It is an iterative process
- What is the value of the data required?
- 'What needs to be captured/generated in the FCM

DISCUSSION POINTS ON OBJECTIVE 6

- INTERNET
- Archiving
- GIS harmonising & Integration
- Remote sensing – terrestrial & marine
- Technology both now and in

DISCUSSION POINTS ON OBJECTIVE 5

- Role of Industry (communication)
- "Cost" of involving stakeholders
- How to manage stakeholders in this process
- Provision of practical



DISCUSSION POINTS ON OBJECTIVE 2

- "'Knowledge of Data' – who articulates this?
- Audit/traceability
- Customers responsibility
- Should data format be a key issue?

DISCUSSION POINTS ON OBJECTIVE 3

- Regional Centres of Experts – would this help?
- A phased approach looking forward in time
- Introduce 'Uncertainty' in data acquisition
- Route Map for where to acquire data

DISCUSSION POINTS ON OBJECTIVE 4

- Should centralised databases be used?
- Metadata
- Limited resources – how do we deliver?
- Skill shortages within the industry

3 FOLLOW UP ANALYSIS

3.1 Overview

A range of consultation / analysis techniques have been used to assist in completing Milestone 2. These were undertaken for the following reasons:

- Provide the necessary information to identify and examine the gaps, duplications and opportunities needed for further interrogation during the completion of the draft Position Papers.
- Manage stakeholder expectations of the research output.

3.2 Stakeholder Discussions

The Research Team undertook specific follow up telephone conversations with a range of key data managers (see Appendix B).

The 38th Defra River and Coastal Conference event in Keele 2003 was used as an effective tool to assist in gathering views for this project. A purposely structured hand out was prepared and disseminated on conference stands. The purpose of this is to focus on stakeholders, users and managers of direct relevance to the project. Attendees are asked to communicate best practice, issues and problems that may be assessed in production of the Position Papers. Appendix D includes all comments received.

A review of current FCM research across the six theme areas was undertaken to establish examples of data and information management issues. Theme Leaders were asked to comment on a table of research projects completed or being completed to date (see Section 4).

3.3 Meetings

Separate meetings carried out up to 1 August 2003) included:

1) Meeting with Cathy Greenall (Data Policy Manager within the Data & Information Policies Group EA) 09/05/03.
2) Meeting with David Morris (CEFAS) at Bristol on 07/05/03.
3) Taunton Hydrographic Office Marine Geospatial Data Industry Seminar 1-2 July 2003.
4) Paul Sayers (HRW), Data and information and the RASP project, (W5B(01)02.
5) Cliff Ohl (HRW), Data and information and the PAMS project.
6) David Ramsbottom (HRW) Data and information and the PAMS project.
7) Paul Sayers (HRW), Best Practice in Coastal Flood Forecasting Project (FD2206).
8) Jule Harries (IACMST, CEFAS) on 17 July 2003.
9) Sarah Lavery (informal discussion at the 38th Defra Conference).

4 LITERATURE REVIEW

4.1 Overview

This section outlines the literature review carried out up to 1 August 2003 to determine whether new research is required, or indeed, where uptake of existing research is required. It is also used to express where existing deficiencies lie.

This section examines projects from the perspective of:

- Title/reference of the work.
- Who is doing the work.
- Why is the work being done.
- What area of the FCM process does the work impact.

The metadata containing this information is "web-ready" and can be used to provide an on-line catalogue of projects such that all users can examine relationships between them. For the purpose of this report, the metadata is presented as a Word table and has been separated out into Defra/EA commissioned projects, EA internal initiatives, other UK projects and International projects.

These tables reflect 'current knowledge' and should not be regarded as an accurate or definitive listing. The project process will seek to update this list and verifying the correct authority of all projects consulted.

The project team clearly understands the joined up approach being undertaken by Defra/EA on FCM research as well as other wider coastal initiatives (e.g.: IACMST). Though to assist the project team, it has been decided to divide ongoing EA initiatives (e.g.: SATIS) from other joint research / project data examples. This section of the report is therefore divided up as follows:

4.2 EA Internal Projects & Initiatives.
4.3 DEFRA / EA Commission Projects and Initiatives.
4.4 Other UK projects/initiatives.
4.5 International projects.

This helps the team to identify the framework of research being consulted upon during the production of the Position Papers.

4.2 EA Internal Projects & Initiatives

The projects included in the following table are projects and initiatives that are being undertaken within the EA in support of FCM. Column O/C indicates if the project is on-going (O) or completed (C).

Table 4.1 EA Internal Projects and Initiatives

Known Project Title	Responsible Organisation	Reason for Project / Summary	Relevance to FCM Area	O/C
Agency Data Map	EA	This map associates data sets with geographical locations	National, acquisition	o
Document Management Systems	EA	The Agency have prepared a series of DIALOG procedures : (DIALOG_Prov0.5 - A procedure detailing oversight interaction with projects. DIALOG_Guidance0.6 - A document giving an overview of what is expected (standards, corporate data, DPA etc): Data Quality Query procedures DataQueryProcDraft.1.0 - Procedure detailing how data quality queries are resolved. This details the interaction between contact centre, data specialists and the rest of the Agency. DataQueryWorkInsDraft.1.0 - Details the responsibilities of individuals within the process. Data Acquisition Plan procedures - CrossCuttingDIAP.0.4 - this details how EA identify and capture requirements for cross cutting (national/shared/multi use) data - AcrossFunctionDAP.0.1 - this shows how functions/departments should identify and log their data requirements –Data Acquisition Proc - For a dataset identified by the above, this documents what steps need to be taken when actually acquiring the data.	National and Regional, Knowledge management	o
Draft National Flood	EA		National, Knowledge	o

Defence Data & Data Management Strategy			management	
EA Data and Information Policy Handbook	EA	This handbook discusses the policy towards data and information in the EA in 1997 and as such is relevant to FCM.	Operating Authority, Needs	o
Interim Guidelines for Consultation and Pilot Catchment Studies	EA and DEFRA	Report relevant to the Catchment Management Plans	Geographical, Knowledge management	o
NFCD Database	EA	A single, easily accessible and definitive store for data on flood and coastal defences that is made available to all operating authorities to allow them to make better-informed decisions on the implementation of flood and coastal erosion management.	National, Knowledge management	o
NE Region Data Management Project	EA	Project linked to the NFCMD and has now been handed over to the EA to carry on with the research.	Regional, Knowledge management	o
SATIS – A Strategic Framework for Data and Information Management in the Agency	EA	Stefan Carlyle work through Agency Head Office. The Data Policy Team is responsible for implementing Agency-wide data management policy, ensuring consistent ways of working and delivering quality data that underpin the Agency as an Effective Communicator and Efficient Operator. The team also ensures new computer systems meet policies and standards and that the Agency can meet Information Age Government targets.	Not used in FCM Regional, Knowledge management	o
Agency Knowledge Management Strategy (2000)	EA	Mike Eastwell (Agency Bristol) office initiated in close liason with Cathy Greenall.	National, Knowledge management - Set up as a corporate report, easily adaptable to FCM	o

Table 4.2 Projects and Initiatives outside of the FCM industry.

Project No.	Project Title	Project Manager	Project Status
E1-056	Artificial Intelligence Systems for Diagnosis and Classification of River Quality	John Murray-Bligh	Active Contract

E1-098	Modelling the Fate and Transport of Particulates in Water Phase 2	Simon Gardner	Active Contract
E1-101	Development of Aesthetic Assessment Education and the Public Participation Approach	Malcolm Gorton	Active Contract
E1-103	Earth Observation for Natura 2000 EC Framework V RTD Shared Cost Action	John Kupiec	Active Contract
E1-114	Collection and Analysis of Environmental Stresses Influencing Biologival GQA Data in 2000	John Murray-Bligh	Active Contract
E1-115	Implementation of the Predictive System for Multimetrics PSYM for the Ecological Assessment of Ponds	Shelley Howard	Active Contract
E1-126	Field Sensor for Soil Biological Quality	Robert Bogue	Active Contract
E1-128	Development of a Portable Low Cost Gas Imaging Sensor	Robert Bogue	Active Contract
E1-129	Mammal Monitoring Bats	Alastair Ferguson	Active Contract
E1-130	Standardisation of River Classifications STAR	John Murray-Bligh	Active Contract
E1-132	Development of an Estuarine Classification Scheme Benthic Component	Alison Miles	Active Contract
E1-133	Development of a Predictive System to Assess the Ecological Status of Rivers and Lakes Using Macrophytes	Jo-Anne Pitt	Active Contract
E1-134	Links with National Biodiversity Network	Alastair Ferguson	Active Contract
E1-136	Development of Ammonium ISE	Mike Weston	Active Contract
E1-138	Development of an Ammonia Field Instrument	Terry Long	Active Contract
E1-139	Classification of Transitional and Coastal Waters for Water Framework Directive	Dave Jowett	Active Contract
E1-140	The Development of Lake Classification Tools for Water Framework Directive	Geoff Phillips	Active Contract
E1-M03	Assistance for Managing Projects	Mike Briers	Active Contract
E1-T05	Technical Service CEH	John Murray-Bligh	Active Contract
E1-T11	Advice on Monitoring Programmes and Data Analysis Technical Service	Dave Martin	Active Contract
X1-020	Knowledge Management	Mike Eastwell	Active Contract

X1-028	Internet Publishing of Information on Agency Science Projects and Products Using the Science	Irina Metzler	Active Contract
X1-044	Research into the Requirements For and Impacts of Public Participation in Environmental Decision Making	Malcolm Gorton	Active Contract
E1-078	Development of Chemical Phosphate Sensor	Mike Weston	Awaiting Complet
E1-131	Development of Estuarine Classification Scheme Fish Component	Steve Colclough	Awaiting Complet
W3-025	Analysis of UKDVS GBDVS	Roger Valentine	Completed Project
W3-027	Telemetry Intranet Site Pilot	Dave Lloyd	Completed Project

4.3 Defra / EA Commission Projects and Initiatives

The projects included in the following table are those associated with FCM within the UK that have been externally commissioned by EA/Defra as part of the national FCM programme. Column O/C indicates if the project is on-going (O) or completed (C). In this table 'Organisation Responsible' is the name of the organisation commissioned to undertake the work. This represents the situation at the time of writing (August 2003). The table should not be used to represent a definitive list of Agency /Defra R&D projects and has been used and adapted to assist the Project Team to deliver the objectives of the FD2314 project (this project). Ongoing consultation with Project Officers of selected research projects took place during the summer of 2003. The selection of more detailed research project assessment is deduced from the Table below. Text in bold italics within the Objectives column denotes the key aspects of relevance to this FD2314 project.

Table 4.3 Processes Theme Projects

Known Project Title	Organisation Responsible	Objectives of Research	Issues associated with Data and Information Management	Relevant Objective (no.)	O/C (date)
FD0404 Continuous Simulation Modelling for Flood Estimation	CEH - Wallingford	To ***develop modelling methods*** for river flood frequency estimation in continuous simulation mode: i.e. modelling whole time series as opposed to events.	This project has developed a new method for river flood frequency estimation using continuous simulation, that is, the modelling of catchment runoff response time series.	1, 2, 4	C Apr 1994 / Nov 2001

FD1004 Estuary Morphology – Survey And Modelling For Managed Set-Back Site	HRW	To ***carry out measurements and modelling*** at the managed set-back site at Tollesbury in Essex, to allow continuing assessment of changes in the vicinity of the breach, and in Tollesbury Creek, following breaching which took place in August 1995.	The HR Wallingford contribution over the duration of the second phase of the project was to carry out measurements and modelling, and to assess changes in the vicinity of the sea defence breach and within Tollesbury Creek.	1, 6	C Apr 1994 / Nov 2001
FD 1202 Causes Of Seasonal Sea Level Variations And Implications For Surge Predictions	POL	To ***understand the processes*** causing variations in surge elevation which result in ***persistent errors in present surge forecasts*** and to improve surge models and prediction systems to account correctly for these variations.	The overall aim of this work was to understand processes causing variations in surge elevation which result in persistent errors in forecasts, seen as offsets between observed and forecast surges.	1, 2, 4, 6	C Jan 1998 / Jul 2000
FD1203 Fine Grid Surge Model Evaluation	POL	To establish whether fine scale models of water body surges can ***improve forecast accuracy*** over the large-scale models currently used for national surge prediction.	The aim of this project was to establish whether fine grid surge-tide models could improve forecast accuracy as compared with CS3, the shelf scale (12km grid) model on which the present national surge predictions are based.	1, 4	C Jan 2000 / Dec 2000
FD 1603 Appraisal Of The FEH Statistical Procedures For Flood Frequency Estimation	CEH - Wallingford	To develop a comprehensive summary of flood frequency estimates using the Flood Estimation Handbook (FEH), thus **anticipating difficulties** that might arise when **applying the FEH** to different catchment types.	The Flood Estimation Handbook (FEH) statistical method of flood frequency estimation comprises a series of procedures for estimating the flood peak of a specified return period at almost any site, gauged or un-gauged, on the UK river network.	1, 4, 6	C Sept 2000 / Jul 2002

FD1901 Development of predictive tools and design guidance for mixed beaches	HRW	The overall aim of the research is to facilitate the development of Coastal Strategy Plans and Beach Management Plans by ***improving understanding of processes and responses*** for beaches with widely graded sediments; ***developing predictive tools*** for beach responses; and ***disseminating information and guidance*** to UK shoreline managers.	During the first year of this 3-year programme, good progress has been made on all objectives. The project has received wide interest both nationally and internationally as it is recognised as an important step forward towards improved shoreline management. Work has benefited greatly from the association between HR Wallingford and Imperial College.	1, 2, 3, 4, 5, 6	Apr 2000 / Mar 2003
FD1905 Estuaries Research Programme (1).	Consortium led by HRW	To ***develop*** further the ***understanding of hydrodynamic and sedimentary processes*** and biological sedimentary interactions within estuaries to build on work done in Estuaries Research Programme Phase I providing outputs for use by BSM Theme ***in developing improved Estuary Impact Assessment Systems.***	The main objective is to ***deliver research*** on hydrodynamic and sediment processes in estuaries and the interactions between biology and sediments. The fundamental new research will inform the further development of the management tools for estuary morphology, water quality and ecology assessed in Phase 1 of the Estuaries Research Programme.	1, 4, 6	O Dec 2001 / Nov 2004
FD1911 Freiston Shore Managed Realignment	CEH-Dorset and Cambridge Coastal Research Unit (CCRU)	To ensure a ***comprehensive monitoring campaign*** is undertaken at the largest managed realignment scheme to be progressed in the UK at Freiston.	The wave and tide monitoring started in October 2001, with the installation of two non-directional wave and tide recorders, placed in the saltmarsh surface. The exact positions of the gauges have been measured using GPS positioning.	1, 3, 4, 6	O Dec 2001 / Nov 2007

FD1912 Sandpit: Effects Of Offshore Dredging	Consortium led by HRW	***To develop reliable guidelines and prediction techniques to better understand and predict*** the physical shore-face processes governing medium and long-term changes of the shore-face and coastal zone in response to the impact of human interference such as sand mining, aggregate dredging, sand dumping, and channels and pits for navigation, pipelines and cables.	The first 5 months of the project has been devoted to detailed planning both within UK and with the European project team, to preparing a collation of existing data to give a firm base on which to make the detailed plans, and to improving the SedFlux sediment predictor model. Exchange of information has been undertaken with CEFAS on Defra funded projects on ecological disturbances caused by gravel dredging. Information has also been exchanged with the EC EUMARSAND project (Southampton University).	1, 2, 3, 4, 5, 6,	O Nov 2001 / Apr 2005
FD1913 Revitalisation of the FSR/FEH rainfall runoff model	CEH – Wallingford	***To make improvements*** to antecedent soil moisture conditions, percentage runoff, design storm definition, and unit hydrograph definitions included in the Rainfall-Runoff method.	Activity has focussed on carrying out a scoping study to determine data availability and consequences for the research programme. The study concluded that flood event data collated for the Flood Studies Report, and supplementary studies, should form the basis of the analyses to be carried out in later phases of the project.	1, 2, 3, 4	O Oct 2001 / Oct 2003
FD1914 Guidebook of Applied Fluvial Geomorphology	Nottingham University	To ***produce a guidebook*** of applied fluvial geomorphology suited to the needs of end users wishing to adopt geomorphic principles, analyses and design approaches in river management and engineering.	To explain the scientific progress to date requires a short review of the circumstances that led to commissioning of the project by Defra.	1, 2, 3, 4, 5, 6	O Dec 2001 / Aug 2002
FD1915 Cohesive foreshore	Posford Haskoning	To identify current best practice / state of the art into the Processes associated	To provide guidance of best practise to those managing an eroding	2, 5, 6	O

erosion and beach morphological change		with the erosion of cohesive foreshores and interactions with the sediment budget, and b) to identify the research and development needs to address the gaps in current knowledge	cohesive coastline such as prevails along the East Coast of England and the Severn Estuary		Mar 2003 / Oct 2003
FD1916 Understanding the lowering of beaches in front of coastal defence structures	HR Wallingford	To identify generic elements and processes involved in the scour of beaches in front of coastal defence structures and to define future research to improve our understanding of these	To improve understanding of scour in front of coastal defence structures and provide preliminary advice for the mitigation of the scour	1, 2, 4	C Jan 2003 / Jun 2003
FD1917 Suitability criteria for areas of restored habitat	CEFAS	DRAFT: To produce an electronic decision tree for users to assess the potential of specific sites for habitat restoration schemes. This will be achieved by reviewing a) the existing knowledge on the criteria for growth of natural saltmarsh habitats and b) the guidelines for selection of sites for habitat restoration	To make the best use of land breached for flood and coastal defence by understanding the factors which make areas likely to establish and support the desired habitat	1, 2, 3, 4, 5, 6	O Jun 2003 / Jun 2004
FD1919 Evaluation of the mapping and assessment of Urban and Suburban areas	CEH – Wallingford	To improve the description of the extent of urban and suburban land cover by updating the catchment descriptor URBTEXT(2000) used in the Flood Estimation handbook	To improve understanding, description and quantification of the processes which contribute to the evolution of fluvial systems. To improve the industry standard procedures for flood estimation in the UK	1, 2, 4	O May 2003 / Mar 2005
FD1920 Impact of engineering works on sediments and habitats in rivers	HR Wallingford	See FD1919	See FD1919	1, 2, 4	O
FD1921/ (W5-192/1) Developing a refined Geomorphological & Floodplain component to the River Habitats Survey Methodology	GeoData Institute	To improve the existing geomorphology module to the RHS methodology in order to help determine sediment sources, movements and fates in catchments including a comprehensive floodplain component.	Not assessed	1, 2, 4	C May 2002 / Aug 2003

W5A(01)0 Impact of Recent Floods on River Morphology and Habitats		Compare existing data with the data from the resurvey to determine the ways in which river channel form has developed and changed in each of the four sub-sets	Not assessed	1, 2, 4	C Sep 2001 / Sep 2002
W5A(02)01 Monitoring protocols for habitat migration and managed realignment	ABP Mer	To provide an improved multidisciplinary approach to understanding the ecosystems at habitat migration and managed retreat sites in coastal and estuarine areas in order to produce more complete assessments and better management approaches.	Not assessed	1, 2, 4, 6	O Jan 2002 / Mar 2005
W5B(00)03 Impact of Agricultural Soil Condition on Floods 2000		To carry out targeted surveys of agricultural soils in selected catchments which have flooded during the 2000 Floods in order to find any evidence that the condition of agricultural soils has contributed to the severity of the flooding	not assessed	1, 2, 4, 6	C Feb 2002 /
W5B(97)04/ W5B(01)04 Shingle beach transport models			not assessed		
W5B(98)03 Evaluation of breach processes at Porlock shingle ridge	Portsmouth University	To record and evaluate changes in topography and vegetation following the sea defence breach to improve future prediction of saltmarsh development and contribute to policy on the management of setback sites	not assessed		O Nov 2002 / Mar 2004
W5B(98)04 Wave attenuation over saltmarshes	Cambridge Coastal Research Unit	To develop improved methods for assessing wave attenuation over saltmarshes, taking particular account of the effects of saltmarsh width, height and vegetation cover, and produce guidelines to assist flood defence engineers in understanding the effects under varying wave and tidal conditions	Not assessed		C Dec 1999 / Feb 2002

Table 4.4 Policy Development Theme Projects

Known Project Title	Organisation Responsible	Objectives	Issue Associated with Data and Information Management	Relevant Objective (no.)	O/C (date)
FD1705 Up-Dating and Modernising the 'Yellow/Blue/Red Manuals' for Appraising Coastal Defences and Flood Alleviation Works	Flood Hazard Research Centre	To ***evaluate*** the use of the Yellow and Red Manuals' results and procedures; to review the statistical/probabilistic approaches to evaluating the benefits of erosion control	The initial results, available as of March 2002, indicated a substantial increase in flood damage potential owing to technological change and other factors.	1, 4	C June 2000 / Oct 2002
FD1805 Improving The Implementation And Adoption Of R&D Results	Improving the Implementation and Alleviation Works	To ***identify***, and ***recommend*** a plan for setting up a user-oriented framework and related services for the effective implementation and adoption of R&D results and other related information from the joint Defra/Agency Flood and Coastal Defence R&D Programme.	With the setting up of the new Joint R&D Programme in Flood and Coastal Defence, a key management objective has been to focus on ***user needs*** and ensure that the intended benefits of the R&D projects are delivered	1, 2, 4, 5, 6	C Feb 2001 / Sept 2001
FD2002 Prediction of Future Coastal Evolution for SMP Review ("Future Coast")	Halcrow	To undertake a prediction or estimation of coastal evolution over the next 100 years	The importance of establishing a ***comprehensive and auditable*** methodology for this project was established very early, therefore effort has concentrated on developing the methodology approach	2, 4,	Oct 2000 / Mar 2002

FD2003 Scheme Prioritisation System Review	Risk & Policy Analysts Ltd.	To provide a way of prioritising Government funding to support all possible flood and coastal defence schemes required at any given time.	This study involved a ***review*** of recent submissions; a period of consultation based on the findings of this review; a workshop to develop ***key criteria***; and a second consultation setting out two alternative revised systems.	1, 2, 3, 4, 5, 6	C Aug 2000 / Jul 2001
FD2004 Extension Of National Appraisal Of Assets At Risk From Flooding And Coastal Erosion	Halcrow	To extend the recently completed National Appraisal of Assets to Wales and to refine the earlier work	The results of the research have been used by Defra to provide support to the spending review process, helping to inform decisions taken regarding future budgetary provisions for the funding of capital works and defence maintenance.	1, 2, 4,	C Oct 2000 / Nov 2001
FD2005 The appraisal of human related intangible impacts of flooding	Risk & Policy Analysts Ltd.	To develop a robust, yet ***simple-to-use***, methodology so that intangible impacts on human health and well being can be accounted for in assessing the benefits of flood alleviation measures.	The literature review aimed to assess the relevance of previous work and to identify possible approaches to measuring and valuing the intangible impacts of flooding. It was found that, whilst there were a number of studies concerning the health effects arising from flooding, there was no existing work on the valuation of such effects specifically relating to flooding.	1, 2, 3, 4,	C Jan 2001 / Dec 2002
FD2007 Improving Public Awareness and understanding about flood risk	Scott Wilson	The generic objective of this research project is *to* ***review current communication practices*** used in coastal and flood defence.	From this, suggestions on ***best practice*** approaches in risk communication and awareness raising are to be supplied. These suggestions will then form the basis of detailed ***recommendations*** on conflict resolution and awareness raising when implementing flood and coastal defence measures.	1, 2, 4, 5, 6	C Oct 2001 / Nov 2002

FD2008 Implementing Managed Realignment as a Strategic Flood and Coastal Defence option	Halcrow	To produce ***guidance*** and ***recommendations*** to enhance and increase the take up of managed realignment as a strategic flood and coastal defence policy option aimed at enhance flood and coastal defence sustainability and achieve environmental gains.	The research comprises a ***review of experience***, both in England and Wales and overseas; conducting postal questionnaires and regional workshops to gather information and opinions; analysing in detail three case studies; and an examination of the implementation of present policy relating to SMP, economic valuation, financial compensation, nature conservation and planning.	1, 2, 3, 4, 5, 6	C Sept 2001 / Aug 2002
FD2009 Consistent Standards of Flood Defence for Flood Cells	HRW	To identify the ***key benefits*** and ***disadvantages*** of adopting consistent flood defence standards drawing on experience at selected sites where inconsistent standards have been reported as an issue.	This research will assess, clearly and objectively, the practical advantages and disadvantages of a policy of consistent flood defence standards and the impact this would have on national, regional and local objectives. It will help determine whether and how current approaches to design and appraisal would need to be modified to adopt a policy of consistent standards and what the broad implications of this would be for local flood risk and national expenditure programmes.	1, 2, 3, 4	C Jan 2002 / Jan 2003
FD2010 Flood Plain Management Manual (Phase 1)	HRW	To provide preliminary guidance on the effective management of floodplains to river managers, local authorities, local communities, conservationists and developers leading to the provision of a Flood Plain manual that forms a ***common reference*** for all parties involved in floodplain management.	The main output is a document which provides preliminary guidance on the contents of a floodplain management manual including identification of the flood plain, flood plain features, the flood management function, land management, conservation, enhancement opportunities and guidance on development control and floodplain zoning. It was aimed to be trialled on managers, local authority	1, 4	Dec 2001 / Apr 2002

			planners and other relevant functions, local communities, conservationists and other relevant stakeholders:		
FD2012 Post Event Appraisal – Phase 1	Bullen	To examine the ***effectiveness of the monitoring and recording procedures*** currently employed by the Operating Authorities and Defra to collect data on events compared to best practice in other industries and the emergency services.	The work to date involves the identification and subsequent review of all relevant recent, on-going projects and initiatives. Only a few topics are likely to require the development of new procedures. This project will therefore draw heavily on those initiatives. This study also needs to take account of these as they may require additional data or changes to reporting requirements.	1, 2, 3, 4, 5	C Sept 2001 / Aug 2002
FD2013 Multicriteria Analysis	RPA	To ***develop and test Multi criteria analysis techniques*** suitable for the appraisal of flood and coastal defence projects.	Review of recommendations for DEFRA/EA project appraisal guidance on Multi-Criteria techniques (data analysis) that will improve flood and coastal defence decision making.		C

4.5 Broad Scale Modelling Theme Projects

Known Project Title	Organisation Responsible	Objectives	Issue Associated with Data and Information Management	Relevant Objective (no.)	O/C (date)

FD0114 Catchment Management System – Phase 1: Hydraulics	HRW	To ***build a Catchment Management System*** for the purpose of catchment management planning, with special reference to flood defence issues.	Integrated Catchment Modelling was the focus of the European EUROTAS project. There was an agreed relationship between Defra-related studies and this project with a proportion of HRW's ***funding*** being used to develop approaches for the latter studies.	1, 4, 5	C Sept 1997 / Mar 2001
FD0421 Catchment Management System – Phase 1: Framework and Demonstration	CEH - Wallingford	To build a ***prototype Catchment Management System*** for the purpose of catchment management planning, with special reference to flood defence issues.	The objective of this project was to build a prototype Catchment Management System for the purpose of catchment management planning, with special reference to flood defence issues. In particular, the system will provide a direct linkage between hydrological and hydraulic models in order to provide an ***improved tool*** for the assessment of flood risk within a catchment.	1, 2, 3, 4, 6	C Apr 1997 / Mar 2002
FD1401 Estuary Research Programme Phase 1	Consortium Led by HRW	To ***compile a new suite of tools*** for predicting morphology, water quality and ecology using existing methods, and make recommendations regarding reliability and the range of applicability	In December 1998 MAFF (now Defra), the Environment Agency and English Nature initiated Phase 1 of the Estuaries Research Programme. This 2-year project was carried out by the EMPHASYS consortium, which comprised consulting engineers, research laboratories and university researchers.	1, 2, 3, 4, 5, 6	C Dec 1998 / Dec 2000

FD1604 Accommodating Uncertainty In Applying Broad-Scale Modelling For Flood Frequency Estimation	CEH - Wallingford	To ***develop and apply methods for quantification*** of the uncertainty about parameters of broad-scale catchment hydrological models for use in estimating flood frequencies by continuous simulation.	The project developed and applied methods for quantification of the uncertainty about parameters of broad-scale catchment hydrological models for use in estimating flood frequencies by continuous simulation.	1, 2, 4	C Oct 1999 / Jul 2000
FD2103 Generation Of Spatially Consistent Rainfall Data – Refinement And Testing Of Simplified Models	Imperial College London and University College London	To provide a method for generating long-term temporal and spatially ***consistent***, rainfall series to support a ***new approach*** to flood estimation based on continuous rainfall-runoff simulation.	In the present project, a combined methodology has been developed. It was envisaged that model application would be based on data from a network of daily raingauges, perhaps with one or two sub daily gauges. The GLM can be fitted using the daily data, and used to interpolate ***missing data***, define daily rainfall at additional locations, or extend the data series by simulation.	1, 2, 3, 4, 6	Dec 2000 / Aug 2001
FD2104 Scoping Of Broad Scale Modelling Hydrology Programme	CEH - Wallingford	To develop the Broad Scale Modelling hydrological R&D programme.	This project presented a strategic vision for the hydrological programme of the Broad Scale Modelling Theme of the Defra/Environment Agency Flood Management Research Programme over a five to ten year time span.	1, 6	C Aug 2001 / Mar 2002
FD2105 Improved methods for national spatial-temporal rainfall and evaporation modelling	CEH - Wallingford	To provide ***appropriate inputs to continuous simulation rainfall-runoff models*** to represent the actual and likely effects of climate change for Broad Scale Modelling (BSM)	Hope generate rainfall series for input into the national continuous simulation runoff model (FD2106) for future use in Catchment Flood Management Plans (CFMPs) and ultimately as a replacement for the FEH (Flood Estimation Handbook)	1, 2, 4, 6	O
FD2106 National river catchment	CEH - Wallingford	To exploit advances in hydrological runoff modelling techniques for the	A preliminary selection of daily sites has been made, based on length of	1, 2, 4, 6	O

flood frequency method using continuous simulation		advantages they offer design practice and planning through river flood frequency estimation	***available*** record, catchment area, data quality and good spatial coverage. The set of catchment properties has been reassessed, so that all properties used in the new work will be ***readily available*** / calculable for any river catchment in Britain.		Dec 2001 / Nov 2004
FD2107 Development of estuary morphological models	Awaiting Award		Not assessed	1, 2, 3, 4, 5, 6	O
FD2108 Broad Scale Ecosystem impact modelling – scoping study	Cascade Consulting	To provide an overview of the topic of Broad Scale Ecosystem Impact Modelling (BSEIM) and define an appropriate and ***cost-effective*** research programme.	There are a number of ***policy*** and regulatory drivers that have stimulated this research, linked to the requirement to better understand the impacts of policies and subsequent measures on the environment and thereby to protect and enhance supported ecosystems.	1, 4, 6	C Jan 2002 / Dec 2002
FD2110 Estuaries Research Programme Phase 2 – Take-up study from Phase 1	Posford	To set up a take up and training programme for the outputs of the Estuary Research Programme Phase 1	Consultation with ***stakeholders*** of the Mersey and Blackwater Estuaries was carried out to establish the ***issues or concerns*** that could form a basis for demonstration projects. In Phase 1, meetings took place with local representatives from the Environment Agency and English Nature and the manager of the Estuary Strategy for each estuary and identified a number of broad issues.	1, 2, 3, 4, 5, 6	C Feb 2002 / Nov 2002
FD2111 Socio-economic impact modelling – scoping study			Not assessed		O

FD2112 Advanced hydraulic modelling tools scoping study	Awaiting Award	Broad Scale Ecosystem Impact Modelling Phase 1	not assessed		O
FD2113 Scoping of broad scale modelling hydrology programme	UCL	Representation of Climate Change for Continuous Simulation	not assessed		O
FD2114 Review of impacts of rural land use and management on flood generation	Newcastle University	To give the current state of information from past and ongoing work of effects of rural land use and soil management on flood generation; to propose and cost a reasoned research programme of inclusion of land management in flood impact estimation	not assessed	1, 2, 3, 4, 5, 6	O
FD2115 ERP2 Research Plan	University College London	To present a five year Research Plan for Phase 2 of the Defra/Agency Estuaries Research Programme (ERP).	The Final Project Report presented a five-year Research Plan for Phase 2 of the Defra/Agency Estuaries Research Programme (ERP)	1, 2, 3, 4, 5, 6	C Dec 2001 / Mar 2002
FD2116 ERP2 Development and demonstration of systems-based estuary simulators	Awaiting Award	Information not readily available	not assessed		O

4.6 Flood Forecasting and Warning Theme Projects

Known Project Title	Organisation Responsible	Objectives	Issue Associated with Data and Information Management	Relevant Objective (no.)	O/C (date)
FD2201 Extreme Flood Recognition, Fluvial	University of Salford	To analyse historical extreme flood events, investigate and identify characteristics of meteorological conditions that can result in extreme floods in order to improve recognition	In the project report, the results of a joint study carried out by the University of Salford and the Met. Office on behalf of Defra are described. The research has	1, 2, 4, 5	C Aug 2002 / Apr 2002

		of possible events in the future.	investigated the nature of very extreme rainfall events and the meteorological situations leading to their occurrence, and also the susceptibility of river catchments to their spatial and temporal rainfall patterns. ***Guidance on the recognition of extreme events is provided.***		
FD2202 Improving dissemination of flood warnings	Qinetiq Ltd	To critically compare current methods with current and upcoming practice employed within the information technology industry.	Aim to develop an improved, customer focused dissemination methodology and review the model of service in terms of leasing or purchase of hardware. Designing a procedure to test the specified system and implement a Pilot Project centred upon one region of the Environment Agency enabling assessment over at least one full summer and winter period is intended.	1, 2, 4, 6	O
FD2206 Best Practice in Coastal Flood Forecasting	HRW	To produce ***best practice*** guidelines within which future coastal flood forecasting should operate.	Not assessed	4	O Mar 2002 / Feb 2003
FD2207 Storm Scale Numerical Modelling	Met Office	To investigate the ability of a storm scale configuration of the Met. Office Numerical Weather Prediction (NWP) model to predict flood producing rainfall up to 12 hours ahead and to develop appropriate tools to interpret and present the predictions in order to enhance operational flood prediction capabilities	Monitoring the weather for new case studies has been ongoing. No good cases have been identified in the period of this report; however there are old events available. Work has been undertaken to classify the different types of case study that are required so that ultimately a balanced assessment of model performance can be obtained.	2, 4, 6	O Jan 2001 / Nov 2004

W5B(95)01 Predicting extreme water levels in estuaries for flood warning	Halcrow	To ***review performance information on existing hydraulic and hydrological models*** used in real-time, to provide guidelines on the most suitable models for use in particular catchment conditions, including confidence limits, and to identify R&D needs.	not assessed	
W5C(99)01/2 Flood forecasting and warning – Best practice baseline review		Information not readily available	not assessed	
W5C(99)01/4 Rainfall Forecasting	Atkins	Information not readily available		C
W5C(00)01 Flood Warning for Vulnerable Groups	University of Surrey	To identify vulnerable groups and investigate how the effectiveness of flood warnings to these groups could be improved. in order to improve their availability & ability to respond and contribute to the improvement in the performance of the flood warning service.		C Jul 2001 / Aug 2003
W5C(00)02 The Social Performance of Flood Warning Communications	MDX University	Information not readily available	Not assessed	O
W5C(00)19 Mitigation of Climate Induced Natural Hazards (MITCH)	HRW	Information not readily available	Not assessed	C
W5C(01)01 Development of Flood Warning Management System	EA	Information not readily available	Not assessed	O
W5C(01)02		Information not readily available	Not assessed	

Estimating antecedent conditions of catchment wetness				
W5C(01)03 Inclusion of organisations in flood planning and warning – Supporting activities	National Flood Forum	Information not readily available	Not assessed	O
W5C(02)01 Improved flood warning awareness and response in low probability/high risk flood zones	Greenstreet Berman	Information not readily available	Not assessed	C

Table 4.7 Risk and Uncertainty Theme Projects

Known Project Title	Organisation Responsible	Objectives	Issue Associated with Data and Information Management	Relevant Objective (no.)	O/C (date)
CC 0337 Regional Climate Change Impact And Response Studies In East Anglia And North West England (REGIS)	Consortium led by Cranfield University	To evaluate the impacts of climate change, through an ***integrated*** methodology, on the agriculture, hydrology, biodiversity, and coastal areas of East Anglia and North West England.	The principal aim of RegIS was the development of a ***robust*** and transparent methodology for stakeholder-led, regional assessment of climate change impacts and cross-sectoral interactions between the major sectors driving landscape change. This methodology has been developed in the North West and East Anglia, and is believed to be transportable to other regions of the UK, thereby providing a framework for further assessments and studies.	1, 2, 3, 4, 5, 6	C Nov 1998 / Oct 2000

FD 0206 Joint Probability Of Extreme Estuarine Water Levels	HRW	To produce and demonstrate a robust methodology for determining extreme estuarine water levels due to the combined effects of tides, surges, flows and waves in a range of realistic situations. To disseminate joint probability research to the UK coastal engineering community	During 2000/01, HRW undertook its final research efforts prior to production of a final report and concentrated on refining, automating and validating various aspects of the ***data preparation***, analysis method, and interpretation of results and assessment of ***uncertainties***. At a late stage in the project, the opportunity arose to apply one of the new developments within the ongoing Thames Tidal Walls Strategy Study	1, 2, 3, 4, 5, 6	C Apr 1997 / July 2000
FD 1204 Integrated Effects Of Climate Change On Coastal Extreme Sea Levels	POL	To derive guidance on changes/trends in extreme sea levels from existing information.	Contributions to any change in extreme sea levels, as observed at the coast, result from a number of inter-related components. The intention was to combine: global MSL change and observed regional trends; regional land movements; tidal changes due to increasing sea level; and changes in extreme storm surge elevations caused by changes in "storminess" with increasing levels of atmospheric CO2	1, 4, 6	C Jan 1999 / Jan 2001
FD 1704 Joint Probability: Dissemination, Beta Testing And Alternative Applications	HRW	To capitalise on the recently developed JOIN-SEA joint probability methods and software, both by industry dissemination and testing, and by finding new and alternative coastal and river engineering applications for them.	Both large waves and high water levels are important in design and assessment of sea defences. Defra has been funding work on joint probability for several years, focusing primarily on its applications to waves and water levels and to tides and surges.	1, 2, 6	C Jul 1999 / Mar 2001
FD 2301 Absolute Fixing Of Tide Gauge	POL	To ***improve*** the monitoring of the vertical land movement component of changes in mean sea level using a	The ***dual Continuous GPS station concept has been further investigated*** and it has been found	2, 4, 6	Mar 2000 / Jun 2003

Benchmarks Phase 2		combination of Continuously Operating GPS Receivers (COGRs) and episodic Global Positioning System (GPS) measurements around the coastline of Great Britain.	that relative vertical station velocities are not biased by periodic variations and are less dependent on the length of the time series. The possibility of combining these relative velocities with absolute gravity or geological estimates of land movement will be investigated during the next stage of the research.		
FD 2302 Risk And Uncertainty Review	HRW	To ***develop standards*** to represent statistical uncertainty in parameters derived from field data and systematic uncertainties (incompleteness) associated with risk models and design methods.	To be assessed	1, 4, 6	Nov 2000 / Apr 2002
FD 2303 Coastal Defence Vulnerability 2075	HRW	To assess the possible changes in coastal defence vulnerability caused by global climate change over the next 75 years.	Three methods of estimating the changes in coastal defence vulnerability between now and 2075 were used.	1, 2, 3, 4	C Jun 2000 / May 2001
FD 2304 To What Degree Can The October/November 2000 Flood Events Be Attributed To Climate Change?	CEH - Wallingford	To address the following key questions: "How unusual was the October/November 2000 flooding and rainfall in a historical context?" and "Can the October/November 2000 floods and rainfall be linked to climate change?"	Viewed in a national context, the extent and duration of the flooding has few recorded parallels. It is impossible to attribute a single weather event to climate change by looking only at that event, i.e. it is not possible to attribute the 2000 flooding and rainfall in them to climate change.	1, 4	C Dec 2000 / Jun 2001
FD 2308 Joint Probability – Dependence Mapping And Best Practice	HRW	To continue the process of dissemination and appropriate take-up of joint probability research which assesses environmental variables including waves, tides, surges, rainfall and wind through dependence mapping and development of test practice guidelines.	***Data series*** on river flows, rainfall, tide, surge, water level, waves, wind-sea and swell-sea were purchased, collated, and where necessary shared between project team members. An outline of the ***best practice guide final report on use of joint probability methods*** has been	1, 2, 3, 4, 5, 6	O Dec 2001 / Nov 2004

			prepared. A mailing was prepared outlining the project aims and methodology. A list of ***consultees*** was assembled		
FD 2311 Environmental Change Indicators For Flood And Coastal Defence	CEH - Wallingford	To identify, define and select a range of climate change indicators relevant to flood and coastal defence and to develop mechanisms for monitoring, analysing and interpreting findings	***This project has sought to identify*** a wide range of possible Environmental Change Indicators (ECIs) for England and Wales related to floods, to ***locate data*** series over sufficiently long periods to make the ECI calculations valid, to produce a small number of pilot indicators, and to discuss their implications for future use and expansion.	1, 2, 3, 4	C Dec 2001 / Oct 2002
FD2315 Concerted Action Performance Evaluation	HRW	To review performance evaluation procedures, develop a risk-based framework and ***identify future*** R&D requirements for performance evaluation and manage the associated ***risks and uncertainties*** of flood defence structures. To produce a first draft of the FCM PAG6 guide on Post-Project evaluation.	To be assessed	1, 4	Mar 2002 / Mar 2003
FD2317 Risks to People	HRW	Research has already been carried out relating the risk of death to many of these factors. This research has been analysed and a preliminary method has been developed for estimating flood risk to individuals and groups. The method requires data on a range of factors including characteristics of floods, floodplains and the affected population. The data are already available or can be derived from	The method has been tested on a small number of contrasting historic flood events. These initial results are encouraging but further development and testing is needed in Phase 2, namely: • Research to refine the methodology including: - linking flood hazard to risks to people - the impacts of flood warning on risks to people		C

		existing or planned data sets and models.	- linking social vulnerability and behaviour with risk of injury/death • Research to apply the methodology within a GIS based system for risk mapping, including: - calculating the flood hazard - development of a map-based approach • Pilot testing • A guidance document on assessing and managing flood risks to people for use by a range of stakeholders.		
AE1039 National Coastal Data Co-ordination (IACMST)	CEFAS	Appointment of Jule Harries	Constant liaison with Jule over work procedures in her remit.	1, 2, 3, 4, 5, 6	O
FD2318 Performance and Reliability in Flood and Coastal Defences	HRW	Information not readily available			O
W5B(00)05 Performance in the management and design of flood and coastal defences – framework study		Information not readily available			
W5B(01)01 Risk evaluation of Agency flood retention reservoirs		Information not readily available			
W5B(01)02 Risk Assessment of Flood and Coastal Defence Systems for	HRW	Information not readily available			O

Strategic Planning					
W5B(01)03 Failure 'on demand' of Flood Defence scheme components		Information not readily available			
W5B(01)04 Climate change impact scenarios	HRW	Information not readily available			
W5B(01)05 Climate change impacts on flood flows in river catchments	CEH – Wallingford	Information not readily available			O
W5D(00)04 Scoping study for Agency / CEH Wallingford Programme		Information not readily available			

Table 4.8 Engineering Theme Projects

Known Project Title	Organisation Responsible	Objectives	Issue Associated with Data and Information Management	Relevant Objective (no.)	O/C

FD 1302 Sand Dune Processes And Management For Flood And Coastal Defence	Royal Holloway University of London	To review the current methodologies and techniques available for the management of coastal dune systems. To evaluate the effects of climate change on dunes and associated beach systems and assess the likely effects of removing hard defences to recreate dynamic dune systems.	Coastal sand dunes are an important landform type and habitat around the coast of the British Isles. The underlying premise of this work is that any national coastal dune management strategy with long-term vision must be based on adequate knowledge of the geomorphology and dynamics of dunes, their ecological and flood defence significance, and their value for other interests.	4, 6	C Jul 1999 / Dec 2002
FD 2401 Coastal Rock Structures On Unprepared Foundations	HRW	Undertake a scoping study into the viability of constructing rock coastal structures on unprepared foundations, including structure performance, constructability, maintenance requirements and environmental issues. Consider future research requirements.	A ***scoping study*** into 'Coastal Rock Structures on Unprepared Foundations' was undertaken by HR Wallingford. The study methodology and findings are documented in the HR Wallingford report SR 577. During the course of the study possible advantages of constructions with limited layers or foundations were identified and an Industry Workshop was held to discuss the issues concerned and ways forward.	1, 4, 6	C May 2000 / Sept 2000
FD 2403 Soft Cliffs: Prediction Of Recession Rates And Erosion Control Techniques: Examples And Publication	High-Point Rendel	To develop an understanding of the processes of cliff stability and cliff recession with respect to managing cliffs.	The results have enabled a much ***greater understanding*** of the processes of cliff stability and cliff recession with respect to managing cliffs. The work will enable practitioners in the field of coastal management to be better able to predict the probability of cliff failure and how to ***evaluate the consequences*** in terms of ***costs, benefits*** and remedial action.	1, 2, 4	C Mar 2002 / Aug 2002

FD2409 Low cost rock structures for beach control and coast protection – practical design guidance	HRW	To prepare practical guidance for the design and analysis of low cost structures for beach control and coast protection.	Good progress has been made in identifying the performance requirements for rock structures, defining present design guidance/practice and collecting scheme information. Appropriate case studies have been identified and analysis has commenced. This is expected to provide a useful foundation from which the practical design guidance can be developed.	1, 2, 3, 4,	Jan 2002 / Dec 2002
FD 2410 Coastal Flooding Hazard By Wave Overtopping	HRW	In collaboration with a number of ***European*** projects, to improve numerical models of wave overtopping of coastal defence structures and to develop design guidance as to which models are suitable for which circumstances.	This research has partially focussed on ***obtaining new data sets*** for test structures that have not been tested previously, and on reproducing comparative data sets for existing empirical methods. The research has provided new data that will enable existing design methods to be improved and updated	1, 2, 3, 4, 5, 6	C Jan 2002 / Mar 2002
FD2411 Reducing the risks of embankment failure under extreme conditions	HRW	To enable operating authorities to ***understand*** and address ***critical issues*** related to the effective performance of flood and coastal defence embankments – particularly to develop a risk-based framework for their design, inspection and maintenance relating to potential mechanisms and consequences of failure.	The scope of this project funding includes both research on flood embankments in the UK and support for the European IMPACT project. For the UK embankments work, initial activity focuses on identification of key players (relating to flood defence embankments) and initiating a programme of consultation. This has been implemented as planned	1, 4, 6	O Jan 2002 / Nov 2004

FD2412 Coastal Flooding Hazard by Wave Overtopping – CLASH	HRW	To develop new methods for engineers and managers to analyse/design defences against wave -induced flooding and overtopping hazards.	Under CLASH and FD2412, HRW are committed to a programme of full-scale measurements of overtopping at Samphire Hoe, Kent, England, followed by a hydraulic model tests at small scale.	1, 2, 3, 4	O Jan 2002 / May 2005
FD2413 Guidance on design and implementation of managed realignment	CIRIA	To improve the design and implementation of managed realignment projects and encourage wider use as a tool for achieving sustainable coastal management and flood defence	To deliver guidance on technical design for realignment schemes and practical advise for engineers to help them address issues that they may face in scheme development		O Mar 2003 / May 2004
W5A(95)02 Fluvial design manual – Phase 2	Black & Veatch	Information not readily available			C
W5A(00)01 Hydraulic performance of bridges and other structures at high flows – Phases 1 and 2	JBA	To develop a computer-based package for advising on, and estimating, the effects of afflux and blockage in fluvial and drainage systems	To be assessed		O Sep 2003 / Sep 2004
W5A(01)01 Reducing uncertainty in river flood conveyance – Phase 2	HRW	To develop improved tools and techniques for estimation of water level for given flood discharge condition, and to implement this management knowledge into flood forecasting, design and maintenance procedures.			O Feb 2001 / Sep 2004
W5A(01)03 Concerted Action on		Information not readily available			

Operation and Maintenance of Flood and Coastal Defences				
W5A(01)05 Application of river and coastal restoration and habitat improvement techniques	River Restoration	To undertake preparatory site data collection and web-site development to facilitate production of a tool kit for river restoration and habitat improvement.	To update R&D Publication 11, "Waterways bank protection - A guide to erosion assessment and management" in order to ensure that best practice is maintained and further encouraged through its use	C Mar 2001 / May 2002
W5A(01)08 Concerted Action on Flood & Coastal Defence Construction	HRW	Information not readily available		O
W5A(01)11 Updating Freeboard Manual		Information not readily available		
W5A(01)12 HEC-RAS river flow model benchmarking	Bullen	to review HECRAS as an unsteady state hydraulic modelling tool to give an authoritative statement of strengths and weaknesses in UK conditions.		C Mar 2003 / Jun 2003
W5A(01)14 Engineering Materials in River and Coastal Engineering	HRW	To produce an overview / reference paper on engineering materials in flood and coastal defences to (a) inform practitioners, and (b) identify gaps in current knowledge or available information. To provide a framework for prediction of performance (durability) of rock armour blocks in coastal defence structures, and related		O

		acceptance criteria for test results. To provide guidance to industry on the sustainable use of timber in coastal and fluvial construction		
W5B(00)01 Weirs – Best practice guidance		Information not readily available		
W5E(02)05 Sustainable re-use of tyres in coastal engineering	HRW	Information not readily available		O
W5E(02)50 SUDS Techniques – hydraulic, structural and water quality issues	CIRIA DTI PII	Information not readily available		O
W5E(02)06 Follow on to Concerted Action on "Delivering the Construction Product"		Information not readily available		
W5G(01)02 IACR – Centre for Aquatic Plant Management	Centre for Aquatic Plant Management	Information not readily available		O

Table 4.9 Other UK projects/initiatives

The non exclusive project list included in the following table represent those initiatives associated with FCM within the UK that are not part of the EA/DEFRA FCM programme. Column O/C indicates is the project is on-going (O) or completed (C).

Known Project Title	Organisation	Issue Associated with Data and Information Management	FCM Area	O/C
Government Interoperability Framework	UK Government	Development of standardised metadata	National, Accessibility and technology	O
Inter-Agency Committee on Marine Science and Technology (IACMST)	UK Government	Committee of all government agencies with and interest in marine and coastal issues.	Covers a number of generic data and information issues in the coastal zone that are relevant to FCM	O
ICZM in the UK: A Stocktake	Defra	Need for improved communication on what ICZM information is important to decision makers and what is not	Generic ICZM data and information problem issues.	o
Marine and Coastal Mapping	Defra/CEFAS	CEFAS are pursuing approaches to promote integrated mapping in the coastal zone. Have published two documents on marine and coastal data / mapping initiatives.	Not directly FCM related, but useful reference on projects covering data access and interoperability in CZ.	C
Irish Sea Pilot project	English Nature	Review of data sets relating to sub-littoral environments and nature conservation in the Irish Sea	Not a direct FCM related project through an interesting incite into data collection procedures.	O
ICZ Map	CEFAS/Defra	Data for the ICZMap pilot areas of The Solent, Firth of Forth and Milford Haven was distributed to key users in March 2003.	Issue of “coastline” definition is of relevance to this project	0
Integrated Coastal Hydrography (ICH),	United Kingdom Hydrographic Office (UKHO) in a partnership with Ordnance Survey,	This is now under way, with the aim of providing an on-line database of hydrographic meta data for all survey data collected in the sensitive shallow waters around the coast of UK.	Whilst ICZMap concentrates on issues surrounding mapping the coastal zone, ICH concentrates on improving knowledge of data	o

	the Environment Agency and the Maritime Coastguard Agency (MCA).		sources and methods which to date has prevented a coherent approach to data capture in the intertidal areas of UK.

Table 4.10 - International projects

The projects included in the following table are all project which included aspects of FCM in countries other than the UK. Column O/C indicates is the project is on-going (O) or completed (C).

Known Project Title	Responsible Organisation	Issue Associated with Data and Information Management / Summary	Relevance to FCM Area	O/C
Global Observing Ocean System (GOOS)	GOOS	GOOS and its European component Eurogoos has the aim of proving a real-time observing network for marine conditions..	Primarily relevant to coastal flood forecasting	O
EC Technical Annex: Service Contract Concerning Coastal Erosion – Evaluation of the needs for action (EUROSION)	EC (DG Environment)	The aim is to establish a pan-European geographically referenced dataset of information needed to support coastal erosion management. It is also seeks to inform European policy for coastal erosion management. The project team are in discussions with the Essex Estuaries Initiative to discuss their case study for Local Information Partnerships.	Primarily relevant to FCM design and planning.	O
ISO 19115	ISO	ISO 19115 for geospatial metadata is now an accepted standard.	All aspects of data exchange and storage related to FCM.	O
North Sea Coastal Manager's Group Project on Sharing Data	??	Related to the above, this is an initiative used ISO19115 in a common metadata catalogue for organisations involved in managing the North Sea Coastal Zone. Led through Germany and John Kupiec at EA Twerton is responsible for UK input.	All aspects of data exchange and storage related to FCMD.	?
CoastBase	EC DG-IST	A project to develop a pan-European distributed catalogue of coastal data	All aspects of data exchange and storage related to FCM	C
GMES	EC/ESA	Initiative to realise a pan-European monitoring network based on EO data. Thematic projects dealing with 'risk management' and 'coastal management'	Relevant to FCM design and planning and also forecasting	O

INSPIRE	EC	An initiative to realise a pan-European spatial data infrastructure.	All aspects of data exchange and storage related to FCM	O
FloodSite	EC	FP6 Research Project that will guide European flood management research for the next 5 years	All aspects of FCM	O
COMRISK	EU INTERREG 3b project	Reviewing coastal flood risk management across a number of member countries	Coastal flood risk	O

5 POSITION PAPERS

5.1 Template for Position Papers

To help the project team prepare an integrated report that covers the six main objectives (Position Papers) for the study, a specific template was been prepared. This attempted to ensure consistency in approach and help in the compilation of an integrated research report.

The Project Team produced draft Position Papers during July/August 2003. These were reviewed during August 2003. Additional information has been made available during the latter phases of the project from key individuals within the Agency, though such information would not be reflected in the Position Papers presented within PR.

The Draft Position Papers represented a deliverable for the project as determined by the project CSG7 form. Consequently, these are included within this PR report for completeness. Whilst the background research into the 6 Position Papers is required as a matter of course, and whilst separate statements were required on each of the six, it was soon realised that a new approach was to be needed for the final TR report. This was because significant overlap in issues was being found.

An example of **'data creation'** is provided for clarification. One Position Paper considers what is needed (e.g.: Position Paper A - Data Needs), another focuses on how this data can be provided (Position Paper C - Data Acquisition), another Position Paper focuses on whether the data can be provided outside of the EA (i.e.: Position Paper E - Stakeholder Involvement) and another can new technology be used to capture it (i.e.: Position Paper F - New Technology).

The Position Papers presented in the following sections (Section 5.2 to 5.7) represent the views of the Project Team at the time of writing (August 2003). The findings are based on discussions with key individuals WITHIN THE FCM INDUSTRY. This methodology had to be adopted to keep the project focused on issues arising within FCM as opposed to evaluating current detailed data and information practices outside of this area.

5.2 Position Paper A, Data Needs

Background to the Position Paper

Data is fundamental to all Flood and Coastal Defence (FCM) practitioners, whether for setting policy, assisting in planning, designing schemes or for routine operations and inspections. Needs occur at a number of levels and time frames, for example, from the wide ranging topics which support

catchment flood management, to site specific, real-time information needed in an operational flood situation.

The development of Coastal Zone Management Plans, Shoreline Management Plans, Catchment Flood Management Plans and other initiatives of the Flood and Coastal Defence (FCM) community are underpinned by various forms of modelling (flood process, flood hazards, flood risks, future scenarios, etc). These plans are tiered from a national to a local level and successful ranking requires "tiered" data sets that are at an appropriate degree of resolution and are compatible with those used at higher and lower tiers.
New modelling systems such as MDSF (broad scale) and RASP (tiered) have shown that data availability can act as a constraint on the application of these methods and the accuracy of their results. The above modelling systems and plans have broad data needs extending beyond flood hydrology and coastal hydrodynamics to include the economic, social, financial and environmental impacts of flooding.

Purpose of this document

This Position Paper compiles the findings from the Project Workshop (held on 24 April 2003) with subsequent interviews among people in the industry. It covers what data the Flood Management industry requires now and in the future along with the decision making process on how this data "theme" is selected (within Agency/Defra etc). This paper will also review where stakeholders/users are being hindered in collating the data needed to advance flood management knowledge.

Link to Project Objectives

The overall project objective is to prepare a single report which will be focused on identifying areas within which data management within the FCM community can be made more efficient and it will set out methods by which this will be achieved. This Position Paper is prepared in light of the "Overview to the Position Papers" write up, and in this sense seeks to ensure that the present and future data needs are documented so that areas with inadequate data can be identified and possible solutions considered.
The information issues within FCM were divided into six areas, each depicted as a wedge in Fig 1 below. Data Needs is the first objective and covers the existing data sets and the uncertainty of the data contained in those data sets in use within FCM.
There is a natural evolution in the topic-subjects, with the findings and/or recommendations of one leading inputs for successive papers.

Approach

The activities leading up to this Position Paper are as follows:
A questionnaire was sent around to members of the FCM industry prior to the 24 April workshop event. This provided an initial response indicating which issues were regarded as priorities within each of the objective areas.

A workshop involving key stakeholders was held to discuss the issues highlighted by the response to the questionnaires and establish if there are additional areas that require attention.

Following on from the workshop, consultations with key stakeholders and others identified in the course of the project have been carried out.

The workshop on the 24th April 2003 was used to identify the data needs for policy, planning and operational purposes and then reviewing these against data availability. All of these responses which are relevant to Data Needs have been reviewed and summarised to produce this Position Paper. In preparing the results of this exercise, three fundamental questions have been kept in mind:

- Who needs what type of FCM data and information, both within the core FCM community and wider users?
- Where do needs fall short of the ideal?
- What are the opportunities and constraints in meeting the ideal state?

Key Questions asked for this Position Paper

The key questions asked in the questionnaire before the workshop were:
1) What are the most pressing data needs for current and emerging initiatives?
Within this need for data, three key themes were considered.
Improvement of data quality
Databases of socio-economic information
Increased awareness of data availability

2) In relation to the above, how is the potential "value" of the data significantly constrained in its usefulness by uncertainty, inadequacy, restricted availability, or non availability of data?

The feedback from the questionnaire and points raised in discussion at the workshop are presented in sections A4 and A5 of this report.

Inter-relationship with other Position Papers

Where a data need is defined, it will have a requirement to be examined in the other Position Paper topics, namely:
Paper B "Accessibility" – once the data is obtained, how will it be made available to users?
Paper C "Acquisition" – who will be responsible for collection and storage?
Paper D "Knowledge Management" – how will different data items be managed and controlled?
Paper E "Stakeholder involvement in data collection" – how far will the "core" FCM community have to interact with or depend on end users to satisfy their requirements?
Paper F "Application of new technology" – does a new or inadequate data need always require new technology, or better operational procedures?

Strategic priorities

The underlying government policy is to improve flood and coastal defence in a cost-effective manner. Various strategies exist to promote this policy, e.g. real time modelling. An important consideration has to be the balance between structural and non-structural flood defence strategies and actions. Thus there is a need for data on fundamental items like flood defence infrastructure, and data that aids non-structural methods in flood management, and forecasting and warning that are highly important, and heavily reliant on data. As operators, the Agency needs to have the best and most effective data. They then need to pass this on as meaningful *information* to end-users. The National Flood Defence Data and Data Management Strategy (NFDDMS), which will have major implications on the National Flood and Coastal Defence Database (NFCMD), is nearing completion.

Issues arising for Data Needs

Before considering feedback from the questionnaire and workshop discussions, there are some overall issues to be considered. Practitioners will always claim the need for more and better data, but in attempting to categorise needs, there are basic questions to be addressed:

How is the performance of various FCM activities constrained by the present level of data availability?
What drivers are likely to bring about change in the future?
Does the capacity exist within the FCM "community" to address the need for more and/or better data, and if not, will the achievement of this capacity be an easy task?

Behind these questions lies an overarching consideration: "If it was so important, why isn't it being done already?", to which there is the corollary: "Why was it thought necessary to have that particular piece of information?"

The feedback points, as summarised from the workshop, have been italicised and organised into 3 categories, as below.

Co-ordination of data sources and initiatives

Central source of knowledge on what data exists. If this is perceived as a need or an issue, it illustrates a problem which relates to the impression that there may be too much data, both to understand and to manipulate. Different centres within the Agency, e.g. Twerton (Bath) and Leeds are major centres for management and control of data, but much data is also managed by function or in geographical locations.
Greater co-ordination in government funding of data collection and management schemes. This is very much a "who-does-what" argument. Within the Agency, how much co-ordination could be achieved, for instance, between major programmes such as FCM and the Water Framework Directive (WFD).

Identification of what data there is access to. This point applies to the need for understanding of data availability at various levels of operation and across the range of internal and external users. The topic is dealt with more fully in Position Papers B ("Data Accessibility") and D ("Knowledge Management"). The fact that the need for better knowledge about what data is available clearly shows a realisation that a perceived data need may not always require a new set of data collection, but better management of information which already exists.

Harmonisation. This can equally refer to data types and structures, i.e. is the data of the same type and format, and is it easy to transfer between users. It was certainly an issue when different regions had different data systems, e.g. Hydrometry, inherited from previous entities. The attempts at several national strategies, e.g. Hydrometry, telemetry, flow modelling, have the potential to address this issue, but implementation has still proved difficult. Protracted timescales, to allow for different Regions to "catch-up" create a situation where initiatives are not complete before the next major programme is introduced.

Better awareness of data availability. This affects both internal operations of the Agency, to access all data needed, but relates to outside users in a two-way manner. For example, the Agency needs data on housing and populations at risk: the local authority responsible for housing and infrastructure need to have data (information) relevant to their need. By issuing a flood warning for a reach of river or coast, the Agency has a general idea of the localities at risk. The local authority needs to apply this warning of a sea or river level to a) infrastructure at risk, and b) specific housing. Both parties might consider they have a need for more and better data to meet their service requirement, but a development of awareness and broadening data applications might address the issue, rather than each organisation undertaking major new data collection projects (see Position Paper E – "Involving Stakeholders in data collection").

Location of data sources. Data may need to be managed nationally at a high level, but it needs to be available locally for operational and management purposes. Availability needs to match operational requirement, and in the emergency role of FCM, this may mean round the clock system support. With high levels of automation (telemetry) in data gathering, and updating outputs, e.g. status of flood warnings updated on EA website every 15 minutes, operators and emergency managers need confidence that these systems are supported and performing as planned.

Applications for improved data.

Hydrodynamic models capable of using high-resolution data. These exist, and considerable effort has been expended by the Environment Agency in developing coherent strategies which assist in the delivery of good quality data which has simple, functional interaction with models. However, disparities exist, which can be represented by extreme cases. One is where the structure and the capacity of the model are the limiting factor in terms of a rigid data configuration, which cannot accommodate newer data facilities. At the other extreme, the move from a point based input model to a gridded form of input requires re-design of the monitoring network. The ultimate goal of

the Agency modelling strategy to open-architecture systems should mean that neither the models not the data type are restrictive upon one another.

Standard of protection of defences. This is likely to require the comparison of existing databases, and developing a system with a high degree of compatibility for users, based on current best practice.

Evaluation of risk. This requires a re-evaluation of a wide range of data as to its applicability to the process of risk assessment. Tasks may need to be initiated to examine how relevant data and information are to evaluation of risk. Statistical information from time series may not always be relevant.

Map - definition of the coastal zone. This is being undertaken through the Hydrographic Office. Te work of IACMST is fundamental to this exercise. A report from Mike Cowling (expected September 2003) shall be referred to in the final integrated report for project FD2314. The ICZM in the UK Stocktake exercise is undertaking a series of UK workshops that is discussing a range of issues including the need for data pertinent to the delivery of ICZM in the UK. These findings shall be presented in the final integrated Technical Report for FD2314 (TR).

Data quality for improving tidal prediction accuracy, extreme level return period estimates and methods. This topic relates to the highly important need to maintain field data to the highest quality standards for confidence, as well as accuracy. It requires uncompromising attention to maintenance and data processing, as well as the utilisation of the most suitable instrumentation.

Improved data on people at risk rather than property. Evidence from recent major flood events has highlighted this as an important aspect, as concerning vulnerable groups living in flood-prone areas. Data exists, and the problems are central to some significant national initiatives, e.g. the National Flood Forum. The main here issues are likely to be communication and convergence of approach, as activities inevitably have a very localised focus, e.g. Bewdley, Chertsey. This issue is elaborated on in Position Paper E ("Involving Stakeholders").

A3.1.3 Data management and application

Better storage management - larger data sets. Links with overall data management and accessibility. This issue is elaborated on in Position Papers B and F.

Understanding current data quality and assessing future data needs. Could be achieved by a combination of maintenance of best practice, including conformity with industry standards, and improved meta-data.

Increased confidence in defence attribute data for RASP and Flood Mapping Strategies. Knowledge of data history important.

Co-ordination. This is fundamental to all activities, internal or external to FCM. The issue extends to the level of interaction between FCM practitioner and Emergency Services

Basic training in data management. Also required is knowledge of what data means and how it is relevant to users. Historically, FCM has had a bias

toward high quality local knowledge through the localised organisation of flood management on catchments, coastal reaches and major administrative areas. Geographical and organisational re-organisation has reduced some of the capacity for the maintenance of knowledge with individuals or unitary groups. Conversely, national centres and higher level functions may have a limited picture on data applications. The situation could be aided by the provision of comprehensive meta-data. However, data operatives, either collectors or processors of data need to have a knowledge of why the data is collected and how it is used.
Better links between the FCM asset inventory and financial information. This would help the Agency and "clients", like local authorities to provide better prioritisation and justification of flood defence maintenance works.

Conflicts and competition

Conflicts invariably occur when there is sharing of data sources, or where there are concerns as to the use of data. Difficulties in accessing external databases (which could also apply to databases of different functions within the same organisation) can lead to the approach that it is easier to set up a new database. The problems of the rain gauge network are a good example, where main operators are the Agency, the Met Office, Water Companies, local authorities, etc. Although organisations may make data available to each other, and standards are applied individually or collectively to maintain quality, there is still not uniform management with regard to: instrument exposure, processing and publishing formats, etc.

Individual operators have their own priorities for the data collected, and a problem exists if a data-sharing organisation needs to apply different criteria, e.g. formats of data exchange, regularity of data transfers, etc (see Position Paper B – "Data Accessibility").

Key factors

The nature of the natural phenomena and operational management of FCM requires that there is an essential need to maintain and optimise databases for continuity and consistency, so that long-term processes and programmes can be monitored. Long term variation and change in flood behaviour, matched with the need for historical information on structures with long operating/design life, require long-term commitment in both staff, finance and investment. These points have all been highlighted in a number of telephone and semi-structured interviews carried out for the project.

Knowledge of what data bases exist, their capacities and accessibility are fundamental to understanding the current situation and future requirements. This currently appears to be an area of concern. Awareness that knowledge on databases, as well as shortfalls in data are probably being highlighted by the development of GIS as a management tool. Strategic programmes, such as the Catchment Flood Management Plans, Shoreline Management Plans Second Generation and real-time flood forecasting applications, are linked to GIS. This highlights the potential for accessing data within that system,

whereas data management limitations in the past entailed a variable level of interaction dependent on individual situations or operators. The issue now is communicating what data is potentially available for a range of uses to wider stakeholder groups (government and non governmental).

Evaluation of the benefits of improvements is essential, in order that a practical perspective is maintained within the technological scope of any improvement. As an example, the goal of current R&D into quantitative precipitation forecasting (QPF) by the Met Office (with Agency collaboration), is to improve accuracy, spatial definition and extend lead-time. What appears technologically possible as targets, may not be achievable through limitations of investment and end-user requirements.

Good/bad practice

Defra/EA have produced, for example, a number of good practice manuals/guidelines on flood forecasting and warning (Ref.1). This particular review included the types of data needed for different parts of the forecasting and warning sequence, and recommendations on post-event data collection. It proposed that better and more consistent practices within the Agency could be utilised and developed by "migrating" good practice from Region to Region, as a more efficient means of improvement than wholesale redevelopment of the process. The development of the document was protracted due to revisions and re-organisation, and its release much delayed. During this time, some major changes in policy and function have reduced the impact of the review, and this is a risk likely in a large organisation. The Review pointed out the importance of there being an adequate framework and plan to implement the uptake of good practice. In this particular instance, the system or uptake was not consistent across the Agency.

The interviews undertaken for FD2314 has identified from some respondents that some data needs could be met by access and sharing with other organisations, e.g. asset databases held by local authorities with FCM responsibilities. Shared use of databases could meet much of the need for data, and Defra/Agency would benefit from the experience and good practice which already exist in the other organisation. Clarification on this point is required, though the main uncertainty amongst interviewees was the level communication being implemented within government departments.

Needs and Drivers

Perceived user needs

The following provides a select list of possible drivers and subsequent needs, primarily focussing on flood forecasting and hydrometry. Coastal examples are discussed in separate Position Papers.
The development of a marine spatial planning authority as proposed in the 'Links' Initiative. This and the setting up of similar agencies will be a considerable driving force in defining comprehensive data needs. The current ICZM in the UK Stocktake exercise is reviewing the current marine planning

situation and workshop events shall be discussing marine spatial planning as a possible way forward.

Better quantification of non-monetary Impacts. The benefits of data in planning, design and operation require better quantification, particularly of non-monetary impacts. Very hard to define by a cost-benefit approach, which has to address the question: "How much better (financially more economic) is a particular design or operation because these particular items of data are available?" A thorough cost benefit exercise was carried out as part of the Rainfall Collaboration Project (Capital Modernisation Fund Project 2000-2002). The analysis concentrated on immediate issues concerning radar rainfall estimation for flood forecasting, and would not necessarily quantify more general benefits within and outside FCM.

Forecasts of Likelihood and magnitude of flood level. This driver should serve to improve field measurement and maintain existing long-term station records. However, this is one aspect in a more general need for improved performance of basic hydrometry, which will serve a range of processes (functions) within the Agency and beyond. The uncertainty is whether such a single-focus improvement be conveniently implemented.

Estimation of general flood risk based on specific flood rainfall events. DEFRA is looking at a second phase of study into extreme rainfall events. To be effective this needs to be part of an overall co-ordinated initiative which will maintain interest in flooding after the impetus given by major events in 1998 and 2000.

The following items were all identified as specific needs where improved data, or better access to data, is required.

Records of properties affected by flooding (see problems associated with this in Position Paper E).

Socio-economic information about residents in flood areas see problems associated with this in Position Paper E).

Databases of community and support groups.

Detailed asset data. A very specific example here is that crest elevation of coastal defences has not been included in the NFCMD in data relating to "service condition".

High resolution bathymetry, real time flood monitoring with Synthetic Aperture Radar (SAR), Canadian Aeronautics Space Institute (CASI) multi spectral imagery.

High resolution elevation monitoring (LiDAR).

Archiving/collection of indicator data in the long-term. The Agency has a programme for monitoring environment change indicators, using various data items (water quality, rainfall, flow, high-tide levels) already collected as routine. It is vital that long-term records, and their quality, are maintained to the highest levels, as the indicators will be key to identifying impacts of climate change, land-use change, etc. In a report on flood indicators (Ref. 2) it has however been noted that problems with basic data, e.g. flow measurement consistency, is limiting the value of processed data sets on annual maximum flood series.

- *Geographic representation of research and capital projects.*
- *Bathymetric data for developing fine scale numerical models for problem areas.*
- *Data quality for improving extreme level return period estimates and methods.*
- *Data quality for improving accuracy of tidal predictions.*
- *Post event data (currently being assessed as part of Defra project FD2012).*
- *Improved high flow flood gauging.*
- *Improved data on people at risk rather than property.*
- *Wave overtopping data.*
- *Valuation of intangible benefits such as environmental losses, stress, leisure valuation.*
- *Measurements of habitat quality.*
- *Long term coastal data sets.*

It is difficult to quantify the benefits of each of the above bullets, or assign a priority that one particular item would be of more or less value to FCM. The usefulness of particular data items will have different weightings at different levels of the FCM operation. All have will have a greater potential value if improved in reliability, and it would be better to have them than not. Some examples of factors which hinder the potential of FCM data are given below.

Historic information on flood defence schemes. Paper files and photos from +20 years ago. Accessing and managing this information is difficult.
Transfer of information from those involved in the construction of new flood defences to those responsible for operation and maintenance issues needs to be better.
Need for better links to financial information on individual assets, which would aid a whole-life and investment management approach to the management of FCM assets.
Knowledge Management - Over the years, flood defence and other flood process staff build up detailed knowledge on flood defence assets and other specific information. Some knowledge may be written down in operation and maintenance manuals, but much is not. Methods are required to record and present this type of knowledge that is not written down before individuals leave or retire, or unit structures change (more detail presented in Position Paper D).
Need for better annotating of our data to let users know the data quality. This will help both internal and external users to apply data in an appropriate manner.

The National Flood and Coastal Defence Database (NFCMD) was highlighted by a number of respondents as potentially meeting many needs, but there was a degree of uncertainty as what it would actually achieve. It might be a useful exercise for the specification of the NFCMD to be reviewed against the outcomes of this FD2314 project (including user views obtained from workshop and questionnaire responses. This is a useful strategy to adopt as other, smaller programmes, such as the Rainfall Collaboration Project (3) have illustrated the tendency for the original aims and facilities to

be modified by time. Here, the original overall objective was to integrate the rain gauge networks of the Agency and the Met Office, to provide a sound database for a number of applications, including improved radar rainfall data. Other ongoing initiatives, including the national telemetry strategy and regional hydrometric programmes have limited the practical results to pilot applications.

Future policy and legal developments

Policies covering the availability of data and information (public domain, levels of service) will drive the need for all round improvements in data capabilities. Defra and the Environment Agency, for example, are subject to the Public Service Information Directive which seeks to improve dissemination of information to a range of services. Details of this Directive are not presented in this Position Paper.

The most important tool in meeting the requirement for public data access will be through web-based information services (elaborated on in Position Paper F). The use of the web as a medium for making data available does, however, stand in danger of becoming a panacea. Publication of information does not guarantee its use, or that proper advantage is taken of its availability, or even that it is useful for the eventual or intended purpose. Basic statistics on "hits" to the Agency's "Floods" page in 2001 were indicative of a high level of interest, but whether this was for public interest or operational use, is not clear. A careful performance evaluation, and repeated national awareness "campaign", as has been carried out since 2000 in relation to the Agency's Flood Warning programme, and is a good example of the recurrent effort required to implement a policy aimed at maintaining a level of service.

Technological developments

This topic is dealt with more thoroughly in Position Paper F. Advanced technology exists for sensing, telemetry and storage of data, giving great scope for type of data, speed of transfer, and a wide range of potential use. The latter raises a major concern regarding data processing. This has to achieve the production of quality controlled data of direct applicability to tasks, and avoid the amassing of raw data. File upon file of data strings are as useless to the potential user as a pile of paper water level graphs or rainfall recorder charts.

Support for databases, models and data collection should not be overlooked. Hi-tech items may well require high-cost maintenance. Electronics have permitted field instruments to operate over long periods between visits: storage is largely no longer a problem: pre-processing helps data presentation and telemetry. However, this is a high investment, high-dependence situation, and failures (inevitable) can be costly in terms of repair and value of information lost. Much higher levels of contingency arrangements are needed than are perhaps first envisaged.

Recommendations

Consultation research undertaken for this project FD2314 has indicated that there is as much concern with finding out what data exists and how it might be accessed, as to specific data items. This suggests that there is a feeling amongst practitioners that better use can be made of existing data, rather than embarking on new data gathering initiatives. This points to the need for high level, strategic management to ensure co-ordination of data and information programmes. A joint DEFRA/EA body, with clearly defined pathways to key operational units in the FCM process could be part of this process.

The variety of needs highlighted in consultation also indicates that careful scoping of existing conditions and developments is required to ascertain their value and appropriateness. It is important that needs for additional and improved data are identified in close relation to other ongoing programmes, e.g. Water Framework Directive. Such an approach should aim at preventing wholesale redirection of effort and capabilities, which is important in the Agency where structural and process re-organisations have, in places, affected continuity.

Risks and obstacles

In the past, many initiatives and programmes have stagnated through lack of resources, in terms of both staff and financial support. It is not clear whether or not the management structures in the FCM are sufficiently flexible and focussed to overcome this problem.

The wide range of sources of data outside of the immediate organisations concerned with FCM, make it difficult to implement clearly targeted programmes, which therefore become dependent on actions outside DEFRA/Agency control.

5.3 Position Paper B - Data Accessibility

Background to the Position Papers

Data is fundamental to all Flood and Coastal Defence (FCM) practitioners, whether for setting policy, assisting in planning, designing schemes or for routine operations and inspections. Needs occur at a number of levels and time frames, for example, from the wide ranging topics which support catchment flood management, to site specific, real-time information needed in an operational flood situation.

The development of Coastal Zone Management Plans, Shoreline Management Plans, Catchment Flood Management Plans and other initiatives of the Flood and Coastal Defence (FCM) community are underpinned by various forms of modelling (flood process, flood hazards, flood risks, future scenarios, etc). These plans are tiered from a national to a local level and

successful ranking requires "tiered" data sets that are at an appropriate degree of resolution and are compatible with those used at higher and lower tiers.
New modelling systems such as MDSF (broad scale) and RASP (tiered) have shown that data availability can act as a constraint on the application of these methods and the accuracy of their results. The above modelling systems and plans have broad data needs extending beyond flood hydrology and coastal hydrodynamics to include the economic, social, financial and environmental impacts of flooding.

This Position Paper compiles the findings from the Project Workshop held on 24 April 2003 and subsequent interviews amongst key stakeholders and users of data in the industry. It addresses the issues of how previously created data can be obtained and which technology is useful for obtaining it.

The information issues within FCM are divided into six areas, each depicted as a wedge in Figure 1. Data Accessibility is the second objective and covers the existing knowledge and the availability of that knowledge in FCM.

Link to Project Objectives

The overall project objective is to prepare a single report which will be focused on identifying areas within which data management within the FCM community can be made more efficient and it will set out methods by which this will be achieved. This Position Paper is prepared in light of the *"Overview to the Position Papers"* write up, and in this sense seeks to ensure that the present and future data accessibility are documented so that areas with inadequate data can be identified and possible solutions considered.

This Position Paper will seek to present the current state of knowledge and present practice with respect to Data Accessibility. It shall attempt to identify areas to be identified and prioritised within the final integrated report.

Approach

The activities leading up to this Position Paper are as follows:
A questionnaire was sent around to members of the FCM industry. This provided an initial response indicating which issues were regarded as priorities within each of the objective areas.

A workshop involving key stakeholders was held to discuss the issues highlighted by the response to the questionnaires and establish if there are additional areas that require attention.

Following on from the workshop consultations with key stakeholders and others identified in the course of the project have been carried out. All of these responses which are relevant to Data Accessibility have been reviewed and summarised to produce this Position Paper.

Key Questions asked for this Position Paper

The key questions asked in the questionnaire before the workshop were:
Identify ways where data accessibility within FCM and other related industries may be improved.
Suggest examples of good practice where necessary.

The workshop on 24 April 2003 examined ways of improving data accessibility, including the use of the Internet, standardisation of archives and the development of "lead data centres" where and organisation is charged with maintaining a specific database. The key issues that were brought up at the workshop were:
Who is best to articulate "Knowledge of Data?". This question amounts to asking "where should meta-data be held and how should it be accessed?" ("Articulate" may also imply that the meta-dataset should be advertised.)
The trace-ability (Audit) of data needs to be improved. In other words, standards of meta-data need to be improved, so that data is adequately described and its fitness-for-purpose can be determined.
A code of practice specifying the conditions for use of various data would be beneficial for the industry to adhere to. Many datasets come with restriction on its use or different price tags for different types of use. These issues are governed by the licence agreements for the different datasets. This paper will address whether licensing issues cause a problem in accessing data for FCM.
If a standard format/typology is implemented it would erase jargon and ensure that all users/providers use a similar language. This is not really a question of access to the data and could be addressed in the data acquisition paper. The use of a common metadata standard may help to standardise some of the language / jargon.

There is a need to differentiate between data acquisition and data capture. Again this issue is not within the strict remit of the paper, so has not been discussed further.

In light of the above data-gathering exercise (and the Framework of Approach discussed in the "Overview" section) the key issue for the paper has been refined to:

"How can previously created data be obtained and which technologies help".

Interrelationship with Other Position Papers

Common Aspects

Data Accessibility has common aspects with some of the other objectives identified for this FD2314 project. This is most clearly seen through the "Framework of Approach" section produced as an overview to all Position Papers. Here, it states that Data Accessibility is (obviously) strongly mapped to the 'access' stage of the data lifecycle, as is the New Technology paper (Position Paper F). This Position Paper B will therefore consider whether advances in technology, or greater use of the present state of the art technology could aid the FCM community to access the data it needs more easily. Data Accessibility is also weakly mapped onto the 'update' and

'retention' stages of the data lifecycle. Both of these stages are strongly mapped to the Knowledge Management paper (and update is weakly mapped to New Technology as well). Issues of when to update data and how long to retain it are included in Position Paper D (Knowledge Management).

The overview "Framework of Approach" section also considered the five principles of data management. Data Accessibility is strongly mapped onto the 'processes and procedures' principle, as is Data Acquisition. The principle states that processes and procedures within an organisation should be described and documented. This paper will address the question of whether the lack of documented procedures and principles hinders access to or take-up of data (due to lack of confidence in it). In the five principles, Data Accessibility is also weakly linked to identifying and implementing appropriate technologies for data management and processing. New Technologies is strongly mapped onto the same topic. This paper will therefore consider whether data access and thus the FCM community as a whole is hampered by the use of the existing technologies.

Strategic Priorities

The following is set as a strategic priority for this Position Paper.
"To enable the FCM community to access the data required, when it is required and with appropriate meta-data (i.e. a good description of the dataset that will allow its accuracy and suitability to be judged)."

The Framework for the Position Paper

Relevant Data Resources, Models and Management

This section gives examples of relevant data resources and how they may be accessed. This is not a comprehensive list of the data available (or needed) nor is it meant to be. It provides relevant examples on how to access data.

Multi Agency Geographic Information for the Countryside (MAGIC)

Multi Agency Geographic Information for the Countryside (MAGIC) is supported by Defra and has many environmental datasets accessible via its web site (http://www.magic.gov.uk/). These include datasets from the Countryside Agency, Defra, EA, English Heritage, English Nature & RSPB. Datasets available include administrative areas, habitat inventories, land classifications, AONB, landscape typology, NNR, Ramsar sites, SSSI, SAC, SPA and World Heritage Sites.

Countryside Information Service

The Countryside Information System (CIS) is a Microsoft Windows-based program developed to give policy advisers, planners and researchers easy access to spatial information about the British countryside. As part of the CIS, the Data Catalogue provides information that enables users to identify and obtain available datasets and a forum for data suppliers to promote their

datasets. Datasets include hydrometric areas, soil types, topography, geology, climatic data, vegetation, crop type and designated areas (including many available through MAGIC).

Environment Agency DIEU

The EA's Data & Information Exploitation Unit (DIEU) is responsible for the development of policy on and the management of agreements relating to the exploitation of the Agency's intellectual property rights and management of copyright. It funds the National Centre for Environmental Data and Surveillance (NCEDS) which holds many datasets, including watercourse, base mapping, designated sites, physical geography and indicative flood risk areas (most of those included in MDSF cane from NCEDS). The EA also runs a "What's in my backyard" service from its web-site that allows the public to access information about environmental risk, which is presented on maps, available at a number of different scales.
Regional offices hold much data – for example on beach profiles (see Position Paper E for more details on this issue).

National Flood and Coastal Defence Database (NFCMD)

The most obvious example of a database is the National Flood and Coastal Defence Database or NFCMD (http://www.environment-agency.gov.uk/subjects/flood/351291/211196/). This is a password-protected database that is being developed by the Environment Agency, in partnership with the other operating authorities. Phase 2 v2.1 is being tested and delivered at the moment. This will allow access to a large database of relevant spatial information via a web site. Access will be granted to staff of Environment Agency, Local authorities, Internal drainage boards and other interested public sector organisations. Training is likely to be required before the system can be used effectively. Access to a help facility is likely to be needed. Support for database systems (not just the NFCMD) will be important to ensure that they are available as and when needed. No discussion is given here on the future implementation of NFCMD or the addition of datasets to assist the industry (eg: links to Oakwood software – se Position Paper E).

English Nature

The GIS Digital Boundary Datasets held by English Nature are available for download from http://www.english-nature.org.uk/pubs/gis/gis_register.asp in a number of formats. Datasets available are the boundaries of Natural Areas, Character Areas, NNRs, SACs, SPAs, Ramsar sites, SSSIs and Ancient Woodlands. Details of geographic data held by English Nature are to be found in the Spatial Information Enquiry Service (SINES). Detailed specifications are supplied with each data set.

Ordnance Survey

OS holds base maps at a range of scales as well as historic maps. Land-line data (1:1250 or 1:2500) has rarely been used as they were seen as too detailed (at least for SMPs). OS MasterMap is an intelligent digital map (i.e. a database) designed to be used with geographical information systems (GIS) and database systems. It contains layers for topography, addresses, transport network and orthorectified aerial photographs at 1:2500 scale (rural) and 1:1250 scale (urban). OS Mastermap will be part of the Government and Local Authority SLA (so consultants employed by them will be able to use it). The datasets provide the basis for a nationally consistent quality within mapping. However the data requirements mean that it is more likely to be used on smaller scale studies than CFMPs or SMPs.

Wave and Beach data

Real-time wave data is available at certain sites from Wavenet (http://www.cefas.co.uk/wavenet/default.htm). This is a good example of a valuable datasets which has come about through effective cross departmental coordination It is also a good example of an initiative that has received a budget commitment for longer than 5 years from central government.

Wave data and beach profiles are among the data from the SCOPAC region available from the Channel Coastal Observatory (http://www.channelcoast.org/). This issue is discussed in more detail in Position Paper E).
Time series of modelled wind and wave conditions may be purchased from them Met Office.

NERC data

Much environmental data in the UK is collected by NERC. It has delegated responsibility for its data, and implementation of its data policies, to seven designated Data Centres, which include.

British Atmospheric Data Centre (BADC) at Rutherford Appleton Laboratory (RAL): www.badc.rl.ac.uk/index.html. Responsible for atmospheric sciences data.
British Oceanographic Data Centre (BODC) at Proudman Oceanographic Laboratory (POL): http://www.bodc.ac.uk. NERCs designated data centre for Marine Sciences. BODC is one model of how to make meta-data and data-sets available to the wider community. BODC takes an end to end approach to marine data management. It is often involved with the initial collection of data at sea, invariably assists in the working up and quality control of data and then helps to assemble the data for use by the principal investigators, prior to their eventual publication on CD-ROM. DGPS tide gauge data is available from POL (see http://www.pol.ac.uk/ntslf/). The European Directory of Marine Environmental Data (EDMED) was initiated in 1991 by the British Oceanographic Data Centre within the EC-MAST framework and has established itself as a de-facto European standard for indexing and searching datasets relating to the marine environment. EDMED describes

over 2300 datasets held by 500 data centres across Europe and is accessible vie the BODC web site.
National Geosciences Information Service (NGIS) at British Geological Survey (BGS): www.bgs.ac.uk/geodata. Responsible for geosciences data.
National Water Archive (NWA) at Centre for Ecology and Hydrology (CEH): www.ceh.ac.uk/data/nra.htm. Responsible for NERC's hydrological data and for the UK Government's National River Flow and Groundwater Level Archives.
Environmental Information Centre (EIC) at CEH: www.ceh.ac.uk/data/eic.htm. Responsible for all other NERC terrestrial and freshwater data.
NERC Earth Observation Data Centre (NEODC) at RAL: www.neodc.rl.ac.uk. Responsible for Earth Observation data held by NERC, notably the satellite imagery archive at Dundee, imagery from NERC airborne surveys, and NERC's archive of imagery from commercial sources.

Details of NERC data policy are given in the NERC data policy handbook (see http://www.nerc.ac.uk/data/policy.shtml) and includes a charging policy. It differentiates between bona fide research for which data are provided free or at reduced rates, and operational or other commercial research for which higher charges are made. NERC also runs a MetaData Gateway at http://www.nmp.rl.ac.uk/ that can be used to simultaneously search the catalogues of data held at several of the NERC designated data centres.

GiGateway

The GIGateway (http://www.gigateway.co.uk/) is run by the Association for Geographical Information (AGI). It allows access to geographical information in three ways:

- The DataLocator helps locate geographical information.
- The DataDirectory locates organisations that provide information and services.
- The AreaSearch allows you to view administrative data from the Office For National Statistics (by post code).

Data-providers include HM Land Registry, OS, BGS, CEH, Improvement and Development Agency, central government (IGGI). The also have a meta-data standard that will be updated to ISO 19115 when that is published.

Current and Planned Research and Acquisition Programme

The EA internal projects and initiatives are set out below.

- Agency Data Map – associates datasets with geographical locations. Useful to increase awareness of datasets.
- EA Data and Information Handbook – discusses policy towards data. Could be updated in light of this project.
- NFCMD – provides a central route for accessing data.
- NE Region Data Management Project. Could provide a template for data management within the agency.
- SATIS a strategic framework for data and information management.

- Other programmes are listed in the Project Record Report 1 (PR) produced for FD2314.

Copyright Issues

Material produced by Government qualifies for Crown copyright protection. The new Freedom of Information Act provides a general right of access to government information Some information is exempt though, because it is commercial or personal, for example. The general right of access is additional to access to information that a public authority publishes. All government bodies are tasked with the creation of "Information Asset Registers". These can be referenced via web sites to see what information is held by individual departments. Further details are available at http://www.hmso.gov.uk. The move by departments and agencies (other than trading funds) to a policy of marginal cost pricing for the licensing of basic "raw" data came into effect from 1 April 2001. Each relevant government trading fund, such as the Met Office, has been asked to prepare an action plan setting out the present position and how they propose to open access to their information further. Some Crown copyright material is covered by waiver conditions. This covers material where copyright is asserted, but waived. Waiver material can be reused free of charge without requiring a formal licence provided that it is:

- acknowledged.
- not used in a misleading way.
- reproduced accurately.

Further details on the waiver can be found at HMSO web site.

SMP2 Data Access Issues

There is currently debate within the Agency on the way forward for data to be produced, and subsequently access for the next round of SMPs. A specific section is produced within the new SMP2 Procedural Guidance Note (Halcrow 2003), however the authors are aware that the issues relating to data access, storage and production are not resolved within the Agency at the time of writing.

Lessons have been learnt from the first round of SMPs. Much of the data collected in the first round of SMPs came from coastal authorities and government agencies, such as EA, English Nature, English Heritage. Other datasets were purchased, including geology (BGS) wind and waves (commonly Met Office). Often data was purchased by the lead consultant on a time-limited licence, so it could not be handed over to the client at the end of the project. A GIS was normally created and used by the lead consultant to overlay information and produce maps (of land use, recreation, management units, coastal processes, etc). Many of the SMPs overran and went over budget. Among the most common reasons for this were purchase and collection of data and undertaking of original mapping (Cooper, Barber, Bray and Carter, Proc ICE, WME, 2003, V154(3) 221-228). All SMPs reviewed by Cooper *et al.* relied heavily on existing reports for information on coastal defence location, type condition and operational responsibilities. Local

surveillance and monitoring were used as was historical information from local authorities and the routinely updated MAFF Coast Protection Survey.

It is hoped that by the time of producing the final integrated report for FD2314, a definitive statement on the data management for SMP2 is produced for the Agency. For this reason, the various Position Papers do not go into considerable detail on this issue.

e-GIF

The e-Government Interoperability Framework (e-GIF) is a UK government initiative to improve electronic document exchange within government. It has a very strong focus on the development of standardised metadata for government, based on Dublin Core and is linked with similar movements across Europe. There is a strong movement away from proprietary systems with XML to be the main exchange format, including GML for geographic data rather than vendor based GIS formats. More details can be found at http://www.govtalk.gov.uk/. E-GIF includes the e-Government Metadata Standard (e-GMS) which lays down the elements, refinements and encoding schemes to be used by government officers when creating metadata for their information resources or when designing search systems for information systems. The e-GMS ensures maximum consistency of metadata across public sector organisations. A cut-down version of the e-GMS developed to help those creating local metadata standards for web sites has also been developed. The e-GIF site also provides access to the UK Government Data Standards Catalogue, which included, for example BS7666 Address with standards for Post Code, Unique Property Reference Number etc which are useful in assessing the receptors of flood risk.

Meta-data standards

There is no universally applied standard for meta-data. Some that are of relevance to FCM include the following:
EDMED – standard descriptor of data held by BODC
FGDC – a geographic metadata content standard.
NGDF – National Geospatial Data Format
ISO 19115 – new standard, with schema being developed.
At the present time FGDC is an appropriate standard to use, which should be relatively simple to upgrade to ISO 19115 when its schema is complete. The SMP2 Procedural Guidance Study (Halcrow 2003) recommends that a metadata node be created through AGI to support the SMP process.

Issues Arising In Accessing Data

Common Themes

The common themes that came through from the initial questionnaire were an increased use of the internet to make data available and the creation of a central data centre which could be responsible for storing and disseminating the majority of the data sets which are relevant to FCM. A theme that

appeared in both the questionnaire responses and the workshop was that often users were not aware of the availability of existing data sets.

Knowing who is developing data sets was also considered to be useful. This applies especially to the "people"; social and environmental data needed for flood risk assessments and integrated flood defence planning. It could also apply to those looking at future chances (e.g. foresight scenarios, demographic change, climate change etc).

Not all data is in digital computer-based datasets. Consultants must bear in mind the need to locate and evaluate relevant datasets and, if necessary, convert them into digital format. These will quite often be held at a local level.

It is important to realise that data often fulfils two roles: as the basis for analysis and as thematic data within which management options (in a SMP) should be set. Therefore the same type of information will be needed at different scales (with different resolutions and accuracy) for different purposes within the same study (whether CFMP or SMP).
For example, more than one set of topographic information will be required for a SMP or CFMP – a detailed topography for modelling and a less detailed background map over which options and other information (land use etc) may be overlain. The different topographic resolutions require different data processing chains (although both may have been derived from the same survey data). Knowledge of what resolution and accuracy is required for each purpose will govern the way the data is accessed. Detailed topography may be obtained from OS 1:10,000 scale map or from the EA LiDAR database or from the EA/Norwich Union SAR surveys. Background maps may be purchased from the OS at a variety of scales.

Access to relevant data is dependent on knowing what resolution and accuracy is required, whether such data exists and where it may be found. In some cases it does not exist. In the example given above it is not clear who processes the data. In other cases the data that has been accessed may be the wrong resolution or accuracy (and this should be readily identified from the metadata) and the question arises of who will be responsible for interpolating or decimating the data? This can generally be left to the consultants although it may be advisable for the standard to be set by the Agency.

If a dataset is supplied nationally from a single supplier, the Agency can arrange that the dataset is supplied to all consultants at a specified standard. This saves money and time by avoiding the duplication of effort. Such datasets already form the basis for the standard data package in MDSF for CFMPs. The use of a 'Standard Data Package' has been proposed for the new round of SMPs (Halcrow, 2003), though, as mentioned earlier, this concept is far from being universally accepted by the Agency. MDSF for CFMPs comes preloaded with nationally negotiated datasets such as topography and socio-economic datasets – not all of which are sufficiently accurate (see Position Paper A "Data Needs"). Thematic datasets are included with MDSF to provide the context against which to appraise the

scenarios developed. The SMP2 Procedural Guidance Note (Halcrow 2003) recommends that the coastal extension to MDSF 'be developed as part of the standard data package'. This would provide a co-ordinated source for core datasets (which could originate in different organisations). There would still be a need for consultants to collect local data as 'Standard Data Packages' are likely to be for national datasets only. The updating of datasets will be covered in Position Paper D – Knowledge Management (see Section 5.5).

Issues of licensing also affect data access. For example, the licenses purchased for much of the data used in the first round of SMPs meant that the databases could not be maintained after the end of the project. Some licenses are limited in the number of terminals – which restricts distribution. The cost implications of the lead contractor or client obtaining datasets under licenses that could be held and used by the client after the end of a study should be considered. Other modifications may need to be made to standard licenses to allow them to be used in the dynamic development of plans.

The main GIS systems in usage at the moment are from ESRI (Arc family) and MapInfo. Examples of GIS usage in FCM include the coastal extension of Multicriteria Decision Support Framework (MDSF) GIS tool. FCM practitioners wanting access to data will increasingly need access to and training in the use of a GIS. However, e-GIF may encourage the use of XML as the main exchange format, including GML for geographic data rather than vendor based GIS formats. There is no need for Agency or Defra to be prescriptive about the platform used for the development of CFMPs or SMPs.

Conflicts & Competition

Similar types of data will be required at different resolutions and accuracy for different scales of modelling (from national to structural). The collation of different spatial datasets at different scales and resolutions introduces issues of compatibility, as there may be mismatches between datasets. For example, a given point may appear at slightly different positions in 2 datasets collected at different scales and with different resolutions.

Datasets belong, generally, to the employers of those who collect the data or to those who fund the collection of data. All parties who have a claim on ownership of a dataset should agree at the outset on how it is to be exploited and how the benefits of exploitation are to be shared.

Licenses can restrict the use of data to a consultant working on a particular project. In order for such data to be retrievable, good records of the data should be maintained (including its metadata).

There is a temptation to suggest that all data should be put into the NFCMD or held at NCEDS (which provide the national datasets for MDSF). However, different data is needed at different scales. Having a single database that attempts to provide all useful information for all FCM purposes is unlikely to be a good idea as such a system will have to hold a vast amount of data in different formats, all of which should be searchable. It makes more sense for

all meta-data to be held in (or accessible from) a central meta-data database. There is nothing wrong with this being a distributed database, so long as it is all searchable from a single entry point. National datasets should be held by NCEDS. The regional and local datasets can be held at a regional level, preferably in specialist data centres where staff has the experience and facilities to deal with meta-data, store data, make it accessible and upgrade the storage medium/system when necessary.

NCEDS has limited resources and it is felt that they have shown a lack of commitment to non-core or non-EA datasets.

The Futurecoast (Defra 2003) output for example is 3 CDs, which include useful information on coastal evolution (that may affect coastal flooding). The information in held in a GIS, but cannot be output except as maps so cannot be incorporated directly into a SMP GIS. The data is therefore not accessible in a useful format.

Key Factors

Accessible data must meet the data needs of the FCM community (see Position Paper A – Data Needs). A business case must be made for preserving and making accessible data.

Good/Bad Practice

The EA Twerton model preparation set up used in MDSF is a good example of using a single centralised data source from which individual data sets can be obtained.

An issue that was brought to attention in the workshop was that data is often presented in a form with no details. It is useful to know where the data comes from, its accuracy/quality and whether there are any restrictions on its use (all issues that should be included in the metadata).

In many cases it is necessary to obtain permission from the originator of a data set to use it, often this is not a simple process and can lead to project delays. This issue has been addressed in the MDSF process via the provision of meta-data.

Needs and Drivers

Perceived User Needs

Data users often require access to data sets as fast as possible. However, there is often a convoluted supply chain to obtain access to the required data. It would be much more convenient to have a single source from which all data sets can be obtained which would effectively be a “data clearing house”. An example of this would be the EA Twerton model preparation for MDSF. In the future this set up will probably become best practice.

There is a vast amount of data available that could be made available. However, people require information that will enable them to complete tasks, rather than access to raw data. This will require knowledge management to direct users to data at the level or tier that they require.

EA, Defra, local authorities and contractors working on CFMPs, SMPs, Strategy Studies and schemes need to access the relevant data as quickly and efficiently as possible.

Future Policy & Legal Developments

The new round of SMPs (SMP2) may use the coastal extension to MDSF. This will bring closer together the needs of CFMPs and SMPs. As mentioned earlier, this issue has not been resolved through will seek to be addressed in the final integrated report for FD2314.

Technological Developments

Present day technology is sufficient to build on for the moment. Building a database that is open to a lot of people, who require a lot of data and will require a powerful and expensive system. The volumes of data and complexity of such a site will mean that users will require broadband access to the internet if they are to be able to operate at a reasonable timescale.
An issue that may need further consideration in the final integrated report is how to plan data accessibility with technological changes in the future. Being reactive and not planning for this as part of a longer term strategy would be remiss of the industry and not appreciative or longer term change. Position Paper F considers this issue in more detail.

Recommendations

The following bullets are possible recommendations for inclusion within the final integrated report.

- Make "knowledge of data" more available through having a database of meta-data (which could be part of the function of the NFCMD).
- Require meta-data to be collected to a particular standard (likely to be ISO 19115 compliant) and registered (with NFCMD or similar central authority).
- Greater provision of national datasets, available through a central source, are already aiding data access and helping to improve compatibility between adjacent plans, providing that the data is provided to an appropriate resolution and accuracy.
- All data sets should come with its format specified (in the meta-data). Data conversion is relatively simple provided the format is known.
- A code of practice covering conditions of use would be beneficial for the entire industry.
- Particular tools (such as MDSF or RASP) will require data to a particular standard and accuracy. To get from raw data to the input for a high level tool, such as MDSF (for example) requires data handling, data storage and access to the data. Getting the same data into the input for a tiered tool (such as RASP) will require different handling, storage and access.

Risks and Obstacles

If a minimum standard is set for new data, there is a risk that useful data will be excluded as not being good enough – even if it is better that the previous data.
The national datasets available from NCEDS and NFCMD (when its fields are fully populated) are good enough to cover most of the needs of a CFMP or SMP. The main difficulty in accessing data is finding the detailed local data needed for Strategy Schemes and projects. Accessing data in these cases is still a matter of talking to the local authority engineers. This issue is discussed further in Position Paper E. Some authorities are better than others at keeping records. As a minimum, local authorities should be encouraged to keep records of the data requested in Position Paper A. A better step may be to encourage the setting up of a national meta-data centre.

5.4 Position Paper C - Data Acquisition

The breadth of data required for CFMP's, SMPs etc and by MDSF/RASP (and any other emerging modelling system) means that data sources are widely distributed within and beyond (in the case of data on financial, social and environmental effects of flooding) the FCM community.

This Position Paper represents one of six being produced for the Agency / Defra R and D project number FD2314. Its purpose is to outline who actually benefits from the data produced in addition to the Agency/Defra. There is a close relationship between this Position Paper and Position Paper B 9 (Data Availability). Attempts have been made to avoid duplication. The readers needs to review the "Framework to the Position Papers" overview write up to understand how this text is to be used in the final integrated report.

The intention for Position Paper C is to define the acquisition of primary (eg: new field data) and secondary data (eg: mapped information). Attempts shall be made to identify what procedures need to be followed to acquire primary and secondary data and information, by who and using which technology. This paper focuses on key questions such as:

Identify ways how data acquisition within the FCM and other related industry could be improved?

Provide examples of any project (current or future) dealing with data acquisition (brought about by current national and European R&D Initiatives) that occur outside the FCM industry that would benefit this research

The key objective of this paper is to identify the current state of data acquisition programmes and initiatives; to assess their strengths and weaknesses; and to comment on their ability to respond to user needs and

other drivers (such as policy development and new legislation). In addition, emerging data and information initiatives will be considered, where relevant.

Background to the Position Paper

The planning, design and implementation of effective flood and coastal defences, and the establishment of an efficient and effective flood warning service, are all dependent on the availability of accurate, relevant and up-to-date data. FCM data is interpreted to provide information for decision makers. The understanding of fluvial, estuarine and coastal processes, which underpins government policies in these fields, cannot be improved unless competent authorities continue to collect data and process them to provide relevant information, and ensure that information about data sources is widely available.

Strategic decision making and large scale planning, within the context of sustainability, places additional requirements in terms of availability of a wide range of data, from meteorology, land use, and physical characteristics to social, demographic and economics data. Historical data often provides an important basis for assessing future trends.

The lack of appropriate data (either through availability or through acquisition problems) can lead to flood and coast defence schemes being inappropriately designed and prone to failure or poor performance. It can also lead to over-design and excessive cost. Information about data sources is crucial to identify gaps, to maximise the use of data, to avoid duplication, and to understand the uncertainty inherent in the data and information.

In terms of acquiring data, the following issues need to be addressed:

- What data and information is really needed both now and in the future?
- What are the benefits of having these data?
- To what extent are these data already available?
- How can the data be collected?
- Who else may benefit from their acquisition?
- In what form should the data be stored and presented?

In recent years, there have been many technical developments that allow the collection of previously unattainable data, greater quantities of data, and cheaper data. These developments are likely to continue and perhaps accelerate. These new data acquisition techniques have yet to be exploited in the field of flood and coastal defence.

Defra and the Agency wish to identify develop and deploy new techniques for measurement, acquisition, storage and dissemination of data and information to support delivery of overall policy objectives. This is an area of continual change and this R&D will help to ensure that Defra and the Agency keep up to date on the availability, costs and benefits of new techniques.

Position Paper F (New Technologies) focuses on this issue in more detail.

The framework for this Position Paper was discussed at the project workshop, held on 24 April 2003. Here it was noted that there are constraints in data management and clarification is needed on the definition and value of data collected by those users involved within the industry. One of the main aims of improving data acquisition is to encourage co-operative effort between stakeholders (e.g. engineers and scientists, and engineers and environmentalists) so that the cost of data acquisition can be shared, thus enabling better flood and coastal defence solutions.

Key questions to be asked
Following on from the Workshop held on 24th April 2003, this Position Paper aims to cover the following issues raised for Data Acquisition:

- Assess future role of "Regional Centres" of Expertise.
- Need to recommend the adoption of a phased approach to data acquisition.
- Introduce 'Uncertainty' into data acquisition planning.
- Establish a "Route Map" for where to acquire data.
- Consider new data collection technologies.
- Common data standards would be a major way forward.
- Acceptance of the "collect once use often" philosophy.
- Automation methodologies should be pursued where possible.
- Establish the potential for joint data acquisition and processing with environmental organisations.

Detail on the discussions for this Position Paper are presented within the FD2314 Project Record (PR).

Strategic priorities relating to data acquisition include:

- acquiring good data and making information about data sources widely available to improve the understanding of fluvial, estuarine and coastal flood producing processes;
- Acquiring accurate, relevant and up-to-date data to enable the effective planning, design and implementation of flood and coastal defence systems, and the establishment of an efficient and effective flood warning service;
- Supporting the acquisition of the wide range of data required by strategic and high level planning
- Cost effective data collection in a manner that will meet the needs of future flood and coastal defence planners to develop strategic FCM policy;
- Establishing the costs and benefits of data acquisition, storage and monitoring, and risks of *not* collecting data;
- Identifying and evaluating alternative 'models' for data acquisition and dissemination;

- Where appropriate, exploit new data acquisition techniques in the field of flood and coastal defence;
- Preparation of a business case to demonstrate the benefits of investing in greater efforts to reduce multiple data collection (and storage), the benefits of securing data that would otherwise get lost, and the efficiency gains from providing appropriate base data;
- Resolving the issue of cost-recovery for data collection and management;
- The establishment of 'centres of excellence' for the collection and holding of different types of data and for agreeing data protocols and standards.

Link to Project Objectives

The overall project objective is to prepare a single report which will be focused on identifying areas within which data management within the FCM community can be made more efficient and it will set out methods by which this will be achieved. This Position Paper is prepared in light of the "Framework to the Position Papers" write up, and in this sense seeks to ensure that the present and future data needs are documented so that areas with inadequate data can be identified and possible solutions considered.
The information issues within FCM were divided into six areas, each depicted as a wedge in Fig 1 below. Data Acquisition is the third objective and seeks to clarify the main project objective to focus, identifying best practice on how primary and secondary data are currently acquired, and from this, identify how this can be improved upon stakeholders may be better involved to assist the industry, identifying the opportunities and constraints of their use.

Perhaps the key link for this Chapter is to clearly determine data needs up front (Position Paper A). Once this is established, a clearer model for who is best to be involved in data management can be deduced. Position Paper A on Data Needs clarifies this situation more fully.

This research project (FD2314), and this Position Paper in particular, seeks to identify links with, for example, project FD2012 "Post Event Appraisal – (Outline) Best Practice Guide - Monitoring, Recording and Analysing Events" (due for completion during August 2003) That work states further work is required to identify any shortfalls, to meet the needs of post event analysis, in these developments and to develop detailed specifications for data collection programmes and storage systems. It states the need to integrate fully with this project (FD2314) within the Risks Evaluation and Understanding Uncertainty Theme.

Interrelationships With Other Position Papers

The topic of data acquisition that is the subject of this position paper has links with all the other research objectives for which position papers have been drafted:

Objective 1 (Position Paper A) - Data Needs: data needs along with legislation and policy aims are key drivers for the acquisition of data and information;

Objective 2 (Position Paper B) - Data Accessibility: the process of improving data accessibility, through standardisation of archives, and the development of 'lead data centres' (where an organisation is charged with maintaining a specific database) all follow on from data acquisition and may need to be coordinated with the process of data acquisition;

Objective 4 (Position Paper D) - Knowledge Management: since data (once processed and used) becomes knowledge, the types and forms of data acquired need to be appropriate to the body of knowledge being developed;

Objective 5 – (Position Paper E) Involvement of Stakeholders in Data Collection: the involvement of stakeholders in data acquisition is an integral part of the data acquisition process and should be well integrated within it;

Objective 6 (Position Paper F) - New Technology: new technology should be applied where appropriate to data acquisition as well as to monitoring, data handling, archiving, dissemination and presentation.

Current & Planned Research & Acquisition Programmes

Internal Initiatives

A literature review of FCM projects commissioned by Defra and the Environment Agency has been undertaken for the project which can be found in Report: FD2314 (PR), and some of the current initiatives in the review identified as relating to Data Acquisition have been listed below:

FD1901 - Development of predictive tools and design guidance for mixed beaches (HRW)
FD1911 - Freiston Shore Managed Realignment (CEH – Dorset Coastal Research Unit)
FD2003 - Scheme Prioritisation System Review (Risk & Policy Analysts Ltd)
FD2005 - The appraisal of human related intangible impacts of flooding (Risk & Policy Analysts ltd)
FD2008 - Implementing Managed Realignment as a Strategic Flood and Coastal Defence option (Halcrow)
FD2103 - Generation Of Spatially Consistent Rainfall Data – Refinement And Testing Of Simplified Models (Imperial College London and University College London)
FD1905 - Estuaries Research Programme (Consortium led by HRW)
FD1920 - Impact of engineering works on sediments and habitats in rivers (HRW)
FD2012 - Post Event Appraisal – Phase 1 (Bullen)
FD2108 - Broad Scale Ecosystem impact modelling – scoping study (Cascade Consulting)

FD2114 - Review of impacts of rural land use and management on flood generation (Newcastle University)
FD2311 - Environmental Change Indicators For Flood And Coastal Defence (CEH - Wallingford)
FD2315 - Concerted Action Performance Evaluation (HRW)
FD2317 - Risks to People (HRW)
W5A(01)0 - Impact of Recent Floods on River Morphology and Habitats
WB5(01)02 - Risk Assessment of Flood and Coastal Defence Systems for Strategic Planning (HRW)
WB5(01)03 - Failure 'on demand' of Flood Defence scheme components

The application of the recently built MDSF (Modelling and Decision Support Framework) to the development of CFMP's and SMP's has triggered the need to acquire more appropriate flood plain/area topographic data than that produced by LIDAR. It has led to the Environment Agency co-funding (with Norwich Union) the collection of SAR (Synthetic Aperture Radar) data as a basis for developing a DEM (digital elevation model) of fluvial flood-plains and coastal flood prone areas.

Data and Information Policy Management

A recent meeting held with the Environment Agency NW Region, centred on the Data & Information Policies Manager (see insert). Concerns over project overlap were raised; these have subsequently been negated through further clarification of the research project objectives, which are wider than the remit of the Data and Information Policies Group.

The roles of the Data & Information Policies Manager

Data protection, data issues and highest risk issue: To make sure that the data meets all legal requirements. Data standards are being developed within IT systems, EGIF - IT Government standards and the EA are further developing standards within NFCMD

How to acquire data: Currently Twerton manage all data such as; LiDAR, OS Data, which then goes out via local servers. There are two host data centres, Leeds and Peterborough are managing the data, with the possibility that it will be made available via the intranet and making sure that all the Agency offices have access to the same data. Licensing already been organised within the Agency.

How to manage data quality: The team are globally looking at Agency data, both externally and internally. The coordination of data acquisitions is done through a national procedure managed by EA. The EA need to start feeding Local Authorities with standards

A risk based approach to data acquisition needs to be better spelled out with a clear communication pathway being set up for users. This will then outline whom to approach to attain appropriate Standards e.g. Regional Centres of Expertise

There are many ongoing internal projects/initiatives dealing with data acquisition, the most significant of which have been outlined below; NFCMD (National Flood and Coastal Defence Database), Shoreline

Management Plan's (SMP's), Coastline Management Plan's (CFMP's), Coastbase, Irish Sea Pilot, English Nature.

NFCMD

The following summarises the work currently ongoing on the NFCMD project. This project however, is subject in the future due to the change in GIS software from MapInfo to ArcView 8.

The final version of the Phase 1 application of NFCMD (known as v1.3) has been rolled out. This version has delivered a significant improvement in performance, and will allow the user base to be increased to up to 400 users.

Work on Phase 2 (which is mainly the addition of further data sets, such as historic and modelled flood events, as well as a number of functionality changes and bug fixes) is well advanced. Factory testing has completed successfully and testing on the Agency infrastructure has started.

Testing of access to NFCMD for non-Environment Agency users began in mid-February 2003. This has proven to be challenging technically.

The government's Flood and Coastal Defence Funding Review has transferred the responsibility for Critical Ordinary Watercourses (COW's) to the Environment Agency. Although the detailed implications have not yet been worked through, it seems likely that this change will result in a reduction in demand for external access to NFCMD. What will remains, however, is the requirement to provide a mechanism through which operating authorities with coast protection responsibilities can access their data.

Interest in NFCMD remains high; the system was successfully demonstrated at the House of Commons in February as part of a parliamentary reception on flood defence issues.

NFCMD is the main source of data for the RASP (Risk Assessment for Flood and Coastal Defence Systems for Strategic Planning) and PAMS (Performance Based Asset Management System) projects, currently underway. Although RASP relies on data and information from NFCMD, this project does not have a data acquisition component. PAMS has identified the need for a revised asset inspection method and envisages that this will lead to the updating of data in the NFCMD.
Shoreline Management Plans (SMP's).

SMP's essentially fulfil a planning role and many of the contextual data requirements are those familiar to the planning system, land use and planning constraints, all of which fall into the category of Data Acquisition.

SMP cell boundaries cross many local authority boundaries and even country divides. Inclusion of thematic data within SMP's relies on the availability of existing datasets. In some respects, these requirements have

been addressed by new data sources. Other datasets may still be inadequate or represent data gaps that have not been fully addressed between the period of SMP editions. Most notably this affects the development of strategic level spatial data describing archaeological sensitivity, without which effective consideration of issues within defence options appraisal is more difficult. English Heritage is addressing this issue with enhanced data capture, but the results are not yet at national level.

The SMP guidance (Defra 2001) recognises the values of using GIS to collate and analyse new datasets. It can be used to re-collate the data from the first round of SMP's. The data outcome of earlier SMP processes consist of:

- SMP data collations and generated data layers.
- Local programmes to fill identified data gaps.
- National research programmes to fill data gaps.
- Scheme strategy plans.

In addition, a significant range of other relevant information, plans and documents have been created or updated, following the completion of the previous study.

- National data programmes (e.g. Future Coast).
- Coastal Habitat Management Plans (CHaMPS).
- Estuary Management Plans.
- New Development Plans.

The following represents a summary of the first draft SMP2 Procedural Guidance report for Defra. At the time of writing, the Atkins team are aware of the concern the Agency have with the current draft in relation to Data Management. Further discussion may be needed with the Agency to establish the way forward for SMP data acquisition. In the meantime, initial thoughts gathered by Geodata Institute and Halcrow are presented below.

Basedata

Basedata fulfils two key roles in the SMP process, as datasets in their own right and as basemaps over which other information is plotted and presented. Universally, mapping with SMP's has used OS datasets and typically, these have been at multiple scales to address the overview, analytical and presentational requirements.

Since the first round of SMP's, a number of new datasets have either become available through the results of existing programmes or through concerted actions and research projects stemming from SMP focused monitoring programmes. Some new data was not available during the first round, such as basedata, which includes OS MasterMap, 1:25k raster data and nationally available orthorectified aerial photographs.

SMP Data Proforma

The SMP Data Proforma for data requests to suppliers based on the review of metadata, sets out the known attributes of the datasets and documents. There will be a range of other data sources that do not conform to national standard formats and will require recording where they contribute to SMP revision. The core datasets are proposed for supply or download from a limited number of agencies with defined supply routes. Despite the desire for a single data source, a number of the licence and distribution arrangements currently constrain this approach. Arrangements have been made with suppliers such that all data sets held by them will be supplied based on a proforma request. These nationally consistent supply routes include EA, EN, EH and use of MAGIC web downloads. This supply will include metadata relevant to the data sources where this is available.

These core datasets will form the 'Standard Data Package' form SMP's. The SMP guidance (Defra 2001) recognises the values of using GIS to collate and analyse new datasets. It can be used to re-collate the data from the first of SMP's.
The data outcomes of earlier SMP process consist of:

- SMP data collations and generated data layers;
- Local programmes to fill identified data gaps;
- National research programmes to fill data gaps;
- Scheme strategy plans.

In addition a significant range of other relevant information, plans and documents have been created or updated following the completion of the first generation of SMPs

Overall procedures
The following list provides an overview of the procedural steps recommended for data management and output within the development of the Plan.

- Establish metadata index to record datasets acquired and used within the SMP development process (theme and coverage).
- Collate all existing datasets generated by the first generation of SMPs and analyse data update requirements (integrate data into GIS and assess the value of the information and gaps).
- Collate and analyse new information available since the last SMP in particular national studies, results of shoreline monitoring and coastal research data. This will include the access to GIS datasets developed for other planning purposes, such as CHaMPS, Estuary Management Plans etc).
- Identify and collate all scheme strategy plans within the SMP area.
- Acquire national 'standard data package' from national agencies and authorities using data request proforma (including MDSF, Futurecoast, etc).
- Incorporate all spatial data within GIS system and where appropriate within MDSF.

- Identify the information gaps and areas where updates or data capture is required.
- Identify regional and local datasets, acquire, and convert to appropriate formats.
- Integrate data themes to generate thematic maps of the influences on coastal defence options and to support analysis of options (overview, processes, defence, conservation, heritage and human environment, planning and management).
- Develop spatial data describing the process and management units.
- Generate map (GIS) data in portable projects and document formats.
- Create metadata for all datasets generated within the SMP production process.
- Create archive copy of datasets for distribution to Coastal Groups.

Licensing

Licensing arrangements usually prevent the outputs of SMPs maintaining the base data with the spatial data layers that make up the mapping outputs of the SMP. Integration of the existing SMP and Strategy Study data collections will need to re-establish the existing information base. Many of the data acquired for first generation SMP purposes were collected from organisations with either express or implied limitations of use to the specific programme, and in some cases limited licence arrangements. This limits the subsequent use of the same data for SMPs revision and also limits the distribution of the resulting SMP data in digital formats. These issues need to be addressed with data providers prior to the development of the SMP revision.

Licensing of the datasets should acknowledge the specific uses, the reproduction, publication and subsequent distribution of the resulting information and potentially the development of web based products. Modification to standard licence arrangements may be required to provide for the type of use envisaged by the programme.

Data Management

Data Management with reference to SMP is considered to include the full lifecycle of project use and future use. The lifecycle encompasses creation, storage, use and update, maintenance and archiving of the resources. Given that, many datasets are licensed for SMP development data management also needs to consider deletion and look forward t o the future.

Data management with in the scope of SMP implies a number of elements:

- Data inventory / Metadata (records about the data)
- Technical data management (formats, storage, archive etc.)
- Data creation standards (where new data is created or existing data captured in digital form)
- Data transfer and licensing (copyright, reproduction, publication and distribution)

Data Management has been covered in greater detail in Position Paper 'Knowledge Management D'.

Metadata

Data collection typically generates a list of documents and datasets. When the data has been encoded, even with little information, the record becomes metadata. Metadata systems may be used to identify and source data. Key data providers have developed their own metadata systems.

Metadata has been covered in greater detail in Position Paper D 'Knowledge Management '

Archiving

Archiving of some of the datasets may not be permitted by the specific licence agreements. In these circumstances metadata are vital if the materials need to be regenerated for subsequent use. Where data reproduction is not permitted it may be necessary to maintain digital copies of the printed diagrams and maps that accompany the SMP rather than the project files used to create these diagrams. Portable Document Format (pdf) data management is recommended for printed map files. It is recommended that a national archive of SMPs in digital format be established. The development of SMPs accessible online would also help with the wide distribution of the information.

Archiving has been covered in greater detail in Position Paper D 'Knowledge Management '

Catchment Flood Management Plans CFMPs

CFMPs fulfil a similar planning role to SMPs. Detailed guidance on the development of CFMPs is given in two volumes published by the Environment Agency, Defra, and the National Assembly for Wales in 2002. A similar overall approach to data and information acquisition and results and knowledge management to that described for SMPs above is envisaged.

Data (especially at a high level or regional scale) forms the core of the CFMP procedures and analysis. Without a comprehensive knowledge or understanding of all datasets available for the catchment, it may not be possible to understand the dominant catchment processes and successfully complete the CFMP. In addition the final CFMP would not bear scrutiny by the catchment stakeholders and credibility of the final Plan could be lost.

Data collection commences early in the Inception Phase of developing a CFMP and continues well into the main part of the process of formulating a CFMP. Most catchments will have a large quantity of existing data and information available from various sources. The challenge for CFMP teams is, therefore, to: identify what is required; identify what is available; and determine the importance of each dataset and the implications to flood risk management and therefore the CFMP. These activities need to be achieved within the confines of the overall CFMP principles, which aim to provide an

overview of catchment flood risks, in a short time frame and without excessive or in-depth analysis. The time frame within which a CFMP is developed will normally preclude the acquisition of new data.

Data Sources
Experience has shown that the majority of data required can be obtained from four main sources:

- The Agency's National Centre for Environmental Data and Surveillance (NCEDS).
- Agency regional and area offices.
- Consultees; and
- Site visits.

The data held by each source often overlaps or is duplicated. Therefore, a 'top-down' approach is advocated whereby NCEDS datasets are collected first, then the Agency regional office is contacted, before in-filling the gaps with information from the Agency area office(s)). If Strategy Plans or other similar studies have previously been undertaken in the catchment, a significant quantity of data may already have been collected. Therefore, early checks should be undertaken to avoid duplication of effort, where possible, and to confirm the accuracy of national datasets (supplied by NCEDS) with Agency regional/area staff.

The MDSF software for ArcView provides facilities for inspecting and assessing data. Certain data are required to enable the software to carry out its functions and it is anticipated that NCEDS will provide most of this data at the beginning of the CFMP process.

Collection of data from consultees should be linked with the key consultation stages, which are identified within the Communication Plan. At key stages (e.g. the workshop following consultation on the Inception Report), consultees should be encouraged to bring with them significant datasets that they hold, or to document their knowledge at the meeting. Obtaining data by sending generic emails or letters to consultees has, from experience with the CFMP Pilot Studies, led to a poor response rate.

The importance of site visits to the catchment by all technical staff working on the CFMP project should not be underestimated. These visits can often resolve questions that arise from the collected data, and help to build a knowledge and understanding of the catchment that cannot be gained from other sources.

Identification of Key Knowledge Holders
The guidelines envisage that within each data source organisation, there are staff who familiar with the data that is available and can be provided. Experience has shown that these 'knowledge holders' are not necessarily fixed by post or seniority, but tend to be staff whose local knowledge of the catchment, or long-term involvement with it, means that they are well informed. Identification of such people is invaluable to understanding what

information is available and how to obtain it. Key knowledge holders should be identified from discussions with consultees.

Information Receipt, Assessment and Audit Trail

The guidelines anticipate that each stakeholder organisation will hold numerous types of catchment data. It stresses the importance of a documented audit trail of typical details, such as: what has been seen or received; its format(s); which part of the catchment it applies to; and its importance for the completion of the CFMP. The audit trail will, it is considered, assist greatly when catchment flood risk management policies and possible measures are being appraised later in the project.

It is seen as important for the credibility of the CFMP, as a broad-scale document, that all major data are identified and documented. Data that are assessed as not directly relevant may be discarded, but the audit trail should remain for stakeholders' information. Data and the audit trail should be in GIS format wherever possible.

Significant National Datasets identified within the guidelines for using MDSF

A flood Modelling and Decision Support Framework (MDSF) has been developed under DEFRA funding to support the production of CFMPs. The MDSF is a software tool based on Geographical Information System (GIS) technology that assists the analyses of data at the various stages of production of a CFMP.

It is assumed that at the start of the CFMP project, NCEDS will provide suitably formatted GIS layers to enable the MDSF to undertake its functions. The data needs for MDSFD are summarised below:

- Ordnance Survey (OS) background mapping;
- Catchment boundaries, and a facility to determine sub-catchment boundaries;
- A digital terrain model (DTM) for the catchment;
- Main river centre lines and water features (CEH digital drainage network);
- Latest IFMs or Section 105 flood envelopes (including extreme flood outlines, when available);
- Land cover data;
- Administrative area boundaries;
- Geological mapping;
- Rainfall information;
- Economic damage data, based on the OS Addresspoint and Valuation Office Focus databases;
- Environmentally designated areas;
- Social impact data, based on enumeration districts; and
- Roads.

Results from the MDSF are heavily reliant on the quality of the original datasets. There is a need to maintain national datasets for the MDSF, each of which has an assessment for quality and accuracy. There will be an on-

going need to ensure datasets are updated and improved datasets are utilised when they become available.

Other National Datasets and Information

The following examples of major datasets that have been, or are being, undertaken on a national basis are given in the CFMP guidelines:

- National Flood and Coastal Defence Database (NFCMD) datasets;
- Other asset survey data;
- Section 24 (5) land drainage surveys, and identification of problems;
- Landscape assessments;
- River Habitat Survey (RHS) data;
- River Restoration Centre (RRC) inventory of River Enhancement Schemes;
- Local Environment Agency Plans (LEAPs) or predecessor Catchment Management Plans (CMPs);
- Water Level Management Plans (WLMPs); and
- Shoreline Management Plans (SMPs).

In addition, local government hold the following national datasets:

- Local Plans (from local authorities);
- Structure Plans (from county authorities);
- Unitary Development Plans (UDPs) (from unitary authorities - if present);
- Regional Planning Guidance (RPG) (from regional government offices);
- Biodiversity Action Plans (BAPs);
- Identification of Critical Ordinary Watercourses; and
- Section 24 (5) land drainage surveys for their area.

Although the above information should fulfil a large part of the data requirements for the CFMP, there may be local data which is important in assessing flood risk management, and which may supplement (or provide better definition) than that obtained from a national approach.

Survey Data

To improve the accuracy of modelling and flood extent mapping from the national datasets, use should be made of the best definition survey data in the catchment. This may be held by the Agency or drainage board and may consist of:

- In-channel cross section surveys;
- Photogrammetry;
- LiDAR or SAR data on flood plain topography and elevations to construct a DTM;
- Other large-scale topographical surveys; and
- Details of hydraulic structures.

Where there are no in-channel survey data available, it may be necessary to undertake a small amount of watercourse survey work. The RHS and NFCMD also contain basic cross section details and so can be useful for cross checking. However, these are not usually referenced to OS datum.

In order to construct any hydraulic model, cross sections across the floodplain may be taken from the DTM, which will also give an early approximation to channel details.

Catchment Processes, Flood Management, Environmental and Social Data
The Agency and consultees will usually hold a significant amount of information on catchment processes and flood management. This may contain:

- Hydrometric and hydraulic information from gauging stations (required for modelling);
- Previously completed models (especially Section 105 hydrodynamic models);
- Geomorphological data;
- Other local datasets (as identified by the Project Board);
- Significant water abstraction locations (with related quantities);
- Groundwater movements; and
- Maintenance information and regimes;
- Operating regimes for hydraulic structures;
- Details of existing flood defences and standards of protection;
- Flood warning arrangements and procedures;
- Agency regional or area flood reports from significant recent events, and details of historical flooding incidents;
- Previous flood studies and other historical information;
- Other non-Agency operating bodies' policies or flood risk management regimes; and
- Water company information on flooding from sewerage systems (DG5 data).

Since a CFMP is a high-level document, collecting detailed environmental information is not necessary to assess flood risk management policies, But, there is a need to identify the location of designated sites and their general water level management and flooding requirements. A significant amount of the information required can be attained from the GIS environmental designation layers provided by NCEDS.

It is likely that other local information on environmental issues relevant to flood risk management may be available, which the CFMP team may need to take into account. The Project Board should assist in the identification of this additional information, alongside consultees such as English Nature and the Forestry Commission. The guidelines envisage that the majority of additional environmental information, other than that provided by NCEDS, should be gathered through readily available documentation and other national datasets.

Although rigorous assessment of the social effects of flooding at a broad scale is constrained by the nature and understanding of the problem, a certain amount of baseline data and information may be useful in assessing the effects on particular areas. The NCEDS information provides data for

the MDSF on aspects such as population age profiles, etc. Local information is also important, such as:
The locations of particularly flood vulnerable buildings e.g. hospitals, schools, retirement homes, emergency response centres and council depots;
Historical information, e.g. newspaper reports, which can assist with the identification of other problems areas; and
The locations of particularly flood vulnerable travel routes, which may help in emergency planning.

The CFMP guidelines outline the sources of key catchment data that need to be collected (or a knowledge attained of) to undertake the CFMP process. Although each catchment is different, the majority will have nationally available data, which makes its identification simpler.

Other information can be identified and collected with the aid of the Project Board, identified key knowledge holders or consultees. Each dataset should be assessed for its implications for flood risk management within the catchment and clearly audited.
It is imperative that any data received from outside the Agency should be presented and stored in a format that complies with the Agency's data standards. The data that is collected will become a valuable list of all relevant information in the catchment. This record may then be used in subsequent Strategy Plans and studies related to Flood Risk Management Solutions, significantly reducing the time taken for data collection activities. Agency staff and other operating authorities may also find the record a useful point of reference that could be regularly updated.

External Initiatives

There are many ongoing external projects/initiatives dealing with data acquisition; English Nature, Irish Sea Pilot, Coastbase. These are some of which have been outlined below:
English Nature
English Nature is currently working with the EA, National Environmental Research Council (NERC) and Defra on an EC LIFE Natura funded partnership project. It is addressing the impact of sea level rise and the flood and coastal defence response on the internationally important habitats protected by the Habitats and Birds Directive together with on a project called 'Living with the Sea'.

The Project aims are to promote:

- Understanding of long term coastal change resulting from sea level rise.
- Sustainable integrated coastal management policies.
- Ownership of shared issues and common solutions.

Irish Sea Pilot

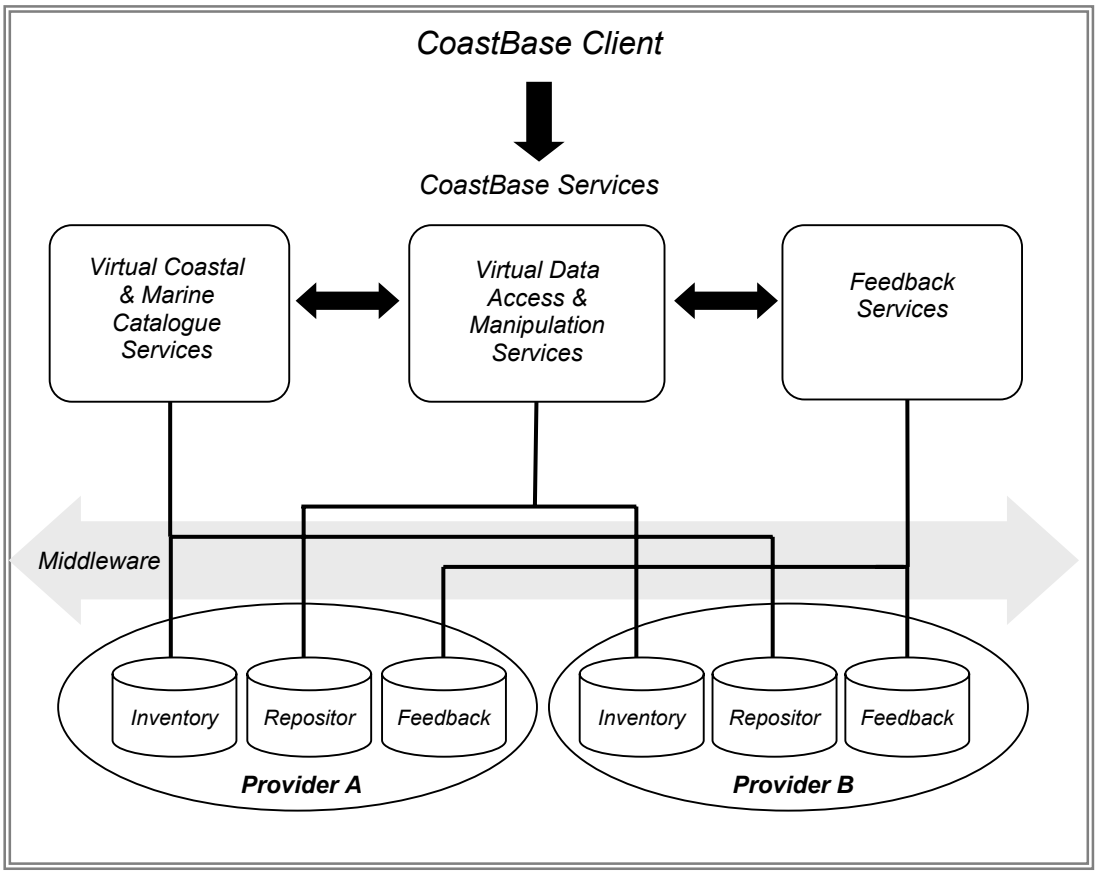
The report on the Irish Sea Pilot sets out the aims of data and mapping and the experience of acquiring data from partner organisations. The main sections in the report are:

CoastBase

The CoastBase Project is supported by the European Commission within the Fifth Framework Programme – Research and Technology Development (DG Information Society) launched in January 2000 by a multidisciplinary from all parts of Europe. The object of the project is to develop a technical architecture for an easy search and access to distributed data and information in the field of marine and coastal environment. It can be an innovative tool to support management and assessment of marine and coastal areas.

The ultimate aim of CoastBase is to improve marine and coastal research, assessment, policy making and cooperation along Europe's coast by creating an internet accessible system architecture, which helps professionals, involved in policymaking and research to query distributed data and information.

The system will link to a broad spectrum of information covering the most important spectrum, stored in various formats, by organisations working on different horizontal levels all over Europe.



Other external projects/initiatives dealing with data acquisition have been outlined below;

The general objectives of the RIPARIUS Concerted Action at the outset of the project were:

- Identify methods of encouraging interdisciplinary communication and co-operation in all aspects of flooding.
- Determine (and if possible prioritise) areas where improved communication will have greatest impact.
- Identify relevant advances in information and communication technology through links with other projects.
- Produce reports which clarify the type and form of information that needs to be disseminated to mitigate the effects of floods.

As a Concerted Action, it was possible to make recommendations on the role of telematics or information technology in this application area, but it was assumed that the mechanics of achieving these objectives would depend on future telematic solutions being put forward.

These objectives were addressed via a Concerted Action consisting of a series of expert meetings and workshops, each of them considering particular topics relating to communication requirements and possible technological and social solutions. This approach facilitated the exchange of information and coordination of approach across EU member states with input from a wide range of user groups.

Development of a pan-European database of rivers, lakes and catchments in support of the needs of environmental policies is being developed by the Joint Research Centre at Ispra (Italy) – GIS based; 250m grid cell scale; information on climate, vegetation cover, morphology, soils and lithology to derive (sic) river networks and catchments; designed to support the implementation of the WFD

The Floods Group within the Institute for Environment and Sustainability (IES) Natural Hazards Project is addressing the impacts of flooding on different temporal and spatial scales, using techniques that include the interpretation of remotely sensed images (a form of data acquisition not often mentioned in the context of FCM in the UK) http://natural-hazards.jrc.it/floods/

IMPACT (Investigation of Extreme Flood Processes and Uncertainty) (EC Res Project EVG1-CT2001-00037) is a pan-European initiative involving nine organisations (including HR Wallingford) includes the collation and analysis of
case study data on breach formation processes in flood defence embankments … ref http://www.samui.co.uk/impact-project/
The RIPARIUS (Risk of Inundation – Planning and Response Interactive user System) is developing telematics (.. an important new suite of tools .. to raise public awareness of flood issues … and providing essential information at times of flooding) … ref www.nwl.ac.uk

Work in Italy by Falcidieno *et al* mentions 'data reduction' as a means of using minimum data for retrieving the maximum information possible in the context of digital terrain modelling

Conflicts and Competition

Overview

Perhaps a key point that has arisen out of this Position Paper and research that has been carried out to date to help prepare these Papers is the need to alter competition so long as it can be couched within a strategy of collaboration.
It is perceived within the industry that there is a lack of collaboration on certain FCM projects, both from academic or govt funded research. The implication of this is that different data sets are often used for geographically or technically similar project, providing different results. An example is that of return period water levels as there is often great confusion over which data or information to use. This relates particularly where the results can be of use to many organisations or functions, although many are not aware of what is planned / already undertaken by others.

Coastal Defence 2000

The Oakleaf Coastal Defence package was designed in response to a brief from Arun District Council for an easily understood, easy to use package to manage the data required to track the estate of the coastal defence assets under their management.

Building on Oakleaf's design philosophy that software should be designed for use as a tool to help rather than hinder people in their day to day administrative tasks, the Coastal Defence package was produced with clear and easily understood screen handling.

All aspects of the management of coastal assets are tracked including access details, deta8ils of construction, scheme costing details and a comprehensive inspections log.

The software is produced using Microsoft Access and Visual Basic and is available in both stand alone and client/server configurations. Information is easily transferred into spreadsheet or graphical analysis formats.

Partnerships need to be encouraged within the FCM industry. The Atkins team are aware of the current Agency discussions with Partnership UK.

Coastal Defence 2000

There are examples of where the industry sometimes misses opportunities to make sure government departments, researchers or consultants are all using same systems. An example of this is NFCMD which is currently not well communicated locally to Local Authorities. The implication of this is that private software developers have seen gaps in the market to assist the industry. Alternative data assets systems have been developed such as

Oakleaf's Access database. Whilst this is seen as a creditable system, there is debate as to whether it is necessary in the future.

Current and future policy, international agreements, and legal developments
Over recent years, the Agency has increasingly prioritised its investment decisions on the basis of flood risk. The Flood Management division of Defra is in the process of developing its Public Service Agreement. Fundamental to a PSA is a Service Delivery Plan, which sets out how the Department will deliver its stated outcome of reducing flood risk. The Department's performance against that plan will be the key to unlocking finance from the Treasury, in competition with other Government spending Departments.

The ability of FCM to secure future funding will be dependant on being able to demonstrate that investment in FCM is having a commensurate reduction in the risk of flooding. Fundamental to the ability both to make informed decisions in FCM, and to demonstrate a reduction in flood risk on a national basis, is the need for good quality data.

Legislation has been and increasingly will be a key driver of data acquisition and management. There are currently four relevant and important initiatives at the European level which should be noted in terms of their impact on FCM matters over the next few years:

- the Water Framework Directive, due to be implemented in full later this year. One of its key requirements is that the focus of planning and strategy should be on river catchment areas and another involves the use of geographical information systems in reporting.

- the Access to Environmental Information Directive, which updates the 1990 version to take into account the impact of the Aarhus Convention as well as the progress of technology and other aspects. This Directive will, as before, be implemented in the UK by means of a Statutory Instrument (the 2002 Regulations), the full text of which is still in the course of preparation at DEFRA.

- the Public Sector Information Directive, which sets out new ground rules concerning the availability of data and information generated by public bodies

- the INSPIRE Initiative, which is currently in the final stages of preparing a Proposal to be put before the European Parliament and the Council of Ministers. This is to do with legislating for the harmonization of geospatial information and systems throughout the European Union, leading off with environmental data but eventually, it is hoped, rolling out to other sectors such as agriculture, transport, health, etc. The priority data sets which will be required of Member States by INSPIRE as proposed by the European Environmental Agency include:

1. Bathymetry

2. Coastline
3. Surface water bodies
4. Water catchments
5. Groundwater bodies / aquifers
6. Water resources
7. Natural risk vulnerability zones
8. Land cover
9. Land use
10. Environmental management and reporting units

It is anticipated that the earliest data for the implementation of the first phases of INSPIRE will be 2007-8, with completion of certain data themes possibly taking until 2015.

The Integrated Coastal Zone Management Recommendations are, of course, not a Directive. The findings of the Stocktake exercise (Atkins 2003) shall be available during May 2004.

Water Framework Directive (WFD)
WFD is the most substantial piece of EC water legislation to date. It requires all inland and coastal waters to reach "good status" by 2015. It will do this by establishing a river basin district structure within which demanding environmental objectives will be set, including ecological targets for surface waters. A lot applies to Data Needs, Acquisition and Knowledge Management. Position Paper 4 should also reflect discrepancies with EA regional Metadata issues.

Data collection typically generates a list of documents and datasets. When the data has been encoded, even with little information, the record becomes metadata. Metadata systems may be used to identify and source data. Key data providers have developed their own metadata systems.

Key Recommendations

Some of the issues covered by this reports such as acquiring data, metadata, the licensing, storing and archiving of data. Clearly current projects have tackled such issues and an accumulation of how these issues were overcome would be the ideal way forward.

The majority of the report centres around the current initiatives: Draft SMP2 Procedural Guidance and also NFCMD. A screening process for data acquisition should be carried out with a periodic review of data with a broad understanding of sensitivity issues.

Joint initiatives with EN (English Nature) and other organisations such as JNCC (Joint Nature Conservation Committee) could be explored to identify how co-ordinated data collection can save money for both organisations incorporating the level of defence and uncertainty elements associated with this needs to be improved.

The ROAME and CSG7 clearly states that some big wins are possible if data collection exercises are planned and processed with the knowledge of those bodies which have a shared interest either in the area or in some of the data. Considerable cost savings are possible if a more co-ordinated approach was taken between environmental groups with and without the Agency and Flood Defence practitioners. This should be explored so that institutional strengthening of the data management protocols and practices can be developed within all relevant bodies in the subsequent research.

Some of the recommendations presented in Position Paper 5 are replicated here as being representative of the way forward for data acquisition within the FCM industry.

Establishing Partnerships

The study recommends encouraging partnerships in acquiring datasets. Defra/Agency can be more proactive and clear in how best to combine resources (internally and externally) when undertaking data acquisition and also in information dissemination. Whilst partnership adopting is seen as a positive approach, it is also key to clearly nominate a lead organisation that is responsible for establishing lead responsibilities and protocols for collecting data on the extent and impacts of all flooding. (The Environment Agency may be best placed to undertake this role under its supervisory role.) Operating Authorities and Professional Partners should be encouraged to collaborate in developing protocols for those items in which they have a joint interest.

Using Existing Mechanisms

It is evident that existing mechanisms are in place for capturing information of flood events or beach profile related data. What is missing is clarity between regions in terms of data acquisition. Wherever possible, the Agency/Defra need to review regularly existing mechanisms of data acquisition rather than setting up duplicatory processes or systems that do not provide a service.

5.5 Position Paper D – Knowledge Management

Flood and Coastal Defence information resides in many different forms across a range of institutions. This knowledge may be in formal flood defence databases, controlled and uncontrolled filing systems, or with individuals.

For a number of reasons it is difficult to keep track of, and make use of, knowledge effectively across the industry. For example, within single government agencies information is held at different levels, e.g. Area, Region and National levels; at different spatial and temporal scales and for different planning, regulation or operational purposes.

In order to manage knowledge effectively the industry needs to know:-

- what their knowledge assets are
- how to manage and make use of these assets to get maximum return/create efficiencies
- how to avoid making decisions based on inappropriate data (scale, age etc….)

This Position Paper focuses on how Knowledge Management techniques may benefit the Flood and Coastal Defence (FCD) industry.

The workshop on the 24th April 2003 considered the benefits of data collections and looked at the development of appropriate techniques, such as GIS, the internet and meta-databases for improving the management of FCD information.

Purpose of this Paper

This position paper compiles the findings from the workshop and subsequent interviews among people in the industry and reviews the overarching benefits of Knowledge Management. It will outline what has been learnt from this approach, evaluating current industry practice and assess future needs in relation to capacity building and training.

The information issues within FCD were divided into six areas, each depicted as a wedge in Fig 1 below. Knowledge Management is the fourth objective and covers the how existing data is used and managed in the context of FCD. Knowledge Management is clearly closely related to data accessibility and the use of new technology that are discussed in separate Position Papers. The inter-relationships between the papers are described in Section 2 and rather than repeating the content of papers B and F, this paper focuses on understanding the value of data in terms of costs/benefits; actions that would improve Knowledge Management and the need for audit processes.

Link to Project Objectives

The overall project objective is to prepare a single report which will be focused on identifying areas within which data management within the FCD community can be made more efficient and it will set out methods by which this will be achieved. This position paper will ensure that the current practices of information management including tools and techniques for collection and storage of data are documented and that areas for improvement are identified and prioritised.

Approach

The activities leading up to this position paper are as follows:

A questionnaire was sent around to members of the FCD industry. This provided an initial response indicating which issues were regarded as priorities within each of the objective areas.

A workshop involving key stakeholders was held to discuss the issues highlighted by the response to the questionnaires and establish if there are additional areas that require attention.

Following on from the workshop consultations with key stakeholders and others identified in the course of the project have been carried out.

All of these responses which are relevant to Knowledge Management have been reviewed and summarised to produce this position paper.

Key Questions asked for this position paper

The Project Record (PR) Report produced for FD2314 states that the object of the Knowledge Management position paper would be to "*evaluate the benefits of data collections and develop appropriate techniques for more widespread application of value of information techniques*"

The key request in the questionnaire before the workshop was:

- *Provide up to three data collection or storage techniques/tools (current or future) that would increase the "value" of information generated/compiled within the FCD industry?*

The questions posed in the questionnaire regarding "Knowledge Management" were as follows:

- *Provide data collection or storage techniques/tools (current or future) that would increase the "value" of information generated/compiled within the FCD industry.*

- *Suggest three incentives (current or future) that would improve participation by the wider community in providing data for flood defence issues.*

- *What are the main risks associated with these?*

  Discussion points on Knowledge Management arising from the workshop were:

- Should centralised databases be used?
- The use of metadata for improved data management
- Limited resources – how do we deliver?
- Skill shortages within the industry – how do we rectify?

  In light of the above data-gathering exercise and the Framework of Approach (discussed in Overview report to all (Position Papers) the key issues for the paper have been refined to:

- The application of Knowledge Management to benefit the FCD industry.

- Understanding the value of data and evaluating the benefits of data collection
- Defining generic work processes and audit principles to be used in FCD projects

These issues form the basis of the discussion later in this Position Paper.

Inter-Relationships with other Position Papers

Common Aspects

Knowledge Management has common aspects with some of the other objectives identified in data and information issues within flood and coastal defence. This is most clearly seen through the "Framework of Approach" overview paper. In this, Knowledge Management is strongly mapped to the 'update' and 'retention' stages of the data lifecycle. New Technology and Data Accessibility are also weakly mapped onto the 'update' stage, while Data Accessibility is also weakly mapped onto the 'Retention' stage. This paper will consider how best to manage its data to assist the FCD community in the use of data and tools to provide knowledge about the issues studied. Issues of when to update data and how long to retain it are also considered here. Knowledge Management should also be loosely mapped to 'storage' and 'access'. Elsewhere in the position papers Knowledge Management is talked about in the context of communication, dissemination, uptake and knowledge transfer.

The "Framework of Approach" also considered the five principles of data management. Knowledge Management is strongly mapped onto the 'audit' principle. The principle states that processes for data use and exchange should be audited and monitored. In the five principles, Knowledge Management is also weakly linked to the 'roles and responsibilities' principle and the 'processes and procedures' principle. The former principle is all about understanding the legal and contractual issues (who does what and who has a duty of care) and performing the expected duties. The latter principle is all about identifying and specifying the organisational processes and procedures that should be followed.

The Framework for the Position Paper

Review of Relevant Data Resources, Models, Management and Projects.

- National Flood and Coastal Defence Database (NFCDD) held by EA.
- National Centre for Environmental Data and Surveillance (NCEDS) part of EA.
- WS Atkins Consultants Ltd., 2001. Overview of Data Management Issues in Flood and Coastal Defence, Defra/EA R&D Technical Report W5G-007/TR.

- Millard and Sayers, 2000. Maximising the use and exchange of coastal data, CIRIA report C541.

- Mayon-White and Dyer, 1997. Principles of good practice for information management. ISBN 0 580 26855 1.

See also list of projects provided in the Project Record (PR) Report.

Relevant External Initiatives

HarmonIT is a research project funded by the European Commission aiming at the development and implementation of a European Open Modelling Interface and Environment (OpenMI) that will simplify the linking of hydrology related models. The establishment of the OpenMI will support and assist the strategic planning and integrated catchment management required by the Water Framework Directive. See http://www.harmonit.org/ for more details.

ENVALDAT was a Concerted Action funded by the European Commission DGXIII (Contract Number: ENV4-CT96-0363). The project set out to look at the methodologies that are in place for valuation of environmental data, with the objective of providing tools that non-specialists can use for assessing data worth in financial terms. See http://www.hrwallingford.co.uk/projects/ENVALDAT/index.html

Issues arising in Knowledge Management

Common Themes from the Workshop

The common themes that came through from the initial questionnaire were very similar to those highlighted in Position Paper C Data Acquisition.

There was uncertainty at the workshop over whether this objective is addressing the dissemination of data or the broader issue of knowledge management. The workshop groups discussed a range of issues, particularly focusing on the use of the internet, metadata, databases and search tools and the limited resources in terms of funding and staff skills to action best practice in knowledge management.

The consensus from the workshop was that web sites and centralised databases should be used to store and access data. An example of such a centralised database that was frequently referred to is the NFCDD (see Position Paper B).

Raw and processed data as well as the results of modelling studies are often stored in relational databases. For example the Section 105 programme involved the population of the Floodplain Information System (FPI) that consisted of a MapInfo interface to an Access database.

Databases allow data to be linked, queried and analysed based on spatial and non-spatial attributes, such a flood event or return period. They can be linked to the Internet, on public or private sites, and company Intranets to allow the sharing of information. Web-based GIS tools can also be developed to allow

interactive map queries and several good examples of this technology can be found on the Environment Agency's web pages.

Data sharing is as much about individual and institutional attitudes as the application of web-based technology. The nature of the FCD industry is compartmentalised with different parts of organisations responsible for flood defence operations, maintenance, planning etc…. Individual divisions may have the data they need and share data only on a "need to know" basis, unaware of its value to others working in related fields.

The use of metadata for improved data management

The development of metadata that describes the nature and quality of digital and analogue data holdings is an important pre-requisite for knowledge management. In some disciplines such as GIS the use of metadata has become well established but within the FCD industry practice is varied among government agencies, consultants and other stakeholders. There is a clear need to develop a metadata standard for flood and coastal defence data. These could be based on one of the existing standards; for example that developed by the Association of Geographic Information (AGI) for GIS data, or some of the common denominators between the various approaches for describing different types of data. The use of meta-databases is discussed in Position Paper F.

NCEDS has an important role in leading the development of meta-data standards. In addition major framework work programmes, such as CFMPs and Flood Risk Mapping, must define consistent formats for project deliverables so that information collected can be effectively shared and used in related projects.

Limited resources & skills shortages

At the project workshop funding, resources and the general skill shortage within the industry were identified as problems. It is unlikely that the FCD industry will be able to attract large numbers of skilled data management specialists, as rates of pay are higher in other sectors. Therefore the industry must work on the basis of having teams of specialists to deal with the centralised national and regional databases as well as more complex IT issues (e.g. NCEDS) and the training non-specialists and flood defence staff in updating, checking and adding-value to existing data sets. It is important that process becomes a partnership within and between institutions so that everyone benefits from improved knowledge management.

The central teams could be tasked with creating tools that will aid the non-specialist to perform necessary tasks in a standard way. The central teams would be responsible for disseminating information about the new tools, via workshops and training courses. The new tools could be software or procedures.

Conflicts & Competition

There was some concern that this project overlapped with the procedures being followed for NFCDD, which is likely to become the centralised database. Importantly, it was stressed that this research project has a wide scope and will only provide an assessment of the current situation and ideas instead focusing on possible ways forwards, preferably seeking quick wins where possible. It was however, agreed that centralised databases, such as that being developed for NFCDD are essential towards the objective of this Position Paper.

Key Factors

Data update

Part of knowledge management involves developing a strategy to assess when data should be updated, to reflect new measurements, new research or new technology. Good management practice should determine when and how such updates are to be applied and to ensure that data users are kept abreast of changes to the data. The major issues for consideration during the update phase of the data lifecycle are shown in Figure 1.

When upgrading a data set to include new information, care must be taken to ensure that existing data is neither lost nor becomes incompatible. All copyright and licensing issues should have been determined at the creation stage and should have allowed for upgrades and distribution. If, however, data from a new supplier is included in an updated database, it is important to consider the implications for the distribution policy at the purchase stage so that suitable access rights may be included in the contract.

Version management of datasets is important in updating a dataset as it may be necessary to retain superseded versions, if they are perceived to have historic importance or may be necessary for data recovery.

The update policy will affect the choice of software and hardware used to store and access the data, as these must be easy to upgrade without restricting access to the data. Funds will be necessary for updating the dataset periodically.

Data update may be driven by the assessment of the data user as to which part of the data / modelling process is the weakest. For example, in RASP, a measure of uncertainty is ascribed to each piece of data. This allows the user to test the sensitivity of the output against the uncertainty in the input. In this way, the most critical uncertainties can be identified and efforts made to update the relevant data with more accurate data (or data at a higher resolution if that is an issue). In other cases an update strategy may be defined that specifies a particular interval between data updating. The decisions on data update will also have to take into account the development of new technologies, which may supersede old technologies and allow data to be collected more accurately or faster or cheaper.

Data updating can also be part of the audit process.

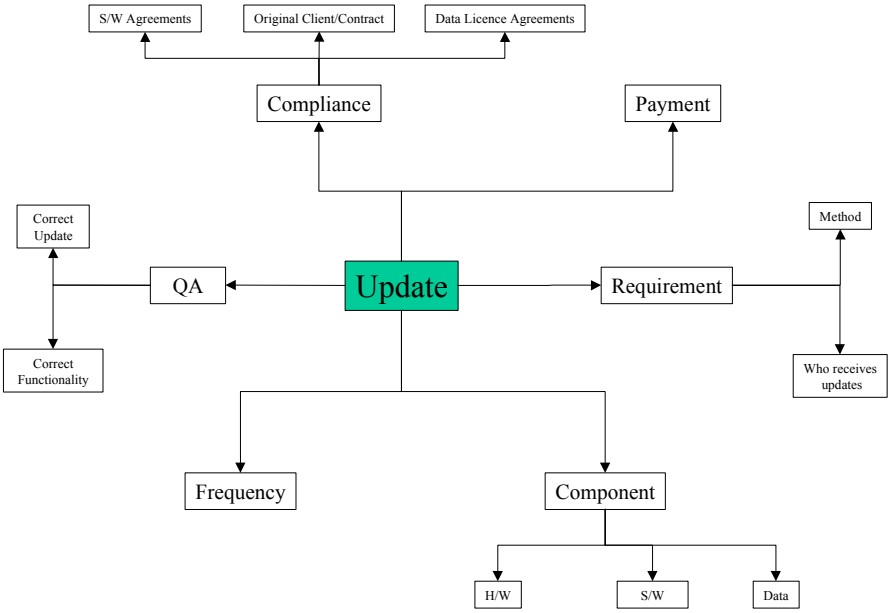


Figure 1. Issues to consider at the update stage of the data lifecycle. From Scientific Data Management by Project Consortia: Best Practice Guidelines.

Data retention

Data retention is covered by the Data Accessibility paper (Position Paper B) which looks at the technology for storing and accessing the data) and Knowledge Management (which considers how much data to hold, whether to retain old data when new has been collected and whether to retain data of dubious quality at all).

Sometimes in FCD the only available data is of poor quality. For example, the only data on crest elevations may come from the specification that states that the structure should withstand a 100 year return period water level. Knowledge management will help to address the issue of whether to use poor quality data or not. In many cases modelling systems will not work without certain mandatory data and values must be entered from whatever source is available. Knowledge Management can still help in identifying the crucial data needs.

Data that is not in active use is often archived. Archived data must be accompanied by metadata. This metadata should state where the data is archived and should be stored separately in a metadatabase so that the data can be located and retrieved easily. It is sensible to keep a copy of the source CDs so that the database can be rebuilt, if necessary. Data may need to be retained long after the project that collected the data has ended. There will be a cost to retaining this data and it is important to identify who has the responsibility for holding the data and who will pay. Centralised databases, funded as ongoing projects, are especially useful for this.

The costs of data retention should allow for the fact that the original storage medium may deteriorate with time and that the hardware and / or software may become obsolete.

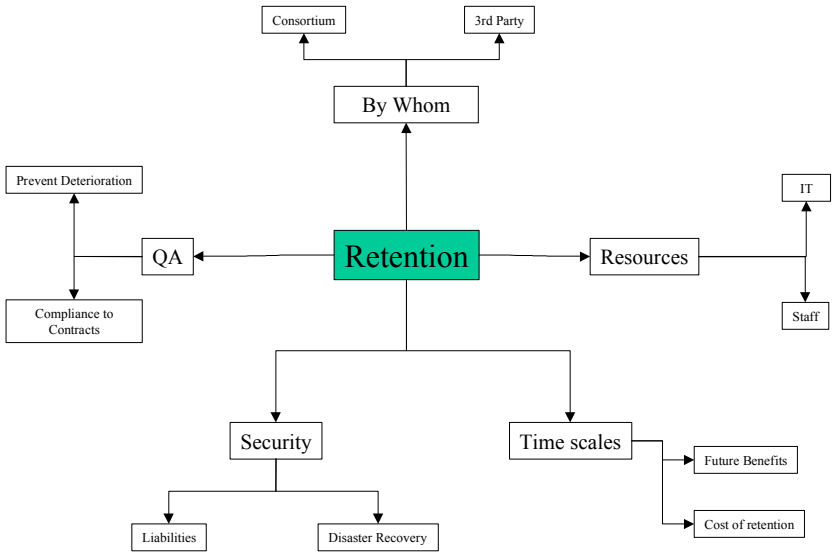


Figure 2. Issues to consider at the retention stage of the data lifecycle. From Scientific Data Management by Project Consortia: Best Practice Guidelines.

Data deletion

Data deletion is the final stage in the data lifecycle. Data may be deliberately deleted as part of the knowledge management process, or it may be lost through ineffective archiving. Data should only be deleted if:

- Its deletion is specified in the contract;
- It becomes technologically obsolete;
- It is replaced by newer information.

Steps should be taken to ensure that valuable data is not destroyed. It is important to establish who has the right to decide that a dataset should be deleted. It may be possible to find an organisation willing to store old datasets rather than having them destroyed, particularly if they then have the right to use and exploit the data. It may be possible to retain the metadata for data deleted by a project, particularly if the data is held by the original source so may be retrieved (under a new license or purchase agreement). The metadata should be amended to record that the data was deleted (by a project or completely) to prevent time being wasted in searching for deleted data.

Understanding the value of data and evaluating the benefits of data collection

The benefits of data collection can be evaluated against a number of criteria, including:

- Does the data enable us to complete CFMPs or SMPs or strategy studies or schemes?

- What is the cost to benefit ratio of the scheme implemented using the data? If the sheme then saves lives that would otherwise have been lost, what is the value of each life?

- What is the value of information on the environment, given that CHAMPS and the Habitats Directive may influence the options that may be offered in a CFMP or SMP?

Some studies have considered the financial benefits of environmental data. These include:

- EC, 1999. Public sector information: a key resource for Europe. Green Paper on public sector information in the environmental society., COM(1998)585.

- Oxford Economic Research Associates, 1999. The economic contribution of ordnance survey GB. http://www.ordsvy.gov.uk

- Love, J., 1995. Pricing government information. J Government Information. 22(5): 363-87.

- Zevernbergen, J., 1998. Free accessibility of geo-spatial information in the Netherlands, the United States and the European Community. Delft University Press.

- Dyer and Millard, 2002. A generic framework for value management of environment data in the context of integrated coastal zone management. Ocean and Coastal management 45: 59-75.

These consider the large amounts of intangible benefits environmental data provides and the issue of how much of the cost of data capture and processing should be borne by the secondary users. Techniques for applying these generic principles have been developed in project such as ENVALDAT (section 3.2) that could be applied to FCD Management as well as ICZ Management. The current Defra ICZM in the UK Stocktaking exercise (Atkins 2003) is reviewing Knowledge Management issues in the context of implementing ICZM in the UK. Results of this project are expected during the summer of 2004.

Defining generic work processes and audit principles to be used in FCD projects

Knowledge management is mapped directly onto the fifth principle of data management of auditing and monitoring the processes for data use and exchange. The issue has been summarised as: "What audit principles and procedures should be used?" The concept of auditing a data management system will be unfamiliar to many, but is similar to the financial auditing of a company, in that the audit provides a series of checks that the system must pass if it is to be seen as acceptable. Auditing ensures that an organisation employs appropriate measures to monitor and document its operations (and those of sub-contractors). The audit system will pick up and document any deviations from designated standards and methods.

Appropriate audit procedures enable the benefits provided by each part of the data processing chain to be evaluated against criteria. It also enables areas where improvement is necessary to be identified (Millard and Sayers, 2000). The auditing process then feeds back into the processes and procedures used to generate, use and exchange data. The auditing stage ensures that the data management system is controlled and complies with relevant legislation and standards.

Issues of the greatest importance in the auditing stage are legal and intellectual property rights and archive policy. Issues of less importance include pricing, funding, advertisement and dissemination, metadata and cataloguing, data transfer and data standards.

In order to audit, one must devise indicators that monitor the success of a process, test the data against the indicators and compare the result with that expected. It is therefore important to decide where your audit points will be. A number of examples of auditing procedures are given below:

1. For example, an organisation may devise a metadata standard for its data management system, with a set number of mandatory entries. A relevant audit process would be to take a random sample of data records and count the number of correctly entered mandatory entries in the metadata. This could be compared to the expected number (= number of mandatory entries times number of records) and if the difference is greater than a specified tolerance (which could be zero) then the suitability of the data and the source of the missing entries would have to be established. If there is a consistent or significant problem then this can be used to revise the processes and procedures set out by the organisation to ensure that the data was created.

2. The accuracy of data can be audited by employing a different contractor to re-take some sets of measurements (chosen at random). The two datasets (of the same data and created to the same specification) can then be compared. The differences between the datasets should be less than a tolerance derived from the specifications set out for the measurements. If it is greater, then this raises issues about the quality of the data.

3. Data processing can be audited using standard datasets for which the correct processed data is known. If data processing centres produce a different answer from the standard then this points to some failure in the data processing chain.

4. Data access can be audited by attempting to get particular datasets. If they were easy to obtain then the data access system is working well. If the data cannot be obtained then the system is not working well (which may be because the data is not in the database, or it could be a data access problem). As an example, in the trials of the high level of RASP, it was not possible to extract a lot of data from mandatory fields in the NFCDD as the data simply was not there.

5. Audits can be made of data ownership and intellectual property rights by checking whether this information has been stored properly, again using a random sample of data.

6. All the people involved in the data lifecycle have a duty of care to the data. This should be set out in the processes and procedures. Knowledge of this can be audited by interviewing staff to ascertain whether they are aware of their duty of care.

The auditing process should include benchmarks and check lists for implementation, operation and quality (Mayon White and Dyer, 1997). The performance of any part of the data management system can be assessed using suitable auditing procedures. The hardware and software used for data management can even be audited for issues such as whether there is a suitable upgrade path and whether the software is useable by a reasonable selection of the FCD community.

Good/Bad Practice

The NFCDD is an example of good practice in this area.

Presently there are major communication problems apparent in the FCD industry. Parts of the industry are guilty of assuming that the wider community has knowledge or data and data requirements and that all make assumptions about knowing what's going on which is not necessarily true. These problems could be partially solved by the holding of a number of newly defined "best practice" events designed to disseminate information on data requirements, available data, accessing data and managing data.

The EA already subcontracts some data collection and specifies in the tender the standard that the work must be carried out to and the format in which the data should be returned. In this way the EA already seeks to ensure that the data is easy to put into a database and contains some metadata.

Conclusions

Databases

Databases will play an important role in the future as they will be the key storage medium for digital data. Knowledge management will ensure that the maximum value is derived from data. In particular, the development of search techniques, such as a data-map (integrated into a GIS) will allow consultants and staff to find out about datasets that they were not aware of. This will prevent the duplication of effort. The main search facilities could be built around a national database of metadata (which does not presently exist). The advantage of having a national metadata database is that it could combine the metadata from NFCDD, the datasets held by NCEDS and regionally held datasets. This would require much less data transfer to the centre than having to compile a national dataset of everything (bearing in mind that data exists in a number of different tiers from the national down to structural elements). Moreover, much data exists in a non-digital format and it would require much less effort to provide proper metadata for these datasets than it would to digitise all the analogue data in the hope that it could be useful in the future.

In order to form a national database of metadata, **a metadata standard** needs to be decided upon and a case for funding developed. This could be based around avoiding the duplication of cost through the collection of data that already exists, plus the added benefits of making more use of previously collected data.

Knowledge management will also increase the use of databases through dissemination and training activities that will ensure that relevant staff (of EA, Defra, other agencies, local authorities and consultants) can use the database systems efficiently and well.

Limited resources and skill shortages

Careful management will be needed to make the best use of limited resources and skilled staff. This will entail greater training of non-specialist staff in data-management techniques (see section D4.1.3). The setting of policies and procedures will ensure that staff without a data-management background can perform basic tasks of data-entry and checking (of data and metadata). Tools may have to be developed centrally by specialist staff to help the non-specialists perform unfamiliar tasks. The audit process can be used to check that such training has been effective and that the data entering data-management systems meets the standards set down. A certain amount can be achieved by the careful drafting of sub-contracts to try and ensure that data coming to the EA (for example) meets standards for accuracy, format and metadata.

Initiatives are underway within the current NEECA Framework (using four key consultants) to improve knowledge management within the industry. Some lessons can be learnt from this process over the past 2 years and how the dissemination of knowledge can be improved within the industry.

Co-ordination of data activities.

The co-ordination of data activities will reduce the duplication of effort and will maximise the use that is made of data. It is an important activity in breaking down the barriers that exist in the FCD community, which tends to be rather compartmentalised. It will require that relevant parties disseminate information about what they are doing and are willing to report back to a co-ordinator (who could well be within the EA). Co-ordination will be needed, for example, to ensure that the right tools are made available to the right people at the right time.

Make the science of knowledge management understandable.

Data management and knowledge management are unfamiliar tasks for many FCD staff. The whole process can be made more understandable by the holding of workshops to disseminate information and providing training for the relevant staff. People will work better if they understand the context within which they are operating and can be convinced that they are adding value.

5.6 Position Paper E - Involving Stakeholders in Data Collection

This Position Paper represents one of six being produced for the Agency / Defra R and D project number FD2314. Its purpose is as follows :

"Investigate the greater involvement of stakeholders, such as riparian owners, in data acquisition, to make use of a low-cost untapped resource and to promote awareness of flood defence issues in the wider community."

The Position Paper text has been based on existing knowledge of stakeholder involvement within the FCD industry. It aims to review the role of stakeholders, how their role can be managed successfully and to (where possible) identify how customers (governmental or non governmental) should be involved in data collection, dissemination and storage. The approach has been to use case study examples, from within the FCD industry and beyond, to present examples of good practice and from this to deduce appropriate ways forward for the FCD industry.

The Paper reviews a cross section of stakeholders, ranging from local community flood action groups through to Government agencies. No specific definition of "stakeholder" is defined for this project, as the focus is more on how external sources to Defra/Agency can be used to assist the industry. Attempts are made to discuss/explore the possibilities of how these external parties can act on behalf of the Agency, and the role of how individuals can be used (eg: appointing flood officers within flood affected communities who would act as co-ordinators of flood event data collection by the public). This is discussed to seek how best to relay the local perspective.

Background to the Position Paper

There is growing expectation and requirement for inclusive community involvement in coastal and flood management. This is evident in the Marine Site guidelines for establishing Natura 2000 habitats on the coast throughout Europe, and in the evolution of coastal habitat management plans and shoreline management plans. In general, the EU directives (notably the Strategic Environmental Assessment and Water Framework Directives), require an increasing element of articulated involvement and social acknowledgement in coastal planning. A critical appraisal of the value of, and dangers associated with, inclusive participatory involvement is therefore timely. More attention is given to this in O'Riordan 2003.

With specific reference to the flood and coastal defence industry (FCD), the recent ICE Commission *"Learning to Live with Rivers"* (2002) document recognised that historical data and locally generated information is of significant value. The role of stakeholders in assisting in the provision of historical anecdotal information should not be underestimated and is discussed further in this Position Paper.

The Commission believes that consideration should be given to increasing the acquisition of **primary data** for catchment planning purposes, including the possibility of installing new telemetered rainfall, water level and soil moisture gauges. One view relates to how stakeholders may be involved in collecting this data or being part of the data dissemination process. The above issues are equally applicable to coastal flood cells as well.

It is also acknowledged that there is a lack of reliable flood event data. Recent Defra/Agency research (FD2012 - Bullens 2003) has undertaken a review of post event data collection techniques, and concurs with the ICE Commission (2002) report that greater emphasis should be placed on the collection of flood data during flood events (fluvial and coastal). This should be done in a way that does not add to the burden already placed upon the Environment Agency and other staff during emergencies. The role of the National Flood Forum (see section E6) and local flood action groups are discussed in more detail in relation to this issue.

The general conclusion of the 2002 report is that the appropriate technical skills are lacking within the industry, from drainage engineers in local authorities to river engineers in the Environment Agency and skilled hydraulic specialists in universities. This lack of skills resources requires urgent attention. It is acknowledged that frequent movement of staff within the industry as part of the staff development programme has an adverse impact on the ability of the industry to respond to flood events. To this end, it is acknowledged that local and detailed knowledge of coastal and rivers, flood defences, hydrology and flood forecasting systems is important. The Commission (2002) suggests the FCD industry needs to consider how to foster skills in all areas.

This Position Paper focuses on how a wider stakeholder group could be involved in bridging this capacity gap that currently exists within the industry.

A view shall be put forward on how best to develop a structure of flood risk management that ensures sustained leadership and professional skills are available as a high priority. In addition, techniques on how all stakeholders can be brought together in partnership to promote the quality of service to the community in flood risk management will be reviewed.

The framework for this Position Paper was discussed at the project workshop, held on 24 April 2003. Here it was noted that there are constraints in data management and clarification is needed on the definition and value of data collected by those users involved within the industry. An important issue to address is how Agency/Defra gain credibility if they become reliant on third party/voluntary groups for key flood event data.

The Position Paper seeks to explore mechanisms to improve current practices, identify how wider stakeholders are being utilised in data collection, and if not why not and seek to outline possible approaches, such as appointing flood officers within flood affected communities, who could act as co-ordinators of flood event data collection by the public to enable better relay the local perspective.

Link to Project Objectives

The overarching "Framework to the Position Papers" Section (applies to all 6 Position Papers) is referred to here.

Policies have been adopted to varying degrees throughout the Agency in terms of involving stakeholders within the FCD industry, but a national policy is required to identify current levels of data dissemination, implementation and ownership. This Position Paper seeks to clarify the main project objective to focus, identifying best practice on how stakeholders may be better involved to assist the industry, identifying the opportunities and constraints of their use.

Perhaps the key link for this Chapter is to clearly determine data needs up front (Position Paper A). Once this is established, a clearer model for who is best to be involved in data management can be deduced. Position Paper A on Data Needs clarifies this situation more fully.

This research project (FD2314), and this Position Paper in particular, seeks to identify links with, for example, project FD2012 "Post Event Appraisal – (Outline) Best Practice Guide - Monitoring, Recording and Analysing Events" (due for completion during August 2003) That work states further work is required to identify any shortfalls, to meet the needs of post event analysis, in these developments and to develop detailed specifications for data collection programmes and storage systems. It states the need to integrate fully with this project (FD2314) within the Risks Evaluation and Understanding Uncertainty Theme.

Approach

Key questions to be asked for this Position Paper

The research that has been carried out to date for this project in terms of the role of stakeholders in data management (collection, dissemination or storage) suggests that there are relatively few sound examples of community involvement in data collection within the FCD industry. It is clear that there are more examples present within other more community-based aspects of integrated coastal management (e.g. beach quality).

The workshop attendees agreed that whilst stakeholder involvement has a potential role in the future, there will be the need for a robust "screening process" to ensure that the correct data is collected or disseminated. It was also stressed that any initiative that involves a range of stakeholders should not be free as any data collection, dissemination or archiving process requires good management which comes at a cost. This issue is discussed further in Section E7.

A clearly defined specification or *"model for data information"* is of paramount importance if Defra/Agency use stakeholders in data collection/analysis process (e.g. for coastal local authorities in beach monitoring). Ensuring consistency and quality is vital if this is to be taken forward.

The main issues derived from the Workshop were:

- What should be the role of the Industry (e.g.: communication, advice)?
- Using stakeholders in the process does not mean the process is free.
- The Industry's role in using stakeholders for data collection needs managing effectively.
- Keep advice practical where possible.
- Assess the National Flood Forum as a group to test the potential use of external stakeholders.
- Would improved knowledge management be useful to raise the level of understanding in the FCD industry?

The approach for this Position Paper has been to clearly set out existing initiatives or co-contributory internal (Agency / Defra) work practices currently underway that seek to use external sources to store, manage, collect or disseminate data.

This is separated from a commentary on relevant external initiatives (though possibly with Agency / Defra involvement) that have been selected as part of a review of ongoing research .

A series of issues arising from the research (phone interview/questionnaire/workshop etc) is set out in Section E7. These shall be cross related to the findings of the other 5 Position Papers and analysed against the overarching Section 1 report for the final FD2314 contract deliverable.

Parallel & Co-contributory Work/Initiatives (Agency / Defra Involvement)

Intra Governmental Geographic Information

Government policy on trading data and information requires clarification, following the development of Freedom of Information legislation and the growing demand for the use of Government data and information for commercial products. The Agency faces increasing demand for the use of its environmental data by value added resellers, particularly from the commercial publishing, property and insurance sectors.

In 2001 the Intra-Governmental Group on Geographic Information (IGGI) set up a working group to appraise the current position and draft recommendations on sharing and trading Government data and information. The aim was to prepare guidance and recommendations on the future exploitation of Government Information.
The scope applied to:

- all Government Departments, including Executive Agencies;
- all data and information held by these bodies;
- potential partners in information supply, such as Local Authorities;
- hard copy and electronic format;
- free and priced information;
- public records elements.

It should be noted that the IGGI Report was essentially a document concerned with general principles and it was not specific to either the Environmental or FCD sectors. There are nevertheless some aspects and lessons that can be learnt from this initiative for the FCD industry in relation to the involvement of stakeholders.

Data & Information Exploitation Unit (DIEU)

A separate example of good practice within the industry is the Environment Agency's Data & Information Exploitation Unit (DIEU).

The objectives of this Unit are as follows:

- To provide a framework for a consistent approach to the supply and exchange of data and information within the Agency and to external organisations. This consistency will in turn improve the accessibility and quality of data and information available.

- To prevent the loss of ownership of the Agency's Intellectual Property, with associated potential implications.

- To establish effective data exchange partnerships by which the Agency will obtain free use of Intellectual Property owned by others.

- To establish the ground rules and maximise potential for exploitation of the Agency's Intellectual Property in the Public and Private Sectors, for commercial and non-commercial projects.

- To facilitate data use within the Agency and amongst others in order to assist in informed decision making.

DIEU provides a single point of contact *(SPC)* when dealing with other government and *not for profit* organisations in issues relating to the acquisition, use and transfer of national data. This task was previously dispersed amongst 8 regional and 26 area contacts dealing with both local and national organisations.

DIEU have worked internally to develop a suite of standard IPR agreements that complement the existing AMS procedures, and provide a vehicle for consistency. These include standard data licences, along with Memoranda of Understanding (MoUs) and Service Level Agreements (SLAs) for the exchange of information.

The differing structures and remits of the various organisations that the Agency does business with have required the development of variations of these. These cover non- financial agreements for organisations that do not charge for data, exchange agreements with financial element for those that do, and overarching agreements for multiple relationships covering both.

The Environment Agency will continue to develop the process management structure to identify the corporate information needs of the organisation. Through this process the "once only" acquisition of data and information approach will be applied. The work of DIEU will continue to encourage the development and use of template Intellectual Property Agreements for the release of Agency data by the Areas and Regions.

DIEU aim to promote closer working relationships with sister organisations in areas such as developing information policy and guidance, the production of updated and new information assets, and sharing best practice. Testing this within the FCD industry could prove to be a good pilot study initiative and something to possibly encourage.

DIEU's current business plan envisages establishing a rolling programme of work covering the next two to three years aimed at:

- the efficient supply of quality data to the Environment Agency's Value Added Resellers (VARs) and partners.
- working with the Data Policy and Data Quality Units to create improved data management standards, procedures and policies.
- collating new Agency-wide datasets.
- optimised procedures for the acquisition, and supply of Agency data.
- developing Agency data management training schemes in partnership with SATIS units.
- developing direct links to Agency data.
- developing the metadata catalogue.
- developing new information products.

- broadening the Agency's information customer base with additional new VARs.
- forming mutually beneficial strategic partnerships with other public sector organisations.
- consolidating the Agency's information asset resources.
- maintaining the pattern of growth in externally-derived revenue.

Shoreline Management Plans (SMP's)

Separate Position Papers discuss in more detail the recommendations set out for the new Procedural Guidance for the second generation of SMPs (Defra 2003). In terms of the role of stakeholders in data collection, attention is focused on a specific aspect of data collection that seeks to involve a range of stakeholders in shoreline inspections. A Scoping Study has been conducted within the Southeast of England (Bradbury 2002) to discuss proposals for an integrated approach to coastal monitoring. The work also indicates how Coastal Groups are taking the proposals forward. After extensive consultation with Coastal Groups active in data collection, a review of regional and local data collection programmes found that the current approach to coastal monitoring is both ad hoc and unsatisfactory. In terms of best practise shoreline management it is evident both at a regional and local scale there is considerable inconsistency in type of data collected, data collection methods, and analysis techniques, although there are several local examples of good practice within the region.

A similar approach is being reviewed for the Agency Anglian Region, where the view is taken that, whilst the concept of the approach being adopted for the Southern Region is a robust template to follow, the practical implementation of it into other Regions (such as the Anglian Region) is problematic and comes at a cost. Unfortunately, there is no national consistency template set up within the Agency for the collection of shoreline monitored data, hence the advocacy of a national metadata approach for shoreline management related data, which, whilst preferred, is not achievable in the immediate term.

The Agency Anglian Region programme easily justified the cost benefit of a regional monitoring exercise involving a range of stakeholders. This is because the output is likely to serve a range of purposes as the findings can be used on a multitude of projects. The problems seem to arise when financial commitment to more than say 5 years is required. The Anglian Region recommend (J. Rawson *pers comm*. 2003) that a streamlining of data collection actions is required with perhaps one organisation granted responsibility to manage and maintain a national shoreline monitoring system. The initiative to fund the current Coastal Data Coordinator (Jules Harries, based CEFAS) is a positive step to longer term commitment in this context. The findings of the IACMST Data Review work (Mike Cowling 2003 – Beth Greenaway *pers comm*) needs to be reviewed to assess compatibility with other government funded initiatives.

Environment Agency Floodline – linking with Local Authorities

A separate example that shows how local authorities can be involved in disseminating useful information on flood forecasting is clearly represented by the Environment Agency Floodline initiative. The following does not outline the generic concept of Floodline, but instead highlights specific examples of its implementation.

One specific example is how the Agency have recently piloted an improved Floodline telephone service to the public involving 29 local authorities. Cambridgeshire, Hertfordshire and Devon were recently at the centre of a test programme to extend the advice line to cover a range of new topics. This now provides:

- Details of local flooding from sources not monitored by the Environment Agency including minor watercourses and surface water run-off.
- Information on local sandbag policy, availability and distribution arrangements.
- Details of local emergency aid and sources of practical help during a flood.
- Local road closures and highway conditions.

Information was supplied and regularly updated by each local authority during the trial. Callers (eg: the public) were then able to access information through the recorded message service or by speaking to one of the call centre agents.

The importance of this trial demonstrates the responsibilities that local authorities have in flood management in unison with the responsibilities of the Agency. It is appreciated that the public want information they can act on and, with Floodline increasingly identified as the first source of flooding information, it was important to initiate a working programme with a range of other partners to improve the range of advice available.

The lessons learnt from the winter 2002 flood event suggest that the Agency should review its capability to support the operation of the Emergency Services Control Centres under larger or longer flooding scenarios. This is being carried out as part of the Agency's Incident Management Project. In terms of data and information management within the future, it is recommended to assess whether there are potential opportunities for the Agency/Defra to involve the Emergency Services in determining the type of data or information needed to improve emergency response to flood events next time around. Local Community groups or regional flood forums may be one possible mechanism for this.

Automatic Flood Warnings

In at risk areas, the Environment agency invites those at risk of flooding a chance to sign up to the Automatic Voice Messaging (AVM). At times of anticipated flood, it is expected that this information is as accurate as possible and updates on a regular basis. In the case of the Bewdley floods in 2000, there was local concern that there was considerable time lag between the

information provided on the AVM and the actual flood warning. Figures up 30 hours water level difference was apparently recorded in some instances (per comm. 2003).

Such inaccuracies in information presented on the AVM are potentially life threatening or economically catastrophic in the case of businesses not being prepared in time for the actual flood event (eg: situation experienced at the Ironbridge Gorge Museum Trust where flood levels came within 1 brick of the working kiln – *pers comm*. Gillian Holland 2003).

Research for this Position Paper has suggested problems when stakeholders hold information they are willing to give to the Agency, it's extremely difficult to find anyone who's prepared to make effective use of the data. In some cases, (during the first flood of 2000), local residents have kept records of all the flood warnings they received, both from the Floodline recordings, and those that came to individuals phones direct from the AVM system.

In these instances, it was discovered that there was a major discrepancy between the two. The Floodline recorded message was already giving a predicted final level of 5.5 m. (4.8m. is the threshold of Severe Flood Warning – Gillian Holland *pers comm*. 2003), when the first AVM message was sent out giving a Flood Watch warning, no houses were affected at that level. It is stated that the AVM didn't move to a Severe Flood Warning until 30 hours after certain residents took a predicted final level of 5.5m off the Floodline recording. Apparently, exactly the same situation happened 18 months later during the flooding of February 2002.

The eventual result is little local faith that an AVM Severe Flood Warning will be run without wasting a considerable amount of time running through misleading lower code bands. The code band system dumbs down what is believed to be an excellent set of local flood warnings into a nationally convenient form.

Relevant External Initiatives

The following represents a few examples of external initiatives being undertaken (some with Defra/Agency staff involvement). Government are aware of the many lessons learned from the floods of October 2000 and, in particular, the importance of community action. The Agency have been working hard with people to develop a local understanding of plans to respond to future flooding incidents. Good examples were the work with the Llandovery Flood Action Group and community groups at Ruthin and Bangor on Dee in North Wales.

A range of case study examples are presented below that highlight initiatives where stakeholders have been involved in data and information management to varying degrees. Examples are cited from recent research gathered from amongst others, the Policy Development theme of FCD research as well as broader areas of interest outside of the research arena.

The Essex Estuaries Local Information System (LIS) Approach

The Essex approach is one of four case studies currently being funded under the EU funded commission entitled "Eurosion" which focuses on setting a coastal erosion management standard for Europe. The other pilot areas are the Netherlands, Barcelona and the Isle of Wight. It is the intention to develop one single prototype LIS, cherry picking the best work from each case study. It is also intended that the final web based LIS will have application at the European level.

It was critical to get participants committed to the project at the early stages of development. It was hoped that this would increase the chance of the LIS system being used beyond the life of the pilot project if local organisations had been instrumental in developing it. This approach, it was felt, would also foster a greater sense of ownership locally and make people feel more confident generally about the new system.

Workshops were held to bring coastal practitioners together in Essex to contribute to the development of the Local Information System. By focusing on planning applications and FEPA licences, participants learned about how these two regulatory processes worked in more detail and at the same time gained better insight into the work responsibilities of other coastal practitioners in the county. The staged approach enabled participants to identify the different information sources required at the various stages of each process to allow the applications to be processed successfully.

At the workshops, participants were introduced to the concept of "soft systems" modelling. This process involved participants working together to identify the various stages involved in processing a coastal planning application and a FEPA licence. By breaking the planning and FEPA licensing processes down into different stages participants were then able to identify the various sources of data required at each stage to enable the planning application/FEPA licence to be processed.

The next stage of the project involves cataloguing the raw data sets as meta data on the Eurosion web- based information system. Each organisation that attended the workshops received an email and letter following the workshops with a request to up-load their organisation's data as meta-data onto the system. Instructions on how to do this were included with the correspondence.

The project is a useful case study to introduce to this Research project as the Essex project seeks to result in:

- stakeholders having a better understanding about the value of working with meta-data.
- retaining support from Essex coastal stakeholders for the continual development of the Local Information System.
- building stakeholders confidence in using the system in their day to day work responsibilities.

- These benefits are obviously very important for the future use of this system.

It is intended that all the meta-data for Essex will be captured on line before the end of September 2003. The Essex prototype system will be tested in the autumn of 2003 with the final LIS completed during 2004.

Preparing a Noise Map using Stakeholders (DEFRA)

The following provides an interesting example (from outside of the FCD industry) outlining how stakeholders have been used in collation data.

The EU Ambient Noise Directive placed a requirement on member countries to assess and manage noise arising from "ambient" sources - primarily transport and industrial sources. The first stage of the investigative process is the production of noise maps for all urban areas and transport corridors, the plan for which was outlined in the Rural White Paper (2000).

Although the mapping process is being let to consultants, one of the ambitions of the project is to actively engage with stakeholders, both as holders of data necessary for the map production, and also to develop noise mapping capabilities at all levels. The first significant mapping contract let was to WS Atkins for the production of a road noise map of London. This ongoing project is being used as pilot vehicle for exploring the methods of achieving dialogue with stakeholders.

The data required for the road noise mapping process includes:
- Geographic location (in 3-dimensions) of roads, buildings, terrain features and acoustic barriers;
- Road traffic movement data;
- Road surface-type data.

Although previous air quality studies provided a useful baseline dataset on the road location and traffic movement data, and the other datasets were not so readily available. It was clear that the best source of this remaining data would be the London boroughs, who are responsible for the management of much of London's road network. Gathering this data from the boroughs would also help establish a relationship with these organisations, and in the longer-term lead to a better appreciation of the noise mapping process.

The data capture process therefore involved contacting all 33 London boroughs, and asking them for detailed information on the roads in their areas – roads missing from the baseline dataset, road surface type, acoustic barriers, and grade-separation (flyovers, cuttings, embankments). Various methods were considered for capturing this information, as shown in the table below:

Method	Pros	Cons
Development of bespoke	Management and control over data submission	Cost of software development

software, where new data could be created and packaged for return;	process Data submitted in finished format – no need for further digitising or processing	Cost of data licensing Potential requirement for training of users
Development of a web-site for online creation and return of data;	Management and control over data submission process Data submitted in finished format – no need for further digitising or processing	Cost of website development Cost of data licensing
Supply of data on CD / internet for editing and use within desktop GIS packages, with data returned as printed maps;	No software development costs Data submitted in almost-finished format – small amounts of processing required	Disparate GIS software packages, if available at all Costs of data licensing Lack of standardisation in the returns
Supply of printed maps for manual editing.	No software development costs No data licensing costs Standardisation of returns	Re-digitising of returns required

The final solution used was to supply printed maps for manual editing. The maps were printed out onto A4 to A0 sheets (1 sheet per London borough) and distributed together with a set of highlighter pens, a sheet of pre-printed labels and an Excel spreadsheet to complete with the relevant attributed data for the items marked on the map.

Respondents were asked to draw the items requested on the maps using the supplied pens. This allowed the use of a consistent colour scheme for the different features. The features were to be identified by sticking the pre-printed labels to the map, and the attributes for that feature (e.g. the height of the barrier, or the type of road surface) entered into the pre-formatted Excel spreadsheet. Wherever possible, choices of data entry were restricted through the use of drop-down menus. The spreadsheet also featured a cover page where meta data was to be entered (name of respondent, position within the organisation etc.).

The maps were distributed directly to the boroughs at a seminar on the project, and to specific named officers by post. Email was used to supply help and

advice, with two lists of "Frequently Asked Questions" circulated to disseminate the answers to common queries.

The initial data response was a return on 15 out of 33 boroughs within the allotted 6 weeks, with a further 5 boroughs submitting data at a later date following prompting by telephone. The returned maps were digitised back into a GIS system and then used as the starting-point for a 3D photogrammetrical survey.

There were a few problems encountered with the use of the maps and spreadsheets supplied – mostly concerned with the definitions of the requirements. Although all returns featured the appropriate coloured lines on the maps, a small number of boroughs failed to complete the meta-data attribute information in the spreadsheets. In most cases however, the digitised returns proved highly effective in guiding the detailed survey, and identifying features whose locations would have otherwise remained unknown.

The success of the stakeholder engagement in this project was felt to have been through the use of an appropriate level of technology, and providing detailed and specific guidance on what was required.

A significant lesson can be learnt from this example in terms of how Defra/Agency can best engage local stakeholders in flood or coastal risk related projects.

Engaging Stakeholders in Strategy Option Setting

This case study does not outline methods for how stakeholders can actively provide information, but instead reviews the methods used to gain effective involvement of stakeholders in the selection of flood management strategies for the Parrett and Tone river systems in the Somerset Levels in the South West of England. These low-lying areas are subject to tide-influenced floods at considerable distances inland, and the river network in the area has a variety of flood defence measures. The study was commissioned to investigate the appropriate use of these measures and the potential for others to mitigating the impact of potential flooding.

Consultation with local stakeholders has taken place throughout the project, through a regular series of panel forums and workshops, where residents, conservation and heritage groups and other representative bodies were able to talk directly to the consultants undertaking the study. Although the primary focus of these forums was to direct and disseminate the outcomes of the flood management strategy, they have also been used to provide input into the work, including:

- establishing the management objectives;
- identifying and prioritising sensitive areas;
- provision of information on species and habitats of concern.

The dissemination and discussion of the different proposed management strategies represented a major challenge for the project team. Each proposed strategy had to be considered under a minimum of three different flood scenarios – 2 hypothetical floods (e.g. 10 year, 100 year) and 1 scenario based on a recent, real flooding event (that which occurred in December 2000). Each element within this matrix of scenarios was modelled using a sequence of 500 hours of rainfall and tidal height in 20 minute time-steps to produce a series of numerical output files showing the water levels at key strategic points in the river system. Ultimately the project has yielded many hundreds of megabytes of computer information needing presentation in an intelligible way.

The main presentation method chosen was to produce maps of each scenario, relating the water levels at the key points to digital terrain models collected from topographic surveys. Intensive use was made of the ArcView 3.2 GIS package from ESRI, together with the Spatial Analyst extension, for grid-based calculations. Although some analysis was possible through standard functions, many of the maps required customised programming using the software's built-in development language.

The simplest maps were those indicating the maximum height of flooding reached during the 500 hour time-period. A second set of maps were produced showing the duration of flooding within the study area, and a third set showing the improvement (or deterioration) in duration as compared to the same flood event under the current management strategy.

As each map represented a single, simple representation of a complex set of results, they provided stakeholders with an easily digestible summary. Even using this method of summarising however, it was still necessary to use around 50 maps to represent the study results.

The use of the maps in the consultation panels provided a clear mechanism through which each strategy could be considered. They allowed panel members to clearly identify specific locations of concern and easily compare between scenarios. Without the availability of the maps it would not have been possible to achieve this level of feedback. Indeed, it was clear from the outset of the consultation panel that they expected to receive output in the form of maps, and that any other presentation mechanism would not be appropriate.

One feature of the discussions, however, was that the maps in themselves often became the focus of discussion, rather than the underlying results. Feedback was received on the style, layout and colour schemes used in the maps, and on the extents shown and which areas had been chosen to represent, and at what scale. Achieving the appropriate level of detail also proved difficult, with requests being received for both more maps and fewer maps.

In order to facilitate comparison within the study, it became necessary to focus in on a few specific points of concern, and to present the flood information for these points in addition to the area-wide maps. This tabular

presentation complemented the graphical map production, allowing scenarios to be compared "at a glance". Having isolated scenarios of interest, the maps could then be used for more detailed scrutiny.

The effective management of the data and information flow to stakeholders was a key element in this project, and it was possible only through the application of GIS technology. Although for some stakeholders the level of information provided was too detailed, on the whole, stakeholder dialogue would not have been possible without the application of this technology.

National Flood Forum (Involving Communities)

Building on the above examples, focus is placed on the role of the National Flood Forum. This is a community action group, founded in Bewdley, Worcestershire. It is a non-profit making organisation formed by victims of flooding and dedicated to working on behalf of its members to find remedies appropriate for each community as well as nationally.

Whilst the Forum works closely with a range of relevant agencies, including the Environment Agency, insurance companies and local authorities, its potential use in data collection is effectively under used. As its role is to ensure that the concerns of the general public are fully understood and appropriate support is given, it is able to provide valuable assistance to the Agency/Defra on real data issues of importance. There is, however, no national approach to determine how this information is captured.

This issue was brought to the fore during the flood events experienced during Christmas / New Year of 2002. During that time, it is estimated that over 1,000 staff, many from outside Flood Defence, were deployed to support with communications, recording the event, carrying out emergency repairs and flood forecasting and warning. In the Thames Region and Anglian Region alone, over 500 staff were involved. This was a tremendous staff commitment over an important holiday period.

The change in flooding frequency over the last few years has meant that many parts of the FCD industry are having to increase the amount of staff on stand-by during holiday periods. Regions are also reviewing what type of shift patterns they should use in order to sustain operational effectiveness over floods of longer duration. Practices vary across Agency Regions according to experience and the Agency needs to ensure lessons learnt are adopted consistently.

One of the key aims of the Flood Forum is to provide a resource centre relating to all aspects of defending, renovating and coping with a flooded property and to organise local Flood Defence Fairs across the UK to give access to flood defence products and encourage self-help. This information is collected and disseminated in a structured an agreed manner, may prove very beneficial to the Agency.

The Figure below represents a screenshot of an existing method, initiated by the National Flood Forum, to gather flood related information from local community groups or individuals. The challenge with this relates to

conveying to the Agency the type of information that is both useable and informative in order to either initiate new implementable ideas on the ground, or to inform new research areas.

The research has uncovered examples of datasets that are not captured by the Agency though would be easily collated by other local stakeholders. For example, in the Southern Region, the Environment Agency Area Office doesn't possess any information on the hierarchy of floor levels in Bewdley (*pers comm*. Gillian Holland 2003). However, it is believed that this information was available via the Police and used by them when they were responsible for delivering flood warnings in Bewdley pre 1996. Bewdley, due to its geographic location in the catchment, get up to 30 hours flood warning, and usually a very accurate final level prediction is possible. The Police used to deliver very personalised warnings, concentrating on those households that they knew a certain river level would reach, warning the lowest houses first, leaving the higher houses that wouldn't be affected.

Issues Arising

Communicating what is required by consultants/academics/planners is a very effective method of improving data and information management within the industry. It is recommended that this issue is developed, identifying clear routes and methods for third parties to be encouraged (as part of a structured data strategy) to provide value to the industry.

The following represents a summary of the findings of the initial research to complete this Position Paper, which has been derived from telephone conversations, questionnaire replies and wider consultation within the FCD industry.

Single point of contact (SPC)

The objectives of SPC are the removal of work duplication for both the Agency and external data providers, in turn reducing the resource implications in the provision of data and the improvement of data management. This needs to be clearly communicated to all range of stakeholders to ensure the message of SPC (wherever this may be) is clearly understood.

The use of SPC will also ensure much better protection of the Agency's and our partners Intellectual Property Rights. This will be done by utilisation of Agency Management Systems, these have been developed to ensure that there is consistency across the organisation by providing a working framework that is open, honest, transparent that will in turn lead to a clear approach to information exchange.

It is acknowledged that there will be a need for the development and use of template agreements across Government as the need for closer working together becomes more imperative. The Agency intends to become a key player in developing these.

There will need to be an expansion of the relationships with partners to include potential joint data set development combining data to produce new or improved data assets. Along with the development of other pilot partnership projects involving the sharing information, knowledge and know how in addition to the simple trading of data.

Where information is combined into large datasets, multiple ownership of the original material brings with it a raft of complexities in terms of agreements and licences. For instance, an information product may derive from the juxtaposition of two or more datasets with quite different IPR arrangements: clarity of agreement, especially if royalties are involved, is essential. At the centre of things is, of course, the fact that any data with a geospatial element at some stage comes into contact with the Ordnance Survey, which is a Trading Fund, which positions it as a competitor in an open commercial marketplace, and also a Crown body, which renders it subject to Crown Copyright rules (see Section E7.5).

Value Added Information and Resellers

Value added information is defined in the Review of Government Information as *"information where value is added to raw data enhancing and facilitating its use and effectiveness for the user, for example through further manipulation, compilation and summarisation into a more convenient form for the end user, editing and/or further analysis and interpretation"*.

Value Added Resellers (VARs) provide this service to the public by obtaining Agency data under an appropriate agreement and repackaging it in a variety of different ways for their own target audience. The Agency has a policy of charging royalties on profits made from the use of Agency data and information in this manner.

The Agency also reserves the right to receive back from VARs upgraded data which has been amended as a result of the additional checking and processing which the VARs carry out.

Appreciating the role of VAR's within the FCD industry needs specific attention and is covered in more detail within Position Paper C (Data Acquisition).

Environment Agency's Data Distribution Policy

The Agency's stated policy is to make information about the environment, and how the Agency is working to protect and improve it, as freely available as it can (see Position Paper on Data Availability).

The Agency also aims to further realise the value of its data resource by encouraging secondary use to help manage the environment. This is done in a variety of ways, including the licensing/selling of information to commercial organisations (see E7.2 above), along with exchanging data and information with other Government Partners.

It is recommended that within the Agency's Action Plan guidance is clearly set out that communicates how such exchanges can take place, and also establish how local groups, such as flood forums can be engaged in this process, particularly with regard to collecting post event flood data.

It also needs to make clear what information is made more easily accessible from the public registers and importantly, what data is not included in or available from a public register under the following exemptions :

- Personal information covered in the Data Protection Act.
- Information subject to National security.
- Information that is commercially confidential.
- Information that is the subject of legal proceedings.
- Information which has been volunteered to the Agency (as described in the relevant Regulations).
- Information whose release would be damaging to the environment.

Quality Assurance of Data Collected

Data quality is an issue which continuously exercises Agency resources. The commercial activities of DIEU (see above) within the SATIS group generate a significant amount of "external" income the greater proportion of which is directed towards supporting the data quality improvement programme.

Operationally, the necessary work is carried out at the National Centre at Twerton, with day-to-day contact being maintained with the Agency's Data Policy Manager.

Additional processes and procedures will, of course, be required in situations where the initial collection of data is not carried out by Agency staff under controlled conditions.

An additional issue arising is the question of whether it is necessary to distinguish between urban and rural flooding, especially in the context of the source of the flood water – mained on non-mained. This may have an impact upon fitness-for-use, which is another aspect of data quality.

A key issue in relation to using local community flood action groups in data collection is ensuring data quality. It is appreciated that sound engineering decisions need to be made from data and information that is robust and credible. However, it is apparent that in cases of post flood event recording, arguably the best people to gather such data are those communities on the ground and not the insurance companies or the Environment Agency. At these times, there is so much potential data that could be gathered, the issue is what really is needed? The current research project (FD2012 – Monitoring, Recording and Analysing Events (Post Event Appraisal): Coordination, Benefits and Use Study) is currently being finalised. Case Study Box 4 outlines the recommended priorities for data collection after an event.

There are examples, however, where current post event data collection may be based on false situations, where inaccurately collected data is compiled on a number of properties affected by flooding. Such data is often collected from reputable sources (Agency/consultants/insurance industry). A particular example of this was raised in Bewdley where the number of properties apparently affected by flooding was grossly underestimated.

Engaging local action groups to facilitate accurate information on actual flood aspects presents a real opportunity for the Agency in particular to address. Questionnaires have, for example, been prepared by some flood action groups, to assist in gaining specific details on which houses or rooms were flooded and why. In addition, capturing local historic flood event information can be gathered at the same time. Anecdotal information gathering, is fraught with subjectivity, though, but if the questions posed attempt to compare recent with past flood events as far as possible on a like-for-like basis, such information may be a value to the Agency in determining a change in flood characteristics.

The collection of information on real time water level details at the time of a flood event may be assisted through the use of local groups and those gathering rain gauge information within a specific catchment. An interesting example of how local data was compiled ahead of a flood event was recorded by the Cuckmere Flood .

Local stakeholders may effectively be used in providing valuable information in terms of the following. These points are elaborated in more detail with Research project FD2012 (Bullens 2003):

- **Flood markers** - More suitable within urban areas where there are plenty of structures and features to mark. Cannot successfully be used on soft landscape features. May become confusing if several marks are made at the same location due to not capturing the peak of the flood on the first visit.
- **Recording levels from known feature** - Requires measurements to be made with a tape measure or similar rather than observation. Prevents observation by the public and promotion of the Agency's name
- **Photographic Records** - Ideal in urban areas where specific features can be picked up. Only suitable as a supplement to additional data.
- **Video Coverage** - Can provide visual evidence of flooding, but does not give data from which levels may be accurately identified. Ground level video's have minimal use due to their limited scope, and should only therefore be used at specific locations.
- **Setting Gauge Boards -** Provide good supplementary data to an area with an existing flood history. Provide continuous recording point to allow comparisons to be made both during an event, and between historic events. Local residents and flood wardens can read boards to allow them to monitor the flood and take appropriate action
- **Supplementary Information –** police and fire records may be useful as an additional secondary source of information.

The Importance of Ordnance Survey

The vast majority of data required for FCD work requires the use of a geospatial matrix in order that sense may be made of it. At some point, therefore, the issue of licensed use and Intellectual property Rights (IPR) must be addressed.

Ordnance Survey and ODPM have negotiated a Pan-government Service Level Agreement under which all government bodies may access OS map data at extremely advantageous fee rates – the Environment Agency is currently saving very significant sums each year as a result of joining the scheme.

Tapping into Local Information Sources (including Academia)

Little attempt seems to be made by the Agency to set a policy to tap into the local knowledge that is still held by those who work on the river. Specific examples have been presented on how local flood groups received their flood related information. The Severn Area Rescue Association at Upton, for example, when asked where they get their information from on how the river would behave during specific events, stated that they ring a man at Diglis Basin who will tell them at hourly intervals night or day what the river is going to do. These groups use this information as a first instance, and not the Area Office at Tewkesbury.

Local flood action groups hold data on flood levels and on how flooding has occurred which would be of use to the Agency and other authorities. The National Flood Forum cite examples where groups of residents hold video and photographic records of flooding in areas where flooding doesn't appear at all in either Local Authority or EA records.

Local detail is vital. Examples have been presented where, for instance, being able to point out to the Police in Bewdley that the entrance to the car park is two foot lower than the main body of the car park in Bewdley has meant that the car park could be cleared of cars before the water was too deep to get them out. Bewdley Residents' Flood Committee is involved in regular Flood Liaison Meetings with the personnel of Silver Control, and this has been of value to all organisations and users alike.

The Bewdley Residents Flood Committee have (through the Agency) this year been requested to set up a 'Customer Panel' to provide feedback to the Agency. Such initiatives should be encouraged elsewhere around the country should this initiative be successful.

Also, the residents' flood group at East Peckham is actually working in co-operation with the local Agency office at West Malling to collect data on the extent of the two recent floods to justify the funding of a flood alleviation scheme. They are putting round questionnaires to householders, and a panel of LA and EA officers are collating the information, pinpointing the gaps in what they need, and asking for further research where necessary.

Key Recommendations

The following recommendations focus on opportunities for improving and consolidating current best practice in involving stakeholders in data and information exercises within the FCD industry.

Establishing Partnerships

The study recommends encouraging partnerships with local stakeholders when managing datasets. Defra/Agency can be more proactive and clear in how best to combine resources (internally and externally) when undertaking consultation and information dissemination. Whilst partnership adopting is seen as a positive approach, it is also key to clearly nominate a lead organisation that is responsible for establishing lead responsibilities and protocols for collecting data on the extent and impacts of all flooding. (The Environment Agency may be best placed to undertake this role under its supervisory role.) Operating Authorities and Professional Partners should be encouraged to collaborate in developing protocols for those items in which they have a joint interest.

Using Existing Mechanisms

It is evident that existing mechanisms are in place for capturing information of flood events or beach profile related data. What is missing is clarity between regions in terms of data collection. Wherever possible, the Agency/Defra need to review regularly existing mechanisms of involving stakeholders in data collection to assist local communities, rather than setting up duplicatory processes or systems that do not provide a service to local communities in times of need. Staff in all operating authorities should be informed that they have a "duty of care" to data. Protocols should be established for the retention of data to ensure the preservation of valuable records. Outside “confirmed” stakeholders may be used to ensure this issue is adhered to.

Using Existing Expertise

Groups and organisations within local flood groups with local experience and expertise in community involvement and consultation need to be utilised effectively whenever possible. Whilst not necessarily “expertise”, it is recommended that Agency/Defra investigate methods of using school resources to undertake historical flooding research, determine whether national curriculum provides scope for focusing topics to produce flood history databases.

Incentive schemes need to be reviewed to encourage the effective use of local expertise. This is a main issue in data maintenance and updating. Contracts may need to be set up as a matter of course to ensure compliance to an agreed specification.

Keeping Stakeholders Informed

This Paper suggests that local resident groups need to be kept informed with accurate information. This is currently taking place through Floodline

(amongst other initiatives), though determining the needs of both the competent authority, coupled with the needs of a local community and their willingness to contribute to data management should be embraced more fully.

Allowing for Continuous Input

Data and information management, involving stakeholders should not be perceived as a "one off" exercise. If it is to be successful, a longer term strategy needs to be established so that ownership of data and partnership alliances can be set up. The Agency (with Defra) may need to agree the format of an evolving strategy that will change to meet the needs of local stakeholders in flood risk areas over time. Therefore it is essential that mechanisms are put in place that enable people to influence the plan for flood and coastal defence management in the future.

5.7 Position Paper F – New Technology

Introduction

The involvement of new technology in monitoring and its application to data and information management need to go hand in hand.
This position paper compiles the findings from the workshop and subsequent interviews among people in the industry and includes a review on the benefits/problems with current technologies and from this, provides recommendations for how new technology may result in changing management practices in the future.

The workshop on the 24th April 2003 examined ways developing and encouraging the application of new technology and new techniques for monitoring, data handling, archiving, dissemination and presentation where appropriate.

Approach

The activities leading up to this position paper are as follows:

A questionnaire was sent around to members of the FCD industry. This provided an initial response indicating which issues were regarded as priorities within each of the objective areas.

A workshop involving key stakeholders was held to discuss the issues highlighted by the response to the questionnaires and establish if there are additional areas that require attention.

Following on from the workshop consultations with key stakeholders and others identified in the course of the project have been carried out.

This paper concentrates on the use of new technology for monitoring, handling, archiving, disseminating and presenting data. The uptake of the new technology will be influenced by factors, such as data needs and knowledge management that are considered in Position Papers A and D.

Key Questions asked for this Position Paper

The key question asked in the questionnaire before the workshop was:
Suggest new technologies that would improve monitoring, data handling, archiving, dissemination and data presentation within the industry?

This question was also looked at in the workshop in further detail and underpins the issues covered in this position paper. Details on the responses are included in the Project Record report for this research project FD2314.

Inter-relationships with other Position Papers

Common Aspects

This Position Paper overlaps with others being prepared for this review. The possibilities for using new technology within flood and coastal defence will depend heavily on the 'Data Needs' identified and prioritised in paper A. The new technologies that will be implemented must be targeted firmly at the needs of the flood and coastal defence community (which incorporates researchers, EA, Defra, local authorities, residents and contractors among other stakeholders).

This 'New Technology' position paper is also closely related to paper B 'Data Accessibility', which is examining ways of improving data accessibility, including the use of the Internet, standardisation of archives and the development of data centres. The 'New Technology' paper seeks to review how best to encourage the application of new technology to data handling, archiving and dissemination. This will clearly include the Internet and the possibility of archiving and accessing data in new ways. Position papers B and F therefore overlap. Paper B is therefore concerned with data formats and questions of compatibility and standards. Paper F is concerned with implementing data exchange and storage in the formats recommended by paper B.

Some of the new technology identified in this paper could clearly be used for 'Data Acquisition' (paper C). However, the focus of paper C is on encouraging co-operative effort to ensure that data is used often and the cost is shared (i.e. the process rather than the technology). The emphasis in this paper is on the development and application of new technology (especially remote sensing technology) for acquiring new data. Papers C and F should then be more or less independent.

Paper D is on 'Knowledge management', which will look at the problems of communication and making sure that knowledge is transferred as well as data being stored. The findings of position paper D should therefore be

considered in deciding which of the new technology options should be taken forward.

Paper E is on 'Involvement of Stakeholders in Data Collection'. This may overlap with this paper F in that a variety of data types are likely to come from stakeholders, so methods of storing data in odd formats will need to be considered. However, it is likely that existing database technology will be able to handle the data that will come from stakeholders. This will need to be reviewed when the final integrated report is produced.

Framework for Position Papers

The information issues within FCD were divided into six areas, each depicted as a wedge in Fig 1 below. New Technology is the sixth objective and covers the existing technology as well as looking at how future technologies might benefit FCD. The use of the Internet and archiving facilities will be looked at specifically.

Review of relevant technology

Internet

Internet is used for downloading data into a database and querying / searching the database. The main GIS systems in usage at the moment are from ESRI (Arc family) and MapInfo). Examples of GIS usage in FCD include the coastal extension of Multicriteria Decision Support Framework (MDSF) GIS tool. Examples of web-portals for data include Multi Agency Geographic Information for the Countryside (MAGIC) which is supported by DEFRA and has many environmental datasets accessible via its web site.

Databases

Databases are used for storing data, querying data, analysis of data. They may be integrated with GIS/Internet. Data must be linked at different spatial scales (e.g. geographical asset -> geometrical asset) via suitable database. Present day technology is capable of doing this. One key issue to consider is the speed of databases in the future and whether one central "hub" holding most FCM data will actually be able to cope with demand from all stakeholders. This issue will need future consideration.

Telemetry

Telemetry is being used to transmit data automatically to data centres where the processed data may become available in near to real time. Telemetry, aided by advances in instrumentation, means that measuring apparatus needs to be accessed far less often than it used to. The advantage of this is cost. The disadvantage is that it can be more difficult and expensive to repair than a simpler system.

Satellite monitoring

Satellite monitoring – frequency of coverage is poor. However, Topex/Poseidon are now used to provide wave heights. Moreover, satellite SAR can give ground elevations to an accuracy of less than a metre (?). Although satellite SAR does not give absolute elevation, comparing the results of successive surveys could be used to give changes in elevation. Satellite SAR surveys could be mapped onto aircraft-based SAR surveys (or other ground truthing) to provide absolute elevations.

DGPS tide gauges

DGPS tide gauges for measurement of water levels and crustal / eustatic movement. (see http://www.pol.ac.uk/ntslf/).

Orthorectified Aerial Photos

Aerial photographs have been used in the past, for example in some SMPs, to illustrate geomorphologic features and to derive datasets. Geo-referenced orthorectified aerial photographs can be incorporated within a GIS to provide the basis for displaying features. Two main sources for these images exist: UK Perspectives and Millennium Mapping. Other data sources should be appraised before a license is purchased. For example, some remote sensed data (Landsat or CASI) may be available. Defra holds a restricted license for England from UK Perspectives, which would not currently allow for use within a SMP.

NEXTMap Britain (Intermap)

Intermap has developed an innovative business strategy in its GLOBAL Terrain Database www.globalterrain.com. Radar data are continuously acquired for global areas of interest, and DEMs and orthorectified image radar products are available online to licensed users, at a relatively low price.

This is the first time that mapping of almost an entire nation will be funded and executed by commercial entities rather than government. With the airborne radar system's ability to acquire several thousand square kilometres in a single mission. A national program such as this can be completed in months, rather than years required for previous national mapping programs using traditional technologies.
Intermap owns and operates two of the most advanced airborne radar systems in the world and carries out most of the world's 3-D radar mapping business. Solidly based on a 25-year history of radar system operation and a broad range of applications development, Intermap has now clearly focused its business on interferometric synthetic aperture radar (IFSAR, or equivalently INSAR) and the creation of DEMs and orthorectified images www.intermaptechnologies.com. As Intermap continually refines the technology, both government and commercial clients have become significant users of the products, and business continues to grow.

CASI

This description of the EA CASI system is taken from the following web-site: http://www.environment-agency.gov.uk/science/monitoring/133105/?version=1.

"The Environment Agency uses a Compact Airborne Spectrographic Imager (CASI, also known as Compact Aerial Scanning Imager) to help in its duty, under the Environment Act 1995, to form an opinion on the general state of the pollution of the environment. The CASI is designed to provide a flexible system which is straightforward to install and operate in a small aircraft. The system has a "pushbroom" configuration, i.e. the full swath width is imaged instantaneously in a large number of spectral wavebands (up to 288) covering the visible and near infra-red regions of the spectrum between 430nm and 900nm. This can be used to construct hyperspectral image data sets for detailed studies of ground or water targets. Spatial resolution can be varied from one to ten metres, and is governed by the flying altitude. Typical applications are:

- Land cover classifications and visualisation.
- Inter-tidal vegetation mapping.
- Identification and tracking of dissimilar bodies of water.
- Monitoring and pollution detection.
- Mapping of mixing zones, outfalls and rivers.
- Estimates of suspended solids concentration and changes in coastal morphology.
- Estimates of chlorophyll-a for use in eutrophication studies.

Survey techniques

Total station

The most frequently used data capture method, in historical monitoring programmes, is by total station theodolite (usually in conjunction with a data logger). The speed of data acquisition is faster than for levelling, since the instrument generally has to be set-up less frequently.

Kinematic GPS

Kinematic GPS provides the opportunity to capture data with a vertical accuracy of approx. ±2 to 3cm and horizontal positioning at approx.±5cm. A minimum of two GPS receivers, linked by radio, are required. One receiver acts as a base station. The EU Galileo system will provide an alternative to the US GPS positioning system in a few years.

LIDAR

Light Detection and Ranging (LIDAR) is an airborne mapping technique that uses a laser to measure the distance between the aircraft and the ground. The EA has a LIDAR system which it has installed in a survey aircraft along with its other operational remote sensing instruments, including the Compact Airborne Spectral Imager (CASI), a thermal imager, high quality sVHS video camera and a digital camera. The aircraft is positioned and navigated using

Global Positioning Satellite (GPS) corrected to known ground reference points. (Details in this section are taken from the EA web-site http://www.environment-agency.gov.uk/science/.)

"The aircraft flies at a height of about 800 metres above ground level and a scanning mirror allows a swathe width of about 600 metres to be surveyed during a flight. Individual measurements are made on the ground at 2 metre intervals [with vertical accuracy of ±0.25m].

The Agency's Flood Defence function has a requirement under the Water Resources Act 1991 to monitor the flood plain. LIDAR is being used to measure land topography and assess coastal erosion and geomorphology. The Conservation function requires information on land being set aside for managed retreat of sea defences. There is also a need to obtain data for a model linking land use, soil type and the potential for erosion prediction. The Agency has generated routines to allow for the removal of surface features from the data sets including vegetation and buildings. Products that can be generated from the LIDAR data include colour coded elevation models, height contour plots and three-dimensional perspective views allowing easy visualisation of surveyed areas. A large and extensive archive of LIDAR data files are available and is searchable using the downloadable database."

Fli-Map and ATLAS

Fli-map and Airborne Topographic LiDAR System (ATLAS) are an air-borne remote sensing techniques for surveying linear features and small areas. The systems are based on laser-scanner systems (i.e. LiDAR systems) linked to differential GPS and mounted in a helicopter which flies at an altitude of 60m and 170m (see Investigation of "Fli-map" System for Flood Defence Asset Monitoring, by Tim Burgess, R&D Technical Report W5A-059/TR/1 or ATLAS – High resolution Laer Terain Mapping). They are similar to LIDAR surveys by aircraft, only operated at lower speed and altitude thereby offering a greater density of points and a better vertical resolution. Typically resolution is 12 – 16 points per metre squared and up to 28 points per metre squared for ATLAS at 150m elevation and 60kph, with a typical swath width of 60m. There was a quoted standard deviation of 80mm on vertical height for Fli-map compared to 170mm for LIDAR from a comparison at one site. ATLAS promises an absolute 3D accuracy of 5cm from 150m altitude. During Fli-map flights, vertical and forward-looking videos are recorded which allow for asset identification and condition monitoring.

Scanning Hydrographic Operational Airborne LiDAR Survey

Scanning Hydrographic Operational Airborne LiDAR Survey (SHOALS) is a bathymetric LiDAR system developed by the US Army Corps of Engineers (Pope et al., 1997, Wozencraft, 2003). SHOALS has provides high-accuracy, high resolution bathymetry for several stretches of coastline in North America. The SHOALS system scans green (532nm) and infrared (1064mm) beams in front of the aircraft. The infrared beam reflects from the water surface while the green beam penetrates to the bottom. The returns are analysed to determine a water depth for each laser pulse that is corrected to allow for water level. Moreover, on-land elevations within half the swath width from

the water's edge are also measured, so SHOALS can be used to measure beaches and nearshore structures. Elevations further inland can be measured if the DGPS system is replaced by a KGPS system to give accurate vertical positions of the aircraft. Typical coverage of a 400Hz system is 25km2/hour at a measurement spacing of 8m. Maximum water depth is 60m. The system is accurate to IHO Order 1 specifications, with quoted vertical accuracy ±0.15m and horizontal accuracy ±3m with DGPS and ±1m with KGPS.

Compact Hydrographic Airborne Rapid Total Survey

Compact Hydrographic Airborne Rapid Total Survey (CHARTS) is a new system that was field-tested in summer 2003 (Wozencraft, 2003). CHARTS combines three sensors in a single system:

- 1000 Hz hydrographic LiDAR.
- 10 MHz topographic LiDAR.
- digital camera.

In addition, there is a DGPS (or KGPS) system and the software includes survey planning, data processing and data editing tools. The hydrographic capability of CHARTS is based on SHOALS, but with the pulse rate increased to 1000Hz so the aircraft can fly higher and greater data density can be achieved. In addition CHARTS has a 10 MHz topographic LiDAR to enhance data-collection over land. The system offers the potential to survey an entire catchment using a single system, including river beds and shallow lakes. CHARTS is also designed to be accurate to IHO Order 1 specifications.

Synthetic Aperture Radar

The application of the recently built MDSF (Modelling and Decision Support Framework) to the development of CFMP's and SMP's has triggered the need to acquire more appropriate flood plain/area topographic data than that produced by LIDAR. It has led to the Environment Agency co-funding (with Norwich Union) the collection of SAR (Synthetic Aperture Radar) data as a basis for developing a DEM (digital elevation model) of fluvial flood-plains and coastal flood prone areas. SAR is also known as Side-Looking Airborne Radar (SLAR) as it only works when the radar beam is mounted sideways. SAR imagery requires tremendous signal processing power, transmitter signals of extreme purity and a platform that moves precisely in a straight line (although deviations from a linear path can be processed out). SAR can look through clouds and rain and does not rely on daylight. Different ground features have different reflectance properties and signal processing can be used for land cover classification.

The rms accuracy of the new jet-flown SAR DTM should be ±1m in all regions except region 8 (the SE of England) where it will be ±0.5m. The survey has been flown and the data processed. Checking of the data is underway.

Advantages and disadvantages of survey techniques.

Airborne SAR and LIDAR can survey a large area faster than Fli-map or ATLAS and all three are faster than ground surveys. The use of DGPS on a backpack or quadbike is a faster method of ground survey than conventional triangulation. LIDAR and Fli-map can therefore survey large lengths of defence in a day and are particularly useful for remote defences or those with difficult access (because of, say, saltmarshes). Neither LIDAR nor Fli-map give ground elevation under vegetation as both record the first returned signal (i.e. top of vegetation). A ground survey can obtain more than just top surface level and position, so can contribute more to a condition survey than LIDAR or Fli-map. A ground survey is the most accurate form of survey, with Fli-map being more accurate than LIDAR. LIDAR is suitable for large area surveys (>10km2) where detail is not too important, while Fli-map is suitable for long lengths of structure (>2km) with video images being used to assist in condition surveys. Ground surveys are suitable for detailed descriptions of small areas or vegetated areas, particularly where further information is required.

One of the most important data needs is for the crest elevation of defences. In the case of man-made defences the crest may be a wall with a very limited width. In order to be able to identify the crest elevation with reasonable confidence, a high resolution is required. Fli-map, Atlas and ground-survey are the only methods that may achieve the required resolution.

Non Destructive Testing

Fragility curves are being used in risk-based flood and coastal defence systems such as RASP. There is no well-defined way of producing a fragility curve for each defence length (although this is one issue that will be addressed in FD2318: Performance and reliability in flood and coastal defences). Knowledge of the internal structure of defences will be important and non-destructive testing may provide some of the required information. Details of techniques can be found in "Use of Non-destructive Testing within Flood and Coastal Defence", by Ogunyoye, Vernon and Smith (December 2002) EA R & D Technical Report W5A-059/TR/2. The report reviewed the use of non-destructive testing to compliment visual inspections with the view to improving the quality and effectiveness of the EA's asset condition assessment. Techniques from the road, dam and rail industries were evaluated. The report concluded that non-destructive testing could make a valuable contribution to the investigation of many problems. Moreover non-destructive testing can be quicker, cheaper and is certainly less destructive than test methods that require the removal of a sample for subsequent examination. Non-destructive testing can also allow the whole of a length of defence to be tested, rather than just one discrete point.

Ogunyoye et al. (2002) list a number of techniques for the non-destructive testing of concrete, metals and earth embankments. These techniques require suitably trained professional staff so could be used as a follow-up to an inconclusive visual inspection. Further assessment of the methods is required before guidance on the methods can be developed.

Current and planned research

The first three research projects described below (RASP, MDSF and PAMS) are not explicitly about new technology. They have been included in this paper as they represent new ways of addressing FCD issues. Therefore they represent the ways in which data will increasingly be used. The findings of these projects will affect data needs as they will outline where data is lacking and can be used to identify areas where the outcomes are most sensitive to an improvement in the data (see also the Knowledge Management paper). Recommendations as to which new technology to adopt can only be made when the need for new data can be prioritised and its specifications set.

W5B(01)02: Risk Assessment of Flood and Coastal Defence for Strategic Planning (RASP)

The objective of RASP is to develop and demonstrate supporting methods for dealing with systems of flood and coastal defences (rather then merely considering single defences in isolation). To enable appropriate levels of analysis to be conducted, as justified by the importance of the decision and its sensitivity to uncertainty, through development of a tiered methodology. At present there is limited guidance on assessing risk to large floodplain areas that depend on numerous, perhaps extensive and diverse, systems of defence such as embankments, walls, and moveable structures. With moves towards more integrated flood management, risk managers must have recourse to sound and practical tools and techniques for assessing the performance of whole systems in order to develop balanced, integrated risk management strategies. RASP will deliver High, Intermediate, and Detailed Level Methodologies to be used for:

- National monitoring of risk from flooding;
- Strategic prioritisation of investment in defence improvements or other flood management options (e.g. increased storage or diversion);
- Targeting flood warning and emergency preparedness;
- Highlighting priorities for monitoring and maintenance and justification of maintenance decisions;
- Scheme design and optimisation.

Outputs will be compatible with standard Geographical Information Systems to support simple user visualisation. RASP will also involve demonstration studies at pilot sites and production of written guidance to enable widespread application. RASP will not be delivering new software but will be inputting into current software development projects such as the MDSF and NFCDD. MDSF and RASP are closely related and are being jointly developed. For further information see www.rasp-project.net.

Modelling and Decision Support Framework for Catchment Flood Management Plans (MDSF)

The objective of MDSF is to provide a tool for use by Environment Agency and consultant staff in the development of Catchment Flood Management Plans (CFMPs). This will enable the CFMP programme to go forward in a

consistent way, by using common data structures and scenario models and providing value for money by avoiding duplication of effort among consultants. The coastal extension of the MDSF GIS tool will enable MDSF to be applied to all flood and coastal defences. The CFMP process requires large quantities of data and various forms of modelling in order to predict flood levels and their effects under existing conditions and with future scenarios of climate change, land use change and development. In order to make modelling a practical option for multiple catchments, a relatively standardised approach is needed to both data and modelling. The MDSF aims to:

- Facilitate assembly and management of catchment data;
- Provide guidance on flood water level prediction throughout a catchment;
- Calculate flood extents and depths, economic damages and social impacts; and
- Provide a framework for policy evaluation and uncertainty estimation.

The Modelling and Decision Support Framework (MDSF) has been developed by HR Wallingford, Halcrow, CEH Wallingford, and FHRC. Its deliverables include procedures (providing guidance on the application of MDSF to CFMPs and on specific aspects including modelling) and software (including customised GIS based on existing ArcView software and modelling tools.) Demonstration of the MDSF software tool is being conducted for development of CFMPs at pilot catchments. For further information see www.mdsf.co.uk.

Establishing a Performance Based Asset Management System (PAMS)

The objective of PAMS is to take a measured step forward in developing a performance-based approach for identifying and prioritising works needed to manage existing flood defences. Organised in three phases, Phase 1 is a scoping study supplemented by case examples, and the subsequent two phases will further develop the resulting methodologies, pilot these at demonstration sites, and yield supporting manuals and software.

Relative to existing methods of appraisal for new flood defence schemes, current approaches to justifying maintenance needs are cruder, as identified by the recently completed report on Operations and Maintenance Concerted Action. The PAMS project will provide an asset management system that enables flood and coastal defence managers to assess the performance of and maintenance requirements for flood defence assets. Furthermore, the project will provide a means of identifying the optimum management intervention to achieve a particular outcome. A framework for performance has been established under recent work on Risk, Performance and Uncertainty in Flood and Coastal Defence, building on the "Source / Pathways / Receptor / Consequence" approach to risk management and establishing a tiered approach to risk-based decision-making. PAMS will build upon this framework, as well as existing research and development completed in the NFCDD, RASP, and MDSF project, as described above.

PAMS will deliver a transitional system revising the Environment Agency's Flood Defence Management Manual (FDMM) and Management System (FDMS). In the long term, full operational delivery of a software-supported, performance based asset management system (to include training, documentation, software interface, etc.). For more information see www.pams-project.net
Other research:

W5C(00)01 Flood Warning for Vulnerable Groups
W5C(00)02 The Social Performance of Flood Warning Communications
W5C(01)01 Development of Flood Warning Management System. New technology could play a role in the development of flood warning systems, especially in continuous monitoring, real-time modelling and the dissemination of warnings to a population at risk.
AE1039 National Coastal Data Co-ordination (IACMST). Links to database needs.
FD2411 Reducing the risks of embankment failure under extreme conditions. Link to non-destructive testing.
W5A(01)01 Reducing uncertainty in river flood conveyance – Phase 2
W5A(01)03 Concerted Action on Operation and Maintenance of Flood and Coastal Defences. Links to surveying, asset performance and non-destructive testing.

Issues arising in New Technology

Common Themes

The common themes that came through from the initial questionnaire were the use of GIS to reference the location of data collected so that it can be accessed through a GIS interface. Also the use of remote sensing was emphasised which would allow a constant stream of data to be received at regular intervals with out the need to collect data from the site individually.

Discussion at the workshop was focussed towards whether there was general harmonisation towards a Geographic Information System (GIS). ESRI and MapInfo are now interoperable. All agreed that increased use of the Internet is very important and will continue, and interestingly, the use of the web has decreased access time to EA data considerably.

It was agreed at the workshop that new technology is less important than enhanced organisation with respect to data collection. Data and technology should support the whole process from start to finish. Thus it was felt that the research project should appraise the current marine remote sensing methods, rather than concentrating on new monitoring technologies in the first instance. Existing remote sensing methods include those being operated through the insurance industry (Norwich Union) and the Agency (DTM techniques and InterMap remote sensing). The latter will have 1 metre vertical resolution later this year. Up and coming technology that will warrant investigation in the short to medium term include Galileo (an alternative to the American GPS

system) and other satellite systems which may bring many benefits to FCD related projects.

The issue of data collection strategies was discussed at the workshop. It was felt that there is a need to have these in place up front to help review the options of changing technologies over time. However, the role of technology in data collection should be a key part of the strategy. For example, should surveys of flood defences be carried out by DGPS (using local pgms) with x,y,z data, comments on the state of the defence length and digital photographs being logged on a pda or laptop? Comments on features of concern could be entered with a precise position and a photograph, which would allow engineering teams to optimise their time and resources in dealing with weak points before failure occurs. Any data collected in such a way should be immediately compatible with the data format needed by NFCDD and should be capable of transmitting the meta-data or the data (by ftp or web portal) to the NFCDD.

The workshop participants felt that initially, money should be invested into logging who has got what data. It would be worth initiating such an exercise as early as possible.

Archiving data is also equally important. This is not done effectively (as it is not a priority) by the Agency because of resources. Historical trend data over longer periods (Foresight looks at 50-100 years) may be of key importance to risk assessment and planning. There is a national need for this.

A key part of this project should be the provision of a discovery meta-dataset.

Finally, incentives are critical to ensure that organisations have long-term interests in managing datasets. Issues to be considered include the setting up of national or regional specialist data centres and ensuring upgrade paths for datasets (some of which are in obsolete data formats).

New technology is also assisting in the development of flood warning systems, through flood warnings on the EA website to the automatic sending of telephone warning messages.

Conflicts & Competition

Data is expensive to collect and organisations typically have a vague idea of its worth. It can be difficult to persuade organisations to part with information (at least at a price the purchaser is willing to pay). The question of liability must also be met. Data provided in good faith may not be accurate. The data provider will not want to accept liability for losses resulting from the use of their data, particularly if the data is used for a different purpose for which it was collected.

The development of new technology is an expensive business. In addition to the development and production costs, training, and maintenance budgets must also be met. The budget to meet these costs is likely to be larger than

for existing technology. However, some technologies, particularly remote sensing ones, provide the opportunity to cover large areas of ground in a short period of time, thus reducing unit costs. Meeting the budget for new technology may mean fewer resources for other parts of the FCD community.

Key Factors

What does EA / Defra need to do to adapt to changing technology over time and how should they bring this into their long-term planning for Flood and Coastal Defence?

The EA / Defra needs to develop a strategy to assess when data should be updated to reflect new technology and its data needs (which will change in time). It should therefore review developments in technology annually and identify significant advances and trends (which may presage a larger change in technology in the future). Once new technologies have been identified they should be assessed against the existing technology. These comparisons should be in terms of .

- Accuracy (maximum as well as root-mean-square or mean absolute error).
- Resolution (number of points per metre squared).
- Cost (including hiring / purchasing, training, operating, maintaining, data processing and data handling).

The comparisons of measurement techniques are likely to involve field trials (at a site or catchment of EA / Defra's choosing). Once data has been collected and compared, it would also be sensible to pass the trial data through the database system to a data user, who should then compare modelling runs with old and replacement data, as this may raise issues which need to be considered.

Each year the results of these comparisons should be assessed against EA/Defra's data and data-management needs. Choices will have to be made regarding which new technologies are to be followed. These choices will be informed by the assessment of the data user as to which part of the data / data management / modelling process is the weakest (see the Knowledge Management position paper, particularly section 4.3.1 for more details about how this might be achieved). The choice of which new technology to take up should be driven by the improvement in (or reduction in uncertainty of) future predictions that is likely to occur. Hence it may not be worth updating a technology with a more accurate or advanced one if the changes do not provide a noticeable improvement in FCD (in whatever area) unless cost savings justify the changes.

When it has been decided to take up and use a new technology, this information needs to be disseminated, not just to those who will be using the new technology, but also to those who will be using new data collected by this technology. Data users need to be aware of the changes to the data they are receiving, as it will affect their model runs.

There have been cases where new technology has not been exploited quickly or fully in the past. For example the EA's uptake of LIDAR was not as quick as it might have been. Moreover, a system of unified rainfall monitoring by radar has been developed, but this has not been integrated into flood forecasting models. Therefore the data is being collected but not exploited fully.

The Knowledge Management paper describes general issues related to the updating of data. However, there are particular issues at different parts of the processing chain, which are considered in the following subsections.

- Data collection.
- Surveying.

More and more surveying will be done using remote sensing technologies. The first SAR topographic maps are undergoing checking. Developments in technology mean that it is becoming possible to detect changes in elevation using satellite SAR. However, one of the main problems associated with remote sensing is the inability to survey under water. Hence a LIDAR survey of a catchment will include top level elevations everywhere, including the top of vegetation and the water surface. Hence details of river cross-sections have to be patched into such topographies. The development of Scanning Hydrographic Operational Airborne LiDAR Survey has extended the LiDAR technique to survey shallow water depths (sufficient for most rivers and inshore areas), thus resolving one weakness. The first integrated systems are being developed that combine a hydrographic LiDAR with a standard topographic LiDAR and a digital camera to produce a system that could potentially survey an entire catchment including river beds and shallow lakes (up to about 50m depth) in a uniform fashion. If such systems are successfully demonstrated, this will resolve some of the data patching issues that affect present day catchment maps.

One weakness with SAR and LiDAR surveys is that they record the top level of vegetation. This can be particularly crucial with tree-lined rivers and streams where a LiDAR survey can show the high tops of the trees with a deep narrow channel where the river is. Post-processing routines can be used to interpolate from the nearest good elevation to the known water surface. However, this will not reveal the details of the river's bank and may be misleading and potentially dangerous. This error will remain, even as root-mean-square errors reduce. It is worth attempting to assess the maximum error as well as the root-mean-square error. Some of the problems can be overcome using the lower and slower Fli-map and ATLAS systems that look diagonally down at river banks and may be able to resolve the banks better. Nevertheless, ground-truthing using more conventional techniques should be used to assess the reliability of remote-sensing techniques in important areas where large errors are likely to occur.

Non-destructive testing

An increased use will be made of non-destructive testing as a means of investigating the make-up and state of defences. This will be combined with

DGPS and digital photography to give greater levels of information on the condition of structures that has ever been given before. In the short to medium term, attention should be given to assessing the suitability of applying technology used in road, rail and dam industries to flood and coastal defences, as these are likely to provide a rapid improvement in our present capabilities using established (although still modern) technology. The topography collected in these surveys could be used to check the values produced by remote-sensing surveys.

Data handling

Data handling is taken to be the transfer of data from one location to another. This may require a change of format or may require the data processor to export data in a given format. Present technology (ftp, web portals, data 'wrappers') exist for these tasks. The development of the grid (successor to the internet) should be monitored as it holds out the possibility of a new model for distributed data processing and / or handling. The total amount of information that will be required to specify each flood and coastal defence length down to the geometrical and structural element level will be huge and the likelihood is that the smaller-scale data will be held at a regional, rather than a national level. Such databases will have to be linked, as is possible at the moment. Present day technology is broadly sufficient in this area (although some is not as widely used as it should be). Care should be taken to choose technologies that appear to have a good upgrade path.

Archiving

A meta dataset needs to be decided upon. This should be ISO 19115 compatible. Present day technology is sufficient to enable data at different tiers to be linked. Policy should be geared towards creating a metadata database and making the contents available over the internet.

Dissemination

NCEDS, the NFCDD and regional offices will probably act as the main dissemination routes in the short to medium term. Software from the MDSF project is being developed to link to NFCDD. GIS tools in MDSF will allow results to be presented. Increasing use will be made of GIS technology, linked to databases and accessible though the internet.

Presentation

Much of the data can be presented in a GIS. Arc and MapInfo can each import data from the other, so there will be no need to specify a national standard. MDSF is providing a standard GIS platform for visualisation and decision support, which will be integrated with RASP (as the projects are being developed together). The take-up of MDSF and RASP will assist in the unification of systems and approach.

New methods of presentation, such as the use of animations of computer models and overlaying orthorectified aerial photographs onto the results of computer models will give increasingly graphic impressions of the potential damage caused by floods. Existing technology enables people to 'fly' through a digital terrain model, getting an impression of elevation. The

potential exists to create a virtual-reality flood or to use virtual reality to 'walk' through a defence, looking at the different layers. This technology will have limited technical use in the next few years, but may be important in generating public support for schemes or plans.

Needs and Drivers

Technological Developments

Rapid technological change has affected the way in which data for FCD is gathered. There is no reason to suspect that the rate of change will decrease in the coming years. The following sections highlight recent advances in different areas of technology and speculates as to which will become more important in the next decade.

Topography / bathymetry

Remote survey technology will be increasingly used to provide large-scale digital elevation datasets. In the short term airborne SAR will provide the base maps for CFMPs and SMPs. Studies at a smaller scale will also rely on helicopter based LiDAR systems such as Fli-map and ATLAS to provide increased numbers of data points. These systems and their successors should provide sufficient resolution to be able to identify crest elevations remotely. The development of combined hydrographic and topographic LiDAR systems may enable entire catchments to be surveyed in a single survey, thus removing the need to patch in elevations from different sources. The inclusion of digital cameras in some remote-sensing systems will enable some assessment of the condition of defence lengths to be carried out remotely as well. Some cross-checking of the elevations will be needed, particularly in vegetated areas.

Non-destructive testing

The next decade will see an increasing ability to measure the condition of defences using non-destructive techniques from the road, rail and dam industries. Adoption and possible adaptation of existing technologies will enable a large amount of additional information to be gleaned relatively quickly. Research will be needed to identify how this data can be used to create fragility curves or other means of assessing the risk of failure. Until the FCD community is happy that it can use this data to improve the forecasting of defence failure, there will be little point is surveying huge lengths of structure. It is likely to take 4 to 5 years to identify the most appropriate technologies and turn their data into useful predictive tools. By that stage, there should be a priority list of river and coastal defence most in need of additional information. Surveying this list could well take the rest of the next 10 years. Non-destructive testing will be combined with small-scale topographic surveys, digital photographs and expert assessment of condition to provide a large amount of information on a defence.

Continuous monitoring of coastal waters and rivers

Increasingly the environmental data for a catchment or a defence length will come from a combination of measurements and numerical modelling. At the

coast, numerical models for waves and water levels exist. These will be calibrated and validated against increasing amounts of measured wave and water level data, collected in organised programmes. It is likely that a combined wave and tide / surge numerical model that uses data-assimilation will be developed and implemented by the Met Office to provide 5-day forecasts of waves and water levels at any point along the coast. Inland the radar rainfall network should be integrated into river flooding models. Such a model would also be able to use meteorological forecasts of precipitation to provide forecasts of river flooding.

Increasing computer storage, improved battery life, better photovoltaic cells and improved data transfer (e.g. telemetry) will be combined with the falling real cost of such items to provide more data-logging capacity that can be left for longer, than ever before. This will allow increasing volumes of data to be collected, sent to a data-centre, analysed and checked for common faults and possible problems, with little human intervention. There will be a tendency to rely on this data and to use it without checking it. This tendency should be resisted. Audit procedures should be set in place (see Knowledge Management paper) to ensure periodic checking of data.

Conclusions

Recommendations

Existing technologies for data capture, analysis, and archiving and data presentation should be developed to maximise the value of existing data collections and data gathering programs. The application of new technology will play an important role in the development of data-gathering strategy. Some of the new technologies have not been applied routinely (if at all) to flood and coastal defence.

It is necessary to know the accuracy that is required for modelling at different tiers (from national down to structural element scales) before new technology can be assessed. This would allow a national standard data package to be defined. We do not even know exactly what data is required in order to develop fragility curves, so it is difficult to assess the new technology that could be used to provide this data. However, we can recommend that the use of non-destructive testing methodologies be tried out to determine which will give the most information on the internal structure of defences.

Existing technology is sufficient to develop the NFCDD for the moment. The MDSF software tool includes a customised GIS based on existing ArcView software and RASP is being developed to integrate with both NFCDD and MDSF. Therefore the existing GIS packages are good enough for the development of flood and coastal defence methods – but there is room for further exploitation of GIS as a visualisation and analysis tool. GIS harmonisation & integration was seen as being important at the workshop. This is likely to occur through the take-up of MDSF and RASP, although this may need to be backed up by a recommendation from Defra or the EA.

The use of the internet as a means of entering data into the NFCDD database (or regional databases) should be explored. The data map concept should be developed to enable relevant parties to locate local sources of relevant data. Although many other databases (such as MAGIC and the EA floodplain maps) are available to the public over the internet, there is no reason why the NFCDD must go down the same route. Password protection and the authorisation of passwords through EA limits access to those who need it and minimises the amount of unnecessary traffic on the network.

A discovery meta-dataset needs to be provided so that previously-collected data can be identified, along with an assessment of it quality and coverage and information on where it is stored and who owns it.

The existing database and GIS systems are sufficiently advanced to support the development of data handling tools (e.g. MDSF / RASP) in the medium term. The areas where new technology may be most usefully be developed are:

- Remote survey of assets by Fli-map, ATLAS or CHARTS.
- Use of mobile technology to load data from the field into the regional or national database (by ftp or internet).
- Use of wrappers or data-transfer software to enable a dataset to be transferred into a previously incompatible system.
- Use of non-destructive testing to assess the condition of defences. This will assist in developing a performance-based asset management system.
- Risks and obstacles.
- Technology should support the whole process from start to finish, whilst projects/initiatives need to plan for changing technological advances in the short to medium term where possible. The knowledge management paper gives general advice on data updating.
- Ownership of valuable data will not be relinquished easily.

The accuracy required for successful decision making has not yet been established. Therefore it is difficult to assess whether new technology has the required combination of accuracy and cost.

Different regions and different agencies tackle the same issues in different ways. There will have to be a unification of standards or else clear notification of the different methods used to collect, analyse, handle, store and process data. Different formats can be converted to make different systems compatible, but issues of data quality will have to be considered.

New technology often carries a high cost. A methodology must be developed for estimating the benefits to be gained from new technology (in terms of accuracy, resolution, coverage and new information) and balancing these against the data needs identified by users of data. There are a number of research programmes (particularly MDSF, RASP and PAMS) that are likely to set the framework for much of the work in FCD over the next 10 years. The methodologies developed for including uncertainty in RASP could provide a suitable framework for identifying the greatest data needs.

6 WORKSHOP 2 – JANUARY 2004

6.1 Draft Report Review Meeting

A second Workshop was held on Tuesday 27 January 2004, at the Environment Agency, Thames Region, Attendees at the event were:

- David Palmer (Agency).
- Jule Harries (CEFAS).
- Beth Greenaway (Defra).
- Rahman Khatibi (Agency).
- Cathy GReenall (Agency).
- John Goudie (Defra).
- Ian Meadowcroft (Agency).
- Suresh Surendran (Agency).
- Stefan Carlyle (Agency).
- Mike Walkden (Bristol University- external reviewer).
- Keiran Millard (HR Wallingford).
- Jonathan McCue (Atkins Project Manager).

Agenda

1. 10.30am Introductions (S. Surendran - 5 mins)

2. 10.35am Overview of the Report (K. Millard – 20 mins)

3. 10.55am External Review on Draft Report (M. Walkden)

4. 11.15am Overview Comments to date on Draft Report (J McCue)
- General Message.
- Compliance to CSG7.
- Response to the written comments.
- Link with other Initiatives (IACMST work etc).

5. 11.45am Discussion / Comments on Sections 1 to 8 & Appendices

6. 12.30pm Lunch Break

7. 1.15pm Discussion on further R&D needs (I. Meadowcroft

8. 1.30pm Discussion on Implementation Plan (C. Greenall)

9. 1.45pm Final Round Up / Agreement for Report (I. Meadowcroft)

10. 2.00pm One to One Detail Discussion (J McCue/ K. Millard)

11. 3.00pm Close (S. Surendran)

6.2 External Reviewer and Steering Panel Comments

The following represents statements from External Reviewer, Dr Mike Walkden on the Draft Final Technical Report. The Project Record (PR) which does answer some of the points raised by the External Reviewer was not submitted for review.

The comments are focused on adherence to project objectives set out in the CSG7.

Objective 1. Data Needs: identify data needs for policy, planning and operational purposes and review against data availability

"The report only partially meets objective 1, but justifies this and demonstrates how this objective could be met in the future. The report does not include a comprehensive review of all FCM data needs but does consider the data needs of RASP, PAMS and CFMPs".

"The report finds that this objective does not need to be met:

"Various studies such as SMP2, NFCDD, MDSF/CFMP, RASP and NFDDDMS, are all examining in detain what data is required for FCM and this study does not need to add to this"

"The report does state a need for meta-data and a system for identifying data-gaps (presumably it was the lack of these that prevented the completion of a comprehensive review of data needs within the project). The suggested approach to identifying data issues (and therefore implicitly 'needs') should be an effective one."

Objective 2, Data Accessibility: examine ways of improving data accessibility, including the use of the Internet, standardisation of archives and the development of "lead data centres" where an organisation is charged with maintaining a specific database

"Objective 2 has been achieved".

Objective 3, Data Acquisition: encourage co-operative effort so that the cost of data acquisition can be shared (e.g. between engineers and scientists, and engineers and environmentalists), which will lead to better flood and coastal defence solutions.

"Objective 3 is substantially achieved".

Objective 4, Knowledge Management: evaluate the benefits of data collections and develop appropriate techniques for more widespread application of value of information techniques.

"Objective 4 has not been substantially achieved".

Objective 5, Involvement of Stakeholders in Data Collection: investigate the greater involvement of stakeholders, such as riparian owners, in data

acquisition in order to make use of a low-cost untapped resource, and to promote awareness of flood defence issues in the wider community.

"Objective 5 has been achieved".

Objective 6, New Technology: develop and encourage the application of new technology and new techniques for monitoring, data handling, archiving, dissemination and presentation where appropriate.

"Objective 6 has been achieved".

Following this event, the Project Team took time to review the Draft TR and take on board salient points raised by the external reviewer and members of the Steering Panel.

Details of all other comments are not included within this PR.

6.3 Breakout Session

Attendees were divided into four groups of three to discuss and prioritise the main recommendations set out in the draft TR report. The aim of this exercise was :

- To gain consensus on the priority of the proposed recommendation (high/medium/low).
- To gain consensus on the "owner" of the recommendation (policy/process/research/all).

The effective work being carried out by the Agency across all sectors within their business was raised during the event. Methods for how to better communicate existing standards etc, to the FCM community were discussed in the context of this report.

The findings of this exercise were amalgamated into one consistent table. Merging of recommendations then took place and a revised "Action Plan" was prepared and placed within the Final Technical Report (TR).

Appendix A: PROJECT FLYER AND QUESTIONNAIRE RESULTS

EXECUTIVE SUMMARY

FD2314 – Position Review of Data and Information Issues within Flood and Coastal Defence

Overview

WS Atkins, were commissioned in 2002 to investigate and document the systems in place to collect data and process information within the Agency, other governmental bodies and the public sector. This scoping study recommended that further study is required. The joint Defra and EA R&D programme have subsequently agreed to fund this 6 month research project (FD2314) under the Risk Evaluation and Understanding of Uncertainty Theme, to develop a strategic approach to FCM data and information, covering the whole 'cycle' of collection, dissemination and use of data for decision-making.

This project aims to support policy development, implementation and operations, taking full account of existing data collection programmes and archives. It relates to users, other Research Themes, external providers, current data managers and those who are involved in wider policy issues on data access both in the UK and in Europe.

The work will be carried out by a team from Atkins, HRW, Halcrow and Almon Clark Associates. The

project is due for completion by October 2003.

What the Project will seek to deliver

Through the efficient use of one coordinated Expert Team, once clear report shall be produced (backed up by separate Position Statement reports). The Report will focus on identifying the areas within which data management within FCM can be made more efficient. The Report shall set out the methods by which this will be achieved, and will include reviews on current/future data FCM projects Of relevance, data acquisition, data handling/storage and data dissemination/sharing. A large number of user requirements need establishing and the methodological approach to prepare the series of Position Papers will ensure that the current state of knowledge is captured and that improvements are clearly identified and prioritised. The Report shall focus on understanding the uncertainties and from this, develop a strategic approach to data and information (that covers the whole cycle of collection, dissemination, and data use) for decision making to support policy development, implementation and operations.

Approach to the Work

The project shall involve a questionnaire, separate consultation (face to face and telephone), workshops, desk studies and literature surveys. Workshop 1 (24 April) will use the findings of the initial Questionnaire (sent to invitees) to focus attention on the six objectives (Position Papers of the project). Specific aspects of each Position Statement are outlined below::

1 **Data Needs**: identify data needs for policy, planning and operational purposes and review against data availability
2 **Data Accessibility**: examine ways of improving data accessibility, including the use of the Internet, standardisation of archives and the development of "lead data centres" where an organisation is charged with maintaining a specific database.
3 **Data Acquisition**: encourage co-operative effort so that the cost of data acquisition can be shared (e.g. between engineers and scientists, and engineers and environmentalists), which will lead to better flood and coastal defence solutions.

4 **Knowledge Management**: evaluate the benefits of data collections and develop appropriate techniques for more widespread application of value of information techniques.

5 **Involvement of Stakeholders in Data Collection**: investigate the greater involvement of stakeholders, such as riparian owners, in data acquisition in order to make use of a low-cost untapped resource, and to promote awareness of flood defence issues in the wider community.

6 **New Technology:** develop and encourage the application of new technology and new techniques for monitoring, data handling, archiving, dissemination and presentation where appropriate.

Deliverables and Key Dates

In order to achieve the project, the following Milestones are set :

- Milestone 1 – 24 March 2003, Inception Meeting,
- Milestone 2 – 24 April 2003, Hold Workshop 1 (Reading Agency Offices)
- Milestone 3 – 8 May 2003, Complete Initial Information Gathering exercise
- Milestone 4 – end June 2003 , Completion of 6 Draft Position Papers
- Milestone 5 – mid July 2003, Workshop 2 to discuss Synthesis of Interim Findings
- Milestone 6 – September 2003, Submission of Final Integrated Report.

Contact Information

Any correspondence in relation to this project should be forwarded to the attention of the Atkins Project Manager, Jonathan McCue, at the following email address :

jonathanmccue@atkinsglobal.com

Risk Theme Project Manager	**Atkins Project Manager**
Suresh Surendran	Jonathan McCue
Environment Agency	Atkins
Kings Meadow House	Birchwood Science Park
Reading	Warrington
RG1 8DQ	WA3 6AT

QUESTIONNAIRE RESULTS

General Questions

Question 1
In your opinion, what are your top constraints to effective data management in the FCM or other related industry at present?

The analysis of the replies came up with three main themes as follows :

Key Themes:

1. **Lack of data coordination, dispersed data, lack of integrated databases**
2. **Data Quality**
3. **Data Accessibility**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Storage on separate and often incompatible systems.
- Poor integration with other factors relevant to geomorphological processes.
- Lack of awareness of what exists.
- Lack of transparency in data used for specific project/uses.
- Issues related to ownership and restricted availability of relevant datasets.
- Understanding of what data is needed to make robust strategic planning decisions – what and how much info is needed.
- Too much data not enough info. How can we better use indicators to inform decisions.
- No coordination between holders of info.
- Lack of clarity about users and their needs.
- Volume of data.
- Involvement of multiple organisations.
- QA and Security; Confidence in quality of existing data, Formal standards, Lack of generic protocols for data recording/storage, enabling effective sharing.
- Access to data; who holds it and how to access it, Willingness to share
- Availability; Users unaware of what data exists, Not always available in the required format.
- Open Application architecture.
- Poor metadata.
- Not recognised as a resource priority.
- No clear strategy in lines of responsibility for data management outside of individual projects. Various data sets of differing quality are housed in different places.
- Not always available in the required format.

- No clear and consistent standards to management policies.
- Transfer of data between systems and organisations.
- Finding data.
- Lack of appreciation amongst staff of the importance of data quality.
- Lack of quality data to supplement National Network tide gauge data sets for use with numerical models.
- Extreme level estimation in complex shallow water areas not always available.
- Lack of understanding of Intellectual Property and its implications
- Too much project work not related to core business and Making it Happen.
- Unwillingness to fund long term collection and management.
- Resistance to collect data because its potential can not be envisioned.
- Too many uncoordinated projects to collate data for different purposes.
- Lack of an easily accessible central database of all information.
- Lack of coordination with common protocols.
- Lack of common tools and agreed input/output.

Question 2
In your opinion, what would be the priority issue to address within this research project?

The analysis of the replies came up with three main themes as follows :

Key themes:

1. **Awareness of data availability**
2. **Common databases and linkages to other data holdings**
3. **Data Quality**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Better quantification of uncertainty with flood risk assessments.
- Ensuring FD meets the requirements of the Strategic Environment Assessment (SEA) Directiv.
- Identification of users and their needs.
- Identification of relevant data sets, ownership and accessibility.
- Practitioner training in GIS, Global Positioning System (GPS) and DATUMS.
- Management of data collection for future use.
- Data management – licenses.
- Promote data sharing.
- High Standards.
- Commercialisation issues with ongoing FD projects.
- Identification of future problems that will need new data.
- Funding.
- Data storage and dissemination.
- Work with the Business Customer to develop joined up research.
- Open and managed access.

Objective 1 - Data Needs

Question 1
What are the most pressing data needs for current and emerging initiatives?

Key Themes:

1. **Improving data quality**
2. **Databases of socio-economic information**
3. **Increased awareness of data availability**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Central source of knowledge on what data exists.
- Greater co-ordination in government funding schemes.
- Development of a marine spatial planning authority as proposed in the 'Links' Initiative.
- Better quantification of non-monetary impacts.
- Forecasts of Likelihood and magnitude of flood level.
- Estimation of general flood risk based on specific flood rainfall events.
- SEA Directive.
- Records of properties affected by flooding.
- Socio-economic information about residents in flood areas.
- Databases of community and support groups.
- Detailed asset data.
- Identification of what data there is access to High resolution bathymetry, real time flood monitoring with Synthetic Aperture Radar (SAR), Canadian Aeronautics Space Institute (CASI) multi spectral imagery.
- High resolution elevation monitoring (LiDAR).
- Hydrodynamic models capable of using high-resolution dat.a
- Standard of protection of defences.
- Evaluation of risk.
- Map - definition of the coastal zone.
- Archiving/collection of indicator data in the long-term.
- Geographic representation of research and capital projects.
- Harmonisation.
- Better awareness of data availability.
- Better storage management - larger data sets.
- Understanding current data quality and assessing future data needs.
- For RASP and Flood Mapping Strategies increased confidence in defence attribute data.
- Bathymetric data for developing fine scale numerical models for problem areas.
- Data quality for improving extreme level return period estimates and methods.
- Data quality for improving accuracy of tidal predictions.
- Location of data sources.

- Awareness of data availability.
- Post event data.
- Improved high flow flood gauging.
- Improved data on people at risk rather than property.
- Wave overtopping data.
- Valuation of intangible benefits such as environmental losses, stress, leisure valuation.
- Co-ordination.
- Basic training.
- Measurements of habitat quality.
- River catchment flows at extreme events.
- Long term coastal data sets.

Question 2
In which of the above is the potential "value" of the data significantly constrained in its usefulness by uncertainty, inadequacy, restricted availability, or non availability of data?

Only a third of respondents answered this question, indicating uncertainty surrounding this aspect of data management.

Objective 2 - Data Accessibility

Question 1
Identify ways where data accessibility within FCM and other related industry may be improved?

Key Themes:

1. **Increased use of the Internet**
2. **Central Data Centre**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Increased awareness of availability.
- Better organisation of metadata.
- Greater openness in the private sector, collaboration and better curation.
- Simplified and Improved GIS interface.
- Data analysis and interpretation tools.
- Use of indicators.
- Collaborative data collection and presentation.
- Structure data to meet user needs.
- Secure websites.
- Involve National Centre at an early stage.
- Data sharing.
- Knowledge of data location/availability.
- Direct access to latest OS mapping from the desktop.

- Switchboard concept.
- Provide access to EA/Local Authority (LA) tide gauge data via the web as are the National Network tide gauges on the Proudman Oceanographic Laboratory (POL) website.
- Access to bathymetric surveys.
- Ability to more quickly alert LA of potential problems.
- Understanding of IP.
- Understanding of where data has originated.
- Addressing business need and vision.
- All data should become public after a stated time.
- Annual circulation of latest data availability.
- Common protocols.
- Specify common standards/methods of measurement.
- Hold all data in one place.
- Provide open access.

Question 2
Suggest examples of good practice examples where necessary

Seven different examples were suggested. The most common example was the NFCMD, which was suggested four times.

- River Habitat Survey (RHS) and Biodiversity Action Plans (BAP).
- British Radioactive Waste Inventory Management System (BRIMS).
- NFFS project.
- NFCMD .
- (Indicative Floodplain Map) IFMs.
- Estuaries database.
- EA Data Centre.

Objective 3 – Data Acquisition

Question 1
Identify ways how data acquisition within the FCM other related industry could be improved

Key Themes:

1. **Consider new data collection technologies**
2. **Common data standards**
3. **Acceptance of the collect once use often philosophy**
4. **Automation**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Adherence to accepted protocols.
- Willingness to contribute to the merging UK monitoring strategy.
- Open architectures.

- Remote Sensing.
- Digital Photograph Database.
- Closer cooperation.
- Closer targeting of data acquisition through better understanding of what data is required.
- Integrated Coastal Zone Management (ICZM) Mapping and ICH projects.
- Agree data needs.
- Plan Ahead.
- Standardisation of methods.
- Better collaboration between organisations who collect the same data.
- Agency survey documents.
- Website databases.
- CD-ROM.
- Install new tide gauges.
- Consistency through Single points of contact.
- Standard data licenses.
- Information acquisition specialists.
- Standard technologies.
- Standard data capture methods.
- Standard storage.
- Specialist data collection teams.
- Access to central database.
- Standard approach to handling commercial constraints.
- Shoreline Management Plan (SMP) process.
- Regional monitoring projects.
- Common protocol.
- Specify common standards/procedures of measurement.
- Identify key parameters to be benchmarked
- Regard data as an asset, not a cost.

Question 2
Provide examples of any project (current or future) dealing with data acquisition (brought about by current national and European R&D Initiatives) that occur outside the FCM industry that would benefit this research.

- SEA in the South West study.
- Cumulative Effects Assessment Scoping Study and Literature Review.
- Environmental Impact Assessment (EIA) and Social Issues Scoping Study.
- Strategic Integrated Appraisal Methodologies Study.
- British Radioactive Waste Inventory Management System (BRIMS).
- Mersey Estuary Survey.
- Dee Estuary Survey.
- IACMST/MarLine/MNBA/AE1039 ERP Uptake.
- Estuaries Research Project.
- Foresight.
- Geomatics publications.

- POL's Liverpool Bay/Irish Sea Coastal Observatory.
- Water Framework Directive River Basin Characterisation.
- South East Region coastal monitoring project.
- Rail and Gas Industries.

Objective 4 – Knowledge Management

Question 1
Provide up to 3 data collection or storage techniques/tools (current or future) that would increase the "value" of information generated/compiled within the FCM industry.

Key Themes:

1. **NFCMD**
2. **Websites**
3. **Centralised database**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Simple structured database.
- Smart searching of unstructured sources.
- Meta database structures.
- Internet Access to database.
- GIS.
- Regional observatories.
- Searchable database, ideally with a GIS interface.
- Developing an agreed electronic data format specification between data owners.
- User accessibility to a centralised database to produce tailored data reports to meet specific needs.
- Accessibility to data by external users through CD-ROM.
- Greater use of EDMS type data systems.
- Increased use of internet based access.
- Explore/extend concept of data warehouse and tools to extract data for use.
- Explore remote data capture.
- 'In my backyard' technology to find geo-referenced information.
- 'Central warehouse' through web.
- Web databases.
- CD/DVD.
- Standardised data processing/analysis methods.
- STEM.
- NFCMD.
- Estuaries Database 2003.
- National Data Centres (EA, BODC, etc).
- Websites.
- RASP.
- PAMS.

- NFCMD.

Objective 5 – Involvement of Stakeholders in Data Collection

Question 1
How should customers be involved in data collection/dissemination/ storage?

Key Themes:

1. **Participate in a range of aspects: data storage, collection**
2. **Identify data needed**
3. **Consistency**
4. **Quality**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- All of these need incentives.
- Risks are obvious ones associated with quality and integrity of data collections.
- Helping to identify data needs.
- Provision of data.
- Signing off of data.
- Participate in defining priorities for data collection.
- Participate in choosing best system for data storage.
- Participate in disseminating data resource.
- Do we have a system for logging calls etc from external organisation/individual? Recording/storing this info so that it can be retrieved? A GIS-based system would assist this.
- The wrong data being used in the wrong process.
- Agree data needs with customers.
- Ensure data standards are clearly defined and communicated.
- There is a significant risk in responsibility for storage being given to third parties.
- Apply conditions of data management and IP to contracts at project procurement stage.
- Recognise win-win situation in sharing information.
- Risks that data is reused and interpreted in a different way which may compromise the customer's position.
- Main risk is maintaining quality standards.
- They should receive and explanation of why data is being collected
- Shown results.
- Encouraged to record data during events.
- Data should be stored/archived by National Authority (e.g. BODC)
- Validation of data.
- Costs involved with the quality control of data.
- Complying to standards.
- Identify data needed.

- Contribute towards standards/quality setting.
- Recognise the value of the data – willingness to pay.
- Provision of all relevant information to a central database would sift and then publicise nationally.
- Project and Programme Management Structure.
- FD Risk Management Strategy leading.
- Customer input to data acquisition is potentially important since they can define data needs and identify gaps in current data collection.
- Stakeholders could have important local historical knowledge.
- Nuclear industry.
- Consistency/quality control.

Question 2
Suggest 3 incentives (current or future) that would improve participation by the wider community in providing data for flood defence issues

Key Themes:

1. **Funding**
2. **Greater awareness of benefits**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Belief that views will be taken into account.
- Understanding of benefits of info provision to Coastal Flood Defence (CFD) planning.
- Sharing info and findings.
- Payment for data.
- Improved definition of flood risks and increased awareness of such risks could possibly be linked to insurance cost.s
- Money.
- Stress the need for data to ensure flood defence schemes are procured
- Seek help from environmental groups to demonstrate increase in river flows link to change in environment.
- Enhancement of centres of excellence.
- Incorporation of data collectors into consortium.
- Guarantee of full acknowledgement of the data source.
- They will get a better service.
- Greater access to data.
- Hopefully improved accuracy of estimates/predictions.
- Greater awareness of the benefits.
- Wider understanding of the legal implications.
- EA getting its own house in order.
- Demonstration of need.
- Funding justification.
- The south-east regional monitoring project is looking into those but the community is still quite restricted.

- Fund or contribute to cost of data acquisition.
- Give contributors preferential access.
- Provide technical support/advice/equipment for data acquisition.

Question 3
What are the main risks associated with these issues?

- Quality Control.
- More work.
- Inability to maintain data system (lack of resources).
- Lack of agreement between stakeholders.
- Cost unsustainable.
- Insurance industry unwilling to cooperate.
- Lack of quality controlled data, unreliable data sources, undefined uncertainties in data.
- Public lack of confidence and/or disagreement about assessed flood risks.

Objective 6 – New Technology

Suggest 3 new technology techniques that would improve monitoring, data handling, archiving, dissemination and data presentation within the industry?

Key Themes:

1. **GIS**
2. **Remote Sensing**

A complete set of unedited replies for transparency and auditing purposes is presented below:

- Geographically structured databases.
- Metadata descriptions.
- Data based forecasting techniques.

- Internet and GIS.
- Use of public access internet sites with password protected private areas for customers sponsoring data acquisition to enable data sharing and rapid updating of existing data sets.
- Interferametric side scan sonar (3D).
- Land base LiDAR, Helicopter based LiDAR.
- CASI multispectral imagery.
- Web technology for presentation, GIS, statistical analysis and graphing.
- Expert systems, neural net technology for data analysis.
- Knowledge Management tools.
- Learn from the experts such as BODC.
- Remote Sensing and field data capture.
- OS GPS Network and Future EA GPS Networks.
- Web Mapping/GIS.

- Automatic on-site validation of data.
- Real time via web or satellite access to tide gauge data.
- Data processing/analysis software availability.
- Web map serving.
- Data streaming from ‘hubs’.

Appendix B: RELEVANT ADDITIONALCONTACTS

The following represents additional contacts suggested at the Workshop 24th April 2003. Where possible, contact was made.

B.1.1 Additional Contacts suggested at the Workshop 24th April 2003

Project	Contact	Details (to best of knowledge)
NCPMS	Richard Nunn Jane Rawson Jim Anderson - Project Manager	Environment Agency Kingfisher House Peterborough Cambridgeshire PE2 5ZR Tel: 01733-371811
SCISYS	Geraldine Flanagan – Contractor	
Beach Monitoring Surveys	Jane Raylson	Anglian Water Anglian House Huntingdon Cambridgeshire PE29 3NZ Tel: 01480-323000 Fax: 01480-323115
Coastal Cell Groups Local Authorities	Talk to Andrew Bradbury Andy.Bradbury@NFDC.gov.uk	New Forest District Council Beach Huts Lyndhurst Hampshire SO43 7PA Tel: 023 80 285463 Fax: 023 8028 5596

Project	Contact	Details (to best of knowledge)
Mapping, LiDAR etc, NCEDS,		Environment Agency Twerton Depot Lower Bristol Road Twerton BATH BA2 9ES
River Habitat Survey	Jim Walker	Environment Agency PO Box 12 Richard Fairclough House Knutsford Road Warrington WA4 1HG Tel: 01925 653999 Fax: 01925 415961
Internal Drainage Board	David Noble - Chief Executive	Association of Drainage Authorities The Mews Royal Oak Passage Huntington Cambs PE18 6EA Tel: 01480 411123 Fax: 01480 431107

Project	Contact	Details (to best of knowledge)
MCEU – Fepa Licences	Geoff Bowles	Defra Marine & Waterways Division (Marine Environment Branch) Ergon House (Area 3A) Horseferry Road London SW1P 2AL Tel: 020 7238 5873/5870 Fax: 020 7328 5724
NCPMS SCISYS	Jim Anderson - Project Manager	Environment Agency
DTI – Floodnet Programme	Craig Hutton cwh@geodata.soton.ac.uk	Geodata Institute University of Southampton Highfield Southampton SO17 1BJ United Kingdom Tel: 023 8059 2719 Fax: 023 8059 2849

Project	Contact	Details (to best of knowledge)
UKHO	John Pepper john.pepper@ukho.gov.uk	The United Kingdom Hydrographic Office Admiralty Way Taunton Somerset, TA1 2DN Tel: 01823 337900 Fax: 01823 284077
BODC etc	Lesley Richards	Proudman Oceanographic Laboratory Bidston Observatory Birkenhead Merseyside L43 7RA Tel: 0151 653 8633 Fax: 0151 653 6269
Coastal Observatory	John Howarth	
Climate Change, PSML, NTSLF	Phil Woodworth	

National Engineering and Environmental Agreement (NEECA) Framework Consultants working with the EA NCPMS:		
Halcrow Burderop Park Swindon Wiltshire SN4 0QD	Babtie Brown & Root	Black & Veatch Consulting (David Keiltes?) **Head Office Address** Grosvenor House 69 London Road Redhill RH1 1LQ Tel: 01737 774 155 Fax: 0 1737 772 767

Appendix C: 38TH DEFRA CONFERENCE FLYER

FD2314 – Position Review of Data and Information Issues within Flood and Coastal Defence (FCM)

Your Help is Required to Improve FCM Data Management

Please Read Below

All aspects of the flood and coastal defence process require effective data and information to undertake inspection, design, monitoring, forecasting and appraisal.

The purpose of this project is to understand the efficiency of current data and information practices and what opportunities exist to improve the flood and coastal defence process by identifying:

- The right information.
  Do we measure the right things?
- The management of information.
  Who does what and how well is it done?
- Information policies and procedures.
  What policies and procedures help/hinder efficient use of data and information?
- Information technology.
  Do we use appropriate technology for data capture, processing and dissemination?

The output of the project is to determine where these limitations can be matched with, where possible, quick fixes and improved uptake of ongoing research and initiatives.

Your help is required for:

1. **Practical examples of where data and information issues are limiting FCM effectiveness**
   e.g .protracted starts to projects, uncertainties in data quality, 'red tape' in data supply
2. **Ideas from your experience as to how this could be improved**
   e.g. future data requirements, streamlining of data access
3. **Examples of best practice information management– including areas outside of FCM**
   e.g. new technologies in the field

Please record your thoughts on the following page and return them as requested.

Contact Information

More information on the project go to www.hrwallingford.co.uk/projects/data_FCM

Client Project Manager
Suresh Surendran
Environment Agency
Kings Meadow House
Reading
RG1 8DQ

Atkins Project Manager
Jonathan McCue
Atkins
Birchwood Science Park
Warrington
WA3 6AT

FD2314 – Position Review of Data and Information Issues within Flood and Coastal Defence (FCM)

By Fax: Completed forms to Jonathan McCue at Atkins : 01925-622054

By Hand: Completed forms to the Atkins, HR Wallingford (FAO Keiran Millard) or Halcrow (FAO Peter Von Lany) stalls at the Defra Flood and Coastal Management Conference 2003.

Your Name: ……..
Organisation: ……..

What are your views on data and information issues in FCM?

1. Practical examples of where data and information issues are limiting FCM effectiveness

2. Ideas from your experience as to how this could be improved

3. Examples of best practice – not necessarily in FCM

What is your role in FCM?
(e.g. modeller for a consultancy, manager of inspection team in a LA, etc.) Please also mention any data and information related initiatives you are involved in.

Further contacts
If we may follow up your comments, please provide yours or your colleague's contact details below

Appendix D: RESULTS - 38TH DEFRA CONFERENCE FLYER

There was a low response to this exercise. The main points raised in the completed returns are presented below.

Question 1 – Provide practical examples of where data and information issues are limiting FCM effectiveness.

EA, NE Region Comments

- Historic information on flood defence schemes. Paper files and photos from +20 years ago. Accessing this information is difficult.

- Transfer of information from those involved in the construction of new flood defences to those responsible for operation and maintenance issues needs to be better.

- Need for better links to financial information on individual assets. To help us take a whole life and investment management approach to the management of our assets. A better link between our assets inventory and financial information may also help us with the prioritisation and justification of flood defence maintenance works.

- Over the years, flood defence staff, build up detailed knowledge on flood defence assets. Some knowledge may be written down in operation and maintenance manuals. We need a way of recording the knowledge that is not written down before people leave or retire.

- Need for better annotating of our data to let users know the data quality. This will help us use data at an appropriate scale.

- Need for data to be recognised as an asset and integral through lifetime of project i.e. early identification of data needs, collection of data during project and passing on of data at project end. Valuable data is being lost.

- Time and effort is because staff members don't make most effective use of technologies. Work goes to external contractors when we already have the facilities in house to perform the work.

EA, Anglian Region Comments

Lack of good, consistent defence standards of protection information, limiting the usefulness of National studies such as; RASP. Unaware of a National drive (including resource, processes, funding) to improve this important dataset.

North Norfolk District Council Comments

We need a consistent stand and approach to data handling. NFCMD is supposed to deliver it.

Lewes Flood Action Comments

Lack of flood probability data at sub flood cell level.

National Flood Forum Comments

Lack of data collection during and immediately after a flood event:
After three waves of flooding in the autumn of 2000, Lessons Learned was published by the Agency. I asked our local EA area office how they had collected the information that 140 properties in Bewdley had been affected by flooding. By the time of the publication of the scoping report for the Bewdley FAS Stage 1, the figure had risen to 175 properties, but the accompanying map of properties that would be affected by a 1:100 year flood (taken as the 1947 level of 5.84m., as compared with 5.56m. in 2000) obviously excluded some of the properties that would be affected by that level. Given that there was a need to justify the expenditure on the defences by as much benefit as possible, this seemed a pity. Local knowledge could have helped.

The Environment Agency Area Office doesn't possess any information on the hierarchy of floor levels in Bewdley. But this information was in the hands of the Police and used by them when they were responsible for delivering flood warnings in Bewdley pre 1996. Because of where we are in the catchment, we get up to 30 hours flood warning, and usually a very accurate final level prediction is possible.

Terry Oakes Associates Ltd Comments

The absence of NFCMD, particularly the coastal fields, is preventing maritime authorities from deciding how best to collect/maintain data. Many LA's are not interested in IT solutions until decision is made.

EA, Southern Region Comments

Estuary wide flood defence strategies – e.g. Essex Estuary suites are presently being done on rolling programme which has had to be tailored to specific data requirements. Particularly lack ADCP data, any decent time series of flow data (lucky to have one spring/neap cycle of currents across mouth, for example), This a problem as we rely so much (and spend so much!) on numerical modelling which needs it for decent validation and calibration.

Engineering design of new schemes – traditional research lab based work on performance of individual structures etc. is fairly common, but we rarely monitor actual schemes, or do post-project appraisals of their actual performance, so don't learn lessons from past sites. Particularly important in innovative schemes which adopt many-structure approaches, e.g. realignments. There is often no statutory driver to monitor either the scheme or impacts of it.

Lack of coordination or agreement between govt departments e.g. SNSSTS – funded by Defra and others, we needed DNSOM (govt) data (bathymetry) but

concerns over the location of submarine routes meant a very lengthy delay in project, with associated costs. Should have been simple to sort out!

Lack of collaboration on certain projects – either academic or govt funded research, can mean different data sets used and different results given for similar outputs e.g. return period water levels, and great confusion over which to use – relates particularly where the results can be of use to many organisations or functions and many are not aware of what is planned / already done by others.

Sometimes missing opportunities to make sure all using same systems – e.g. NFCMD not well communicated locally to LA's in time to prevent them investing in alternative systems such as Oakleaf's Access database. Credit to Oakleaf, they saw a potential sales opportunity and have sold a good system, but debate whether it is necessary or whether LA's worried about fulfilling HLT's simply jumped for it as we didn't communicate NFCMD plans well enough.

Question 2 – Provide ideas from your experience as to how this could be improved / Examples of best practice.

EA, NE Region Comments

Set up a national project for archiving with dedicated resources e.g. a scanning service.

EA, Dales Area has started to put together a specification to help the transfer of data from those constructing defences to those maintaining them.

The EA's new financial management system may help to link financial information on individual assets but its main aim will not be flood defence asset management.

We need to encourage people to use systems that store information on the work that this being done so that a formal record is kept.

We put together a number of notes on the Risk Assessment for Strategic Planning project to ensure that Ridings Area staffs were aware of how the data should be used.

We try to share skills and knowledge within the organisation of the application of technology.

EA, Anglian Region Comments

Early communication of data requirements that can be put in programme and budgets planned. Often areas (where local data is procured) don't hear about such work until a time when outputs have been produced.

North Norfolk District Council Comments

From what I have seen NFCMD needs a front end to allow various formats to be used. T. Oakes is talking to Defra about the Oakleaf database that was developed for asset management for LA's.

Lewes Flood Action Comments

EA willingness to confirm action group estimates derived from EA data i.e. take stakeholders seriously.

National Flood Forum Comments

Local flood action groups hold data on flood levels and on how flooding has occurred which would be of use to the Agency and other authorities. I've met groups of residents who hold video and photographic records of flooding in areas where flooding doesn't appear at all in either Local Authority or EA records. Local detail is vital. For instance, being able to point out to the Police in Bewdley that the entrance to the car park is two foot lower than the main body of the car park in Bewdley has meant that the car park could be cleared of cars before the water was too deep to get them out. Bewdley Residents' Flood Committee is involved in regular Flood Liaison Meetings with the personnel of Silver Control, and this has been of value to all sides.

Little attempt seems to be made by the Agency to tap into the local knowledge that is still held by those who work on the river, or used to work on the commercial barges that went up and down the lower Severn. When I asked Severn Area Rescue Association at Upton where they got their information from on how the river would behave, they told me they ring a man at Diglis Basin who will tell them at hourly intervals night or day what the river is going to do. They do not ring the Area Office at Tewkesbury. I imagine that the situation is the same elsewhere.

If you have information that you wish to give to the Agency, it's extremely difficult to find anyone who's prepared to listen to the point you're making. I know this from personal experience, as during the first flood of 2000, I kept a record of all the flood warnings I received, both those I took myself from the Floodline recordings, and those that came to my 'phone from the AVM system. I discovered that there was a major discrepancy between the two. The Floodline recorded message was already giving a predicted final level of 5.5m. (4.8m. is the threshold of Severe Flood Warning), when the first AVM message was going the rounds giving a Flood Watch warning - no houses affected at this level. The AVM didn't move to a Severe Flood Warning until 30 hours after I'd taken a predicted final level of 5.5m off the Floodline recording.

Exactly the same thing happened 18 months later during the flooding of February 2002. The eventual result has been an uneasy compromise for reasons I still can't quite understand. The AVM messages have been re-scripted, but I have no faith that an AVM Severe Flood Warning will be run without wasting a considerable amount of time running through misleading lower code bands. The code band system dumbs down our excellent local

flood warnings to a nationally convenient form. I have talked to ex NRA employees from other areas who confirm this is true elsewhere.

Terry Oakes Associates Ltd Comments

Develop NFCMD coastal fields. EA presentation to last Coastal Defence forum (Defra) said this was in hand but nothing heard since May 2003. Suffolk Coastal DC is using Oakleaf database.

EA, Southern Region Comments

Increase value and extent of regional monitoring programmes – our Anglian programme justified cost benefit easily at last review. Is used on multitude of projects, but at no time has more than 5 year approval. Need commitment to ongoing monitoring. Needs major streamlining / one organisation to manage and maintain system if it is to be implemented anywhere else other than Southern Region, where Andrew Bradbury and others are innovative and fabulous but unlikely to be found elsewhere! Developments like funding Coastal Data Coordinator (Jules Harries, based CEFAS) are a good sign.

- Developing and enhancing MoU's between national and local organisations is major way to improve data sharing issues – we have national post holder (Michael Rose) dedicated to this – again, good development.

- Simple way of improving data issues for us – we often go back to historical work, need the supporting data, and realise we never asked for it to be delivered when the original work was done. Then we have to pay to get it / use it, as often we didn't even secure copyright! We need to improve standard conditions of contract with our consultants who then subcontract survey work (not so much of an issue in this region as most is handled by this group using standard EA survey spec.)

Question 3 – Provide examples of best practice – not necessarily in FCM

EA, Anglian Region Comments

We've just undergone a process for NFCMD of capturing digitally all our historic flood outlines and are working to reduce the reliance on paper systems.

North Norfolk District Council Comments

In particular, combining coastal, land drainage and other assets in one database would be advantageous.

Lewes Flood Action Comments

Trying to set up dialog that would deliver.

National Flood Forum Comments

As part of our work programme this year, we are meant to be being involved in setting up a 'Customer Panel' to provide feedback to the Agency. Since we haven't had a meeting as yet to discuss this project, I have no idea what is involved or the potential application, but we are enthusiastic about the idea.

This week alone I have put in comments to your research project, a University of Surrey project on EA interaction with Special Interest Groups, and the social research area of the proposed Flood Risk Consortium project. I think the Agency would be helped from every point of view if it held direct discussions with stakeholders and developed its own expertise, rather than setting researchers and PR companies between its staff and those affected by its policies.

Terry Oakes Associates Ltd Comments

The Oakleaf Asset Management database has coastal elements which should be able to be linked to NFCMD. Someone needs to contact Oakleaf development team who want to work with EA NFCMD.

EA, Anglian Region Comments

Having been very critical, must also say that things have improved enormously in past 5 years – predominantly with development of data sharing and use of the internet for advertising data availability. Agency needs to adopt more use of its own internet site for advertising and disseminating data.

Best practice – Anglian and Southern region monitoring programmes. (check capacity of good survey companies to offer similar programmes country-wide – we have over burdened some regional teams / many do not pass minimum quality thresholds.)