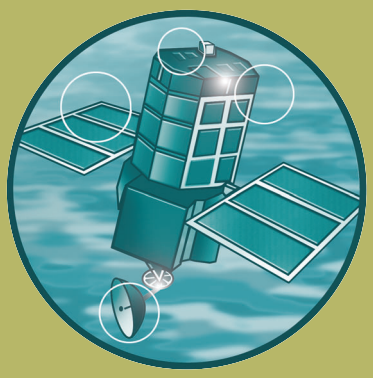
Joint Defra/EA Flood and Coastal Erosion Risk Management R&D Programme

Improving data and knowledge management for effective integrated flood and coastal erosion risk management

A guide to good practice

R&D Technical Report FD2323/TR5



Environment Agency

defra
Department for Environment Food and Rural Affairs

Joint Defra/Environment Agency Flood and Coastal Erosion Risk Management R&D Programme

Improving Data and Knowledge Management for Effective Integrated Flood and Coastal Erosion Risk Management

Work Package 5 - A guide to good practice

R&D Technical Report FD2323/TR5

Produced: September 2007

Author(s):
Andrew Robinson
Fola Ogunyoye
Greg Guthrie
Tim Burgess
Claire Brown
John Chatterton
Charlie Rickard

Statement of use
This is a draft of the principal output of FD2323 'improving data and knowledge management for effective integrated FCERM.' It provides good practice guidance on how to effectively manage data and knowledge for FCERM based on an objective-led approach. Its intended users are managers, suppliers and users of FCERM information both within and outside the FCERM industry.

Dissemination status
Internal: Released Internally
External: Released to Public Domain

Keywords:
Data management; flood risk responsibilities; coastal erosion responsibilities; informal ontology; data justification; data quality; data provenance; data appraisal; metadata standard; data storage

Research contractor:
Fola Ogunyoye, Royal Haskoning, Rightwell House, Bretton, Peterborough, PE3 8DW, email f.ogunyoye@royalhaskoning.com

Project Partners: ABPmer, J B Chatterton and Associates, Cranfield University, Pennine Water Group (Sheffield University), Charlie Rickard.

This work package was led by Royal Haskoning.

Defra project officer:
Dr Suresh Surendran, Environment Agency, Kings Meadow House, Reading, RG1 8DQ, email suresh.surendran@environment-agency.gov.uk

Publishing organisation
Department for Environment, Food and Rural Affairs
Flood Management Division,
Ergon House,
Horseferry Road
London SW1P 2AL

Tel: 020 7238 3000 Fax: 020 7238 6187

www.defra.gov.uk/environ/fcd

Published by the Department for Environment, Food and Rural Affairs. Printed on material that contains a minimum of 100% recycled fibre for uncoated paper and 75% recycled fibre for coated paper.

PB No. 12527/19

Executive summary

The success of integrated flood and coastal erosion risk management (FCERM) is underpinned by the use of good data, information and knowledge management. A review of approaches within the FCERM industry to planning data collection and the management of the data once obtained shows that there is a tendency to focus on data, as opposed to the business objectives for which the data is required to support. This data-led culture has resulted in an ineffective approach to data management, where the cart is effectively driving the horse. This current approach has given rise to:

- Inability to determine the optimum amount and quality of data required and hence justify the procurement of additional data when needed
- Data in the wrong form, requiring a lot of additional work to convert to useful information
- The duplication of data and its management, due to lack of awareness of data that already exists
- Data redundancies due to lack of objective-led planning
- The inability to re-use or maximise the use of data due to lack of knowledge about other parts of the business requiring the same data
- The inability to share data due to lack of knowledge about others requiring the data and inconsistent standards

Following earlier reviews of data issues within the joint Defra/Environment Agency R&D programme, Defra commissioned the FD2323 project to develop a strategic approach to FCERM data management, to ensure it effectively feeds into knowledge about the business and the delivery of FCERM objectives.

The FD2323 project involved the development of a framework for improving data and knowledge management through a move into a more objective-led approach to data management. A number of techniques and tools were developed within the project to support the culture change required to deliver the objective-led approach. The FD2323 project was carried out within five work packages. This document (FD2323\TR5) is the principal output of the project, capturing and presenting its key outcomes in form of guidance to support a more effective management of data and knowledge within FCERM. The guidance aims to support data and knowledge management, through:

- Developing a framework for objective-led data management
- Establishing links between data and business objectives
- enabling data provenance;
- characterising data consistency, quality and appropriateness;
- providing a framework for data appraisal;
- focussing on data users and suppliers of data and their interactions; and
- improving data access and exchange

The guide follows a Philosophy-Concept-Practicalities format, through outlining the link to the overall philosophy of objective-led data management, presenting the key concepts and principles, and then outlining good practice approaches

and tools to deliver the concepts. The generic nature of this guide requires readers to carefully consider how it applies to them and how to best implement it. It sets out processes to apply rather than procedures to follow.

This document has been developed and structured to answer the basic questions of managers, users and suppliers of FCERM information, through the process of understanding the link between a business objective and the required information. From this the data and associated quality attributes required to support that process can be assessed. In particular, the guidance recognises that it is information rather than data that the business managers often require, and that data required plays a supporting role that needs to be well understood, appraised and documented. From the knowledge that business objectives underpin data requirements and management, tools are then provided that support aspects of the management of the data lifecycle.

This guidance recognises that for data to translate effectively to knowledge, there is a need for obtaining data of sufficient form and quality, as well as maximising the use of the data through ensuring awareness of the data's existence and its maximum sharing and re-use by the whole FCERM community. The good practice approaches and tools are outlined within the document and are expected to engineer a significant step-change in FCERM data and knowledge management. These benefits are likely to be limited, without a culture change towards more willingness to share data and to enable data to be shared, through better and more consistent recording of information about data.

This is a practical guide for all users, managers and suppliers of FCERM data, information and knowledge. These consist of FCERM operating bodies (Environment Agency, Local Authorities, Internal Drainage Boards, and the Water Industry), and interested organisations such as conservation and environmental bodies, government departments, commercial bodies and engineering/research bodies. While this guidance has been developed as a stand-alone document, more detailed information about the development of the principles, techniques and tools are available in the other Technical Reports outlined below:

- FD2323\TR1 – The development of the objective-led concepts and the systematic representation of the links from FCERM objectives through to data required to underpin their delivery;
- FD2323\TR2 – The development of tools to provide provenance to data, improve consistency and ability to share data;
- FD2323\TR3 – The development of a knowledge management tool to provide an interactive link between management objectives and relevant available information, and to help connect the users and suppliers of data;
- FD2323\TR4 – The development of a methodology for appraising the value of data to support business decisions on optimum data acquisition;

Acknowledgements

The research was commissioned by Defra/Environment Agency and was undertaken by Royal Haskoning. The research manager for Defra/Environment Agency was Suresh Surendran.

The project was managed by Fola Ogunyoye of Royal Haskoning. Charlie Rickard (independent consultant) was the technical reviewer. David Morris (CEFAS) was the external reviewer.

The guidance is the culmination of research (work packages) undertaken by the project team:

Royal Haskoning	Fola Ogunyoye, Andrew Robinson, Tim Burgess, Greg Guthrie
ABPmer	Claire Brown, Chris Jackson, Paul Lacey, Alun Williams
Cranfield University, Silsoe	Joe Morris, Agnieszka Romanowicz
JB Chatterton & Associates	John Chatterton
Pennine Water Group	Richard Ashley, John Blanksby, Adrian Cashman

Project Board

The research was guided by a Project Board, which comprised of the following members:

Trevor Linford	Environment Agency (Chairman)
Suresh Surendran	Environment Agency (Project Officer)
Ian Meadowcroft	Environment Agency (Project Executive)
John Goudie	Defra (Project Funders)
Shirley Greenwood	Environment Agency (FRM Policy)
Chris Hill	GeoData Institute, University of Southampton
Graham Lymbery	Sefton Metropolitan Borough Council
David Morris	CEFAS
David Palmer	Environment Agency (Data & Technology)
Bill Rodham	Environment Agency (Strategic Planning)

Contributors

Valuable guidance and material was provided at the project technical workshop at the Environment Agency's Reading office on 18 March 2005, through subsequent consultations and the user pilot trial at the Royal Haskoning Offices on 21 February 2006. The research contractor would therefore like to acknowledge the following contributors:

Ken Banfield	Anglian Water
Jackie Banks	Environment Agency
Adam Baylis	Environment Agency
Andrew Bradbury	New Forest District Council
Nick Burke	Environment Agency
Rebecca Chedderton	Environment Agency
Dave Denness	Environment Agency
Catherine Dolbear	Ordnance Survey
Earl Edwards	University of Nottingham
Jaap-Jeroen Flikweert	Royal Haskoning
Cathy Greenall	Environment Agency
Fiona Hemsley-Flint	Oxford Brookes University
Dr Peter Jones	Welsh Assembly Government
Gordon K Hutchinson	Meteorological Office
Lisa Killick	Environment Agency
Fiona Mactaggart	SNIFFER
Roger Morris	English Nature
Peter Murphy	English Heritage
Keith Nursey	Environment Agency
Robin Poole	Environment Agency
James Proctor	Environment Agency
Sarah Reid	CIRIA
Simon Tanner	Environment Agency
Paul Wisse	Sefton Metropolitan Borough Council
Patrick Woods	Royal Haskoning
David Worth	Royal Haskoning
Les Wright	King's Lynn Consortium of IDBs
Paul Wyse	Environment Agency

Contents

List of figures

List of boxes

List of tables

Abbreviations

AGI	Association for Geographical Information
BSI	British Standards Institute
Cadw	Historic environment agency within the Welsh Assembly Government
CCW	Countryside Council for Wales
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CEH	Centre for Ecology and Hydrology
CERMS	Coastal and Erosion Risk Management Strategy
CIRIA	Construction Industry Research and Information Association
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DQS	Data Quality Score
EN	English Nature
EU	European Union
FCERM	Flood and coastal erosion risk management
GIS	Geographical Information System
HLT	High Level Target
ISO	International Standards Organisation
JNC	Joint Nature Conservation
MDB	Metadatabase
NFU	National Farmers Union
NPD	National Property Dataset
NRP	Non-Residential Properties
ODPM	Office of the Deputy Prime Minister
PVd	Present Value of damages
RSPB	Royal Society for the Protection of Birds
SDA	Service Delivery Agreement
UKHO	United Kingdom Hydrographic Office
WAG	Welsh Assembly Government
XML	eXtensible Mark-up Language

1 About this guide

1.1 Introduction

The success of integrated flood and coastal erosion risk management (FCERM) is underpinned by the use of good data, information and knowledge management. This document aims to support users, managers and suppliers of FCERM data and information with the ability to access and manage FCERM data in such a way that it is efficient, avoids repetition and redundancies, and maximises the use of appropriate supporting tools and technology.

This guidance is the culmination of an R&D project (FD2323) within the joint Defra/ Environment Agency programme with the overall objective of improving data and knowledge management within FCERM. The need for this project was identified within a preceding project within the joint R&D programme 'A Position Review of Data and Information Issues within Flood and Coastal Defence' (FD2314). It highlighted that significant opportunities exist to improve the flood and coastal erosion risk management through better management of the data management life cycle and its interactions.

These recommendations, and building on other initiatives such as the Environment Agency's Data Management Strategy, form the basis for this R&D project FD2323 to improve data and knowledge management for effective integrated FCERM within England & Wales. Details of the individual work packages are provided in Section 1.4.

1.2 Purpose and scope

The guidance promotes a framework which will assist FCERM managers to assess their data needs and maximise the knowledge available on associated information. This will enable improved efficiencies in sourcing and management of information they require to carry out their business. The framework embraces a culture change to a more "objective-led data and information management", where the need for and management of data is driven by an understanding of the management objectives. Within this approach, data is used to provide underpinning information for decision making and not to drive the process. The guidance is aimed at the achievement of this culture change with the provision of tools to support the change.

The guidance aims to make a significant step change in the awareness and knowledge about improved FCERM information management through the development of new tools to plug the critical knowledge and application gaps.

The scope of the guidance is the coverage of FCERM, which includes coastal, estuarine, fluvial and pluvial flood risk as well as coastal erosion.

1.3 Readership and using this guide

Although the research was commissioned by Defra and the Environment Agency, the target audience of the guide is far wider reaching. The guide is aimed at users, managers and suppliers of data, information and knowledge related to the FCERM community (in England and Wales). These consist of FCERM operating bodies (Environment Agency, Local Authorities, Internal Drainage Boards, and Water Industry Companies), and other relevant organisations such as environmental bodies (Cadw, Countryside Council for Wales, English Heritage, English Nature, Forestry Commission, Joint Nature Conservation, National Trust, RSPB), government departments (Defra, Department of Transport, ODPM, the Crown and Defence Estates) and commercial engineering and research bodies.

The research contractor, Royal Haskoning, realises that readers coming to this document want answers to questions sometimes of a general nature and at other times on particular issues. With this in mind, Figure 1.3.1 has been created to direct the reader to the relevant chapters where particular questions are addressed. While the diagram allows readers to dip into the guidance, it has also been designed to encourage readers to seek answers to questions they may not have foreseen, thus making them more aware of the bigger picture.

The guide has been put together following a logical Philosophy-Concept-Practicalities route. First the reasons for the approach and concept are explained (Philosophy). Then the principles of the approach – manner to address the problem - are set out (Concept). Subsequently means and tools to put the concept into practice are described (practicalities). The focus and size of the guide ensures that all users, managers and suppliers of FCERM data should benefit from all aspects of it.

Chapter 2 of the guide outlines the fundamental principles of the guide, explaining the “why do it this way” and how to rationally characterise the FCERM system to start the objective-led process. The chapter is purposefully short and succinct to encourage every reader to read it since it contains the underlying thinking for the rest of the chapters.

The method of identifying and mapping data needs for FCERM is laid out in Chapter 3 by considering FCERM legislation and associated strategies. Data justification (Section 3.2) acknowledges the concept that there is a basic standard (quality) of data required to fulfil each FCERM role and it is essential for the integrity of the FCERM industry. So data beyond this level of quality requires justification. Then a data appraisal framework is presented, applying appraisal principles, to improve the targeting of resources in optimising data and maximise the use of data and benefits deprivable from it.

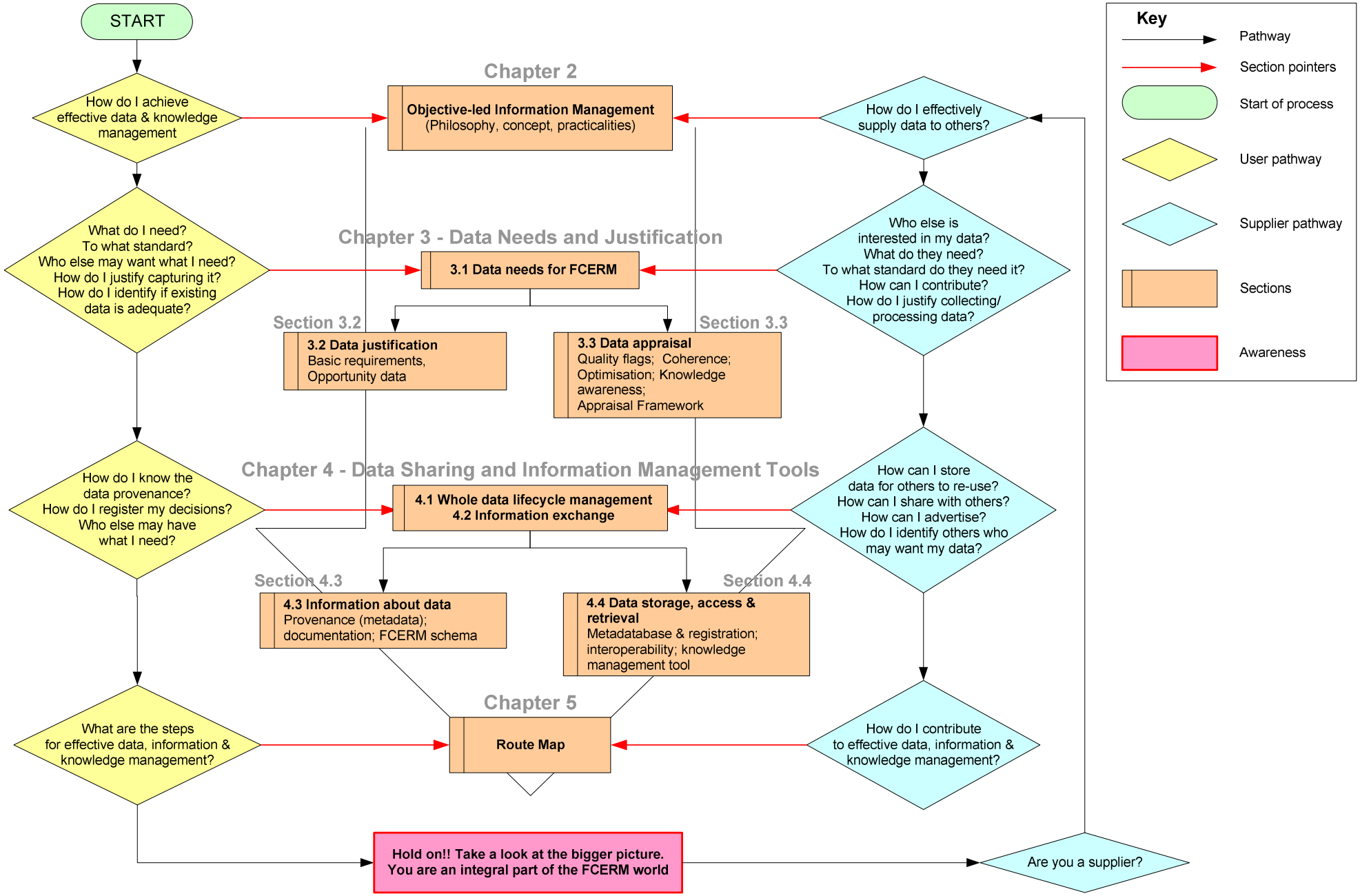


Figure 1.3.1 Pathway to using Guidance

In recognising the inefficiencies within the data lifecycle and the knock on effects, tools are outlined in Chapter 4 to improve data sharing and knowledge management. Section 4.2 illustrates the exchange of data and information and relationships between organisations in the FCERM community. With this understanding of the data and information involved in FCERM, an appropriate tool (metadata) has been identified to improve the ability to share data, which also provides provenance to data. Section 4.3 outlines the metadata standard suitable to capture all data types resulting from work, studies and surveys carried out within the FCERM industry. Procedures to manage the creation and maintenance of metadata are also set out that improve data storage (Section 4.4). Options to improve data access and advertising are illustrated. Elements of the objective-led approach have been brought together in the form of a tool with features to improve knowledge management, such as the retrieval of relevant FCERM data and information from the plethora of sources.

1.4 Origin of guide

The guide is the culmination of research studies (Work Packages) within the FD2323 project. Work Package 1 forms the foundations for the development of the other studies and the guidance. Details of the packages are summarised below and also the relationships to each other are illustrated in Figure 1.4.1.

- Work Package 1 – The development of an 'ontology' to provide a systematic representation of the links from FCERM objectives through to data required to underpin their delivery and the associated information exchange network;
- Work Package 2 – The development of an ISO 19115 compatible metadata standard for FCERM, and its management through an ISO 19135 compatible format;
- Work Package 3 – The development of a knowledge management tool to support the ontology by providing an interactive link between management objectives, tasks within these and relevant available information;
- Work Package 4 – The development of a methodology for appraising the value of data to support business decisions; and
- Work Package 5 – this guidance document

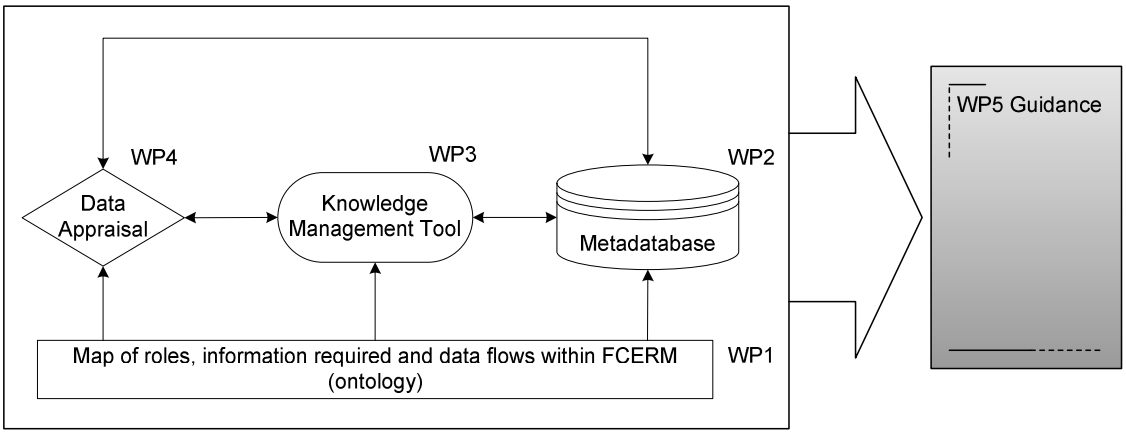


Figure 1.4.1 Overview of FD2323 Work Packages and links

In addition to outlining the good knowledge and practice developed within this project, this guidance document also includes good practices identified from the literature review and links with other ongoing projects/initiatives.

Methodologies and tools developed within the FD2323 project were tested with case studies and piloted with representatives of the user community to assess their practicality. Significant issues identified are highlighted within this guide.

The outputs of the overall FD2323 project will improve the use of data for knowledge management as it will be underpinned by an understanding of the providers, users and those responsible for management of data at all levels. Specific benefits are summarised below:

1. The developed ontology for information management will greatly improve the knowledge about information, its sources, responsibilities and structure of its management. It will provide a clear link between objectives and the data required to support it and the flow/exchange of that data. This clearly has the potential to bring efficiencies and improved links between FCERM data and knowledge management as it allows whole life sourcing and management of data to be underpinned by the required use. This will allow improved accessibility and use for improvement of FCERM, including the identification of structures and information exchange needs. The FCERM ontology is developed in Technical Report 1 (FD2323\TR1).

2. The metadata standard and management systems will provide an opportunity for improved consistency and quality of flood and coastal risk information. In addition, they are practical tools that can be used by the whole of the industry. The use and management of common standards relevant to FCERM data will enable data provenance and improved sharing of data within and across the FCERM industry. The development of the FCERM metadata standard and its management can be found in Technical Report 2 (FD2323\TR2). A prototype metadatabase for FCERM can be obtained on a CD from the Defra project officer.

3. The information management tool will provide the ability to maximise the benefits of the ontology and to easily link, share and reference FCERM information and associated data availability and relevance to particular objectives. This will allow improved scope for efficiency of data collection, management and exchange/sharing. Technical Report 3 (FD2323\TR3) details the development of the information management methodology. A proof of concept tool for FCERM developed and successfully tested within this study. can be obtained on a CD from the Defra project officer.

4. The appraisal tool will provide framework for valuing and appraising data and its management through a logical and transparent methodology. The framework has been tested with case examples and is ready for further development into a decision support tool. The framework has been tested with case examples and is ready for further development into a decision support tool. This will be invaluable in supporting decisions about data management by providing opportunity to appraise data and target overall

investment to areas of best value. Practices of data appraisal and justification are researched in Technical Report 4 (FD2323\TR4) as well as the appraisal tool and data quality flagging.

While this document has been written as a stand alone guide, reports of the other work packages are referenced within the guide to allow readers to delve deeper if they wish on particular aspects. Readers are also signposted as necessary to other documents where useful additional information is contained.

2 Objective–led Information Management

2.1 Current data management

Within data management, the adoption of five principles are recommended by CIRIA C541 (2000) and Defra FD2314 (2004e). These are based on principles adopted by British Standards Institute (BSI) for the management of electronic documents (Mayon-White and Dyer, 1997). The five principles for good data management are illustrated in Figure 2.1.1. They are technologically and politically independent to ensure longevity.

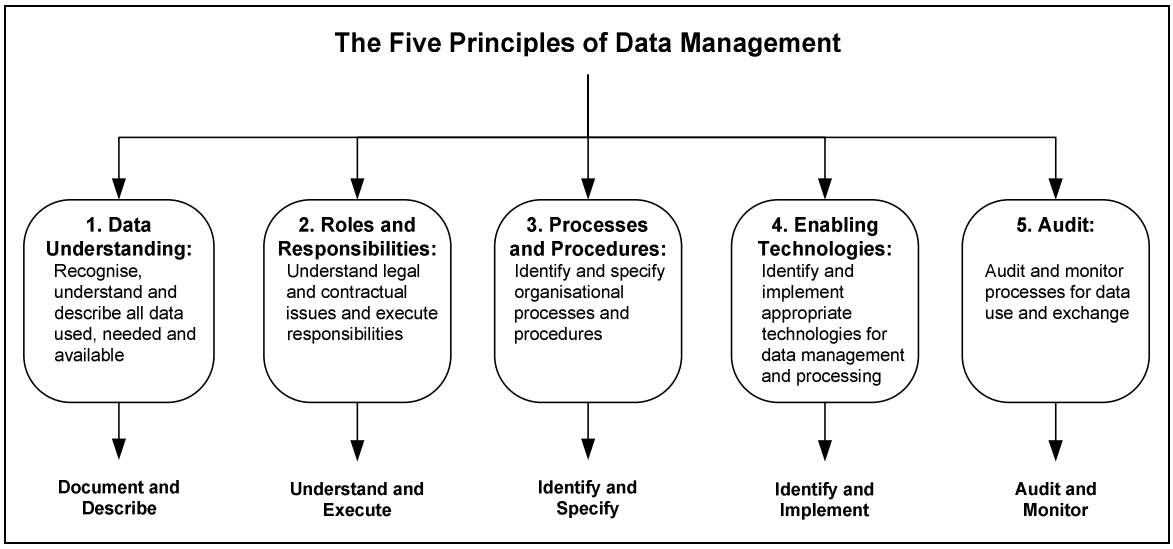


Figure 2.1.1 Five principles of data management (Mayon-White and Dyer, 1997)

These principles are pointers on how to manage the data lifecycle, Figure 2.1.2. Once data is collected/recorded (Creation) then it is stored (Storage) for a particular purpose. This data might be improved with better data (Update). It can also be retrieved (Access) for other purposes and stored (Retention) elsewhere. Alternatively the data could be retained/archived (Retention) but may be recovered (Access) later. The last stage is where data is destroyed (Deletion).

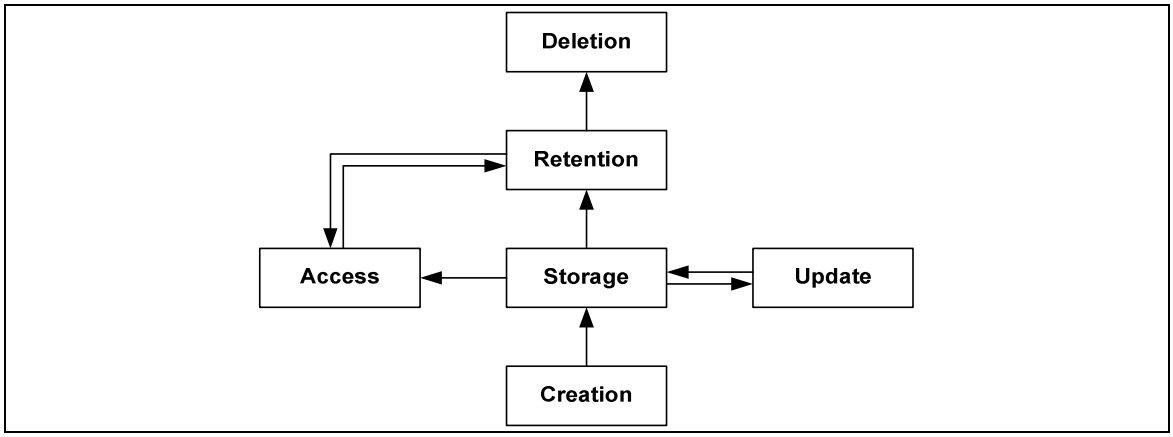


Figure 2.1.2 Data lifecycle

It has been noted in the past that "effective data management is the cornerstone to derive maximum value from data" (CIRIA 2000, Environment Agency, 2002). However, an approach which first focuses on data collection, then tries to find a purpose or use for the data afterwards is essentially data-centric. This approach does not provide maximum value to business knowledge and limited performance will be derived from the associated data and information. This lack of focus on the overall business objectives is limiting the value obtainable from the available data. Examples of these inefficiencies are outlined in Box 2.1.1.

The following are a few examples of inefficiencies due to poor data and knowledge management. Specific place names and data have been obscured to protect the identity and integrity of organisations.

1. At the site of an estuary there have been 4 major flood risk mapping studies in the space of 3 years. The local city council commissioned a strategic flood risk assessment. Two different offices of an operating authority commissioned two separate modelling studies. A maritime organisation produced another modelling study. All these studies were carried out independently of each other and yet needed of the same types of data. The lack of knowledge of others' business needs and data synergies has meant a duplication of data and lost opportunities to reduce costs.

2. A review of the probable maximum flood was required for a flood storage reservoir in a heavily urbanised town. Data and information on the catchment were located in disparate sources. Records did not show the origin of certain details and background on the catchment and associated urban watercourses. Consequently assumptions were made in the analysis. Calculations showed that the spillway was unable to safely pass the flow therefore corrective works are required. If the risk has been overestimated then unnecessary works have been carried out and funding could have been allocated elsewhere. If, however, the risk has been underestimated then the community downstream of the reservoir is still at risk.

3. Analysing the standard of a sea wall required an understanding of the surge element. A search revealed that a sea level record existed for the site and so was requested. It was only when the record was obtained that it was found to be inadequate. If it was known that the record had gaps, then alternative data could have been sourced and time saved.

Box 2.1.1 Examples of inefficiencies in data management

The lack of a proper framework onto which data collection and management can be hung is the missing link that continues to prevent effective use of data, and the maximisation of knowledge obtainable from the information it provides.

CIRIA C541 guide focused on maximising the use and exchange of coastal data. It defined terminology of data (extracts in Box 2.1.2). It also importantly recognised that information and data can, physically, be the same, but it is the context that defines its value.

Data	Representations or analogues, often numeric, of phenomena
Information	Data that can be directly interpreted for decision-making or management purposes.
Knowledge	Understanding, achieved through the result of using information.

Box 2.1.2 The language of data (extracts from CIRIA, 2000)

Taking this a step further, this guidance recognises that the context is defined by the objective of the decision maker. Therefore maximum value can be derived by focusing on achieving the objective and the role of data in supporting this, rather than focusing on the data, as illustrated in Box 2.1.3.

Data is what is collected or measured; and in this sense is individual, relates to an individual attribute: for example beach level, water level, land level or bird count. It has no identity beyond the attribute upon which it is focused. It is not specifically referenced to any other data and by itself means nothing. That a structure is at +3m ODN, on its own has no value. It is only in combination with other data, creating a data set, that specific data has use. The structure is at +3m, the mean high water spring (MHWS) tide level is +3.5m ODN. Information is created that the structure is below the MHWS tide level. The information is that there is a risk of the structure being overtopped.

Knowledge comes from understanding this information. That there are defences and that therefore the level of risk is limited; that such and such water level is of such and such a probability and that the actual risk is that what ever the loading on it; the structure is disused and the implication of it being overtopped is irrelevant.

Box 2.1.3 Data, information and knowledge from an objective

To make a significant step change in this area there is a need for a culture change from ‘a data centric focus’ to ‘an objective led information management,’ within which the requirements for data and its management is developed.

The objective-led approach sets the context for the data lifecycle and its management (using the BSI adopted five data management principles), thereby optimising the value of data, information and knowledge. The need for and management of data is driven by an understanding of management objectives, as illustrated in Figure 2.1.3, rather than data driving the process. The data lifecycle and its management principles lie within “Data” in Figure 2.1.3

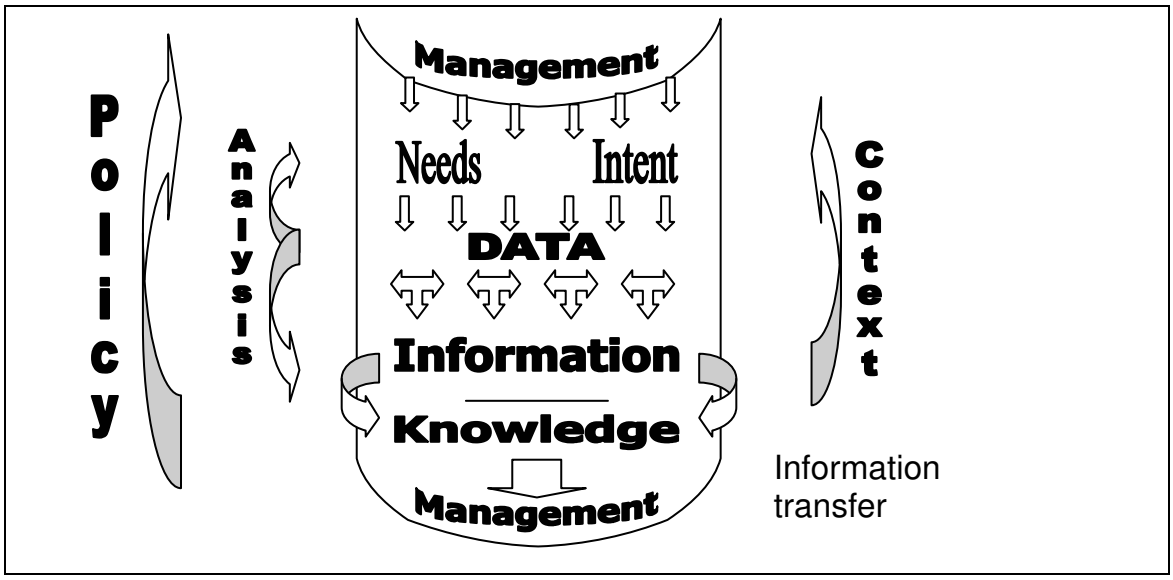


Figure 2.1.3 Conceptualisation of objective-led data, information and knowledge management

2.2 Objective-led information management principles

Objective-led information management focuses on the purpose and reasons for the management of data and information. By understanding the context then the data lifecycle aspects can be made more effective and efficient; knowing the reason results in better targeting of resources and better defined data and information requirements.

The objective-led approach facilitates:

- Assessment of data needs required to fulfil a business objective; and
- Knowledge of improving efficiencies in sourcing and management of information required to carry out the business

The principles to achieve these are:

- An understanding of the needs for the data and other stakeholders (within and outside FCERM) who may also need/use the data. (Sections 3.1 and 4.2)
- An understanding of the information and associated quality to support the objectives/needs and so the data needed to produce the required information (Section 3.1)
- The development and optimisation of data needs and management based on the above (Section 3.3)
- The improvement of consistency of data documentation and management to enable improved access/sharing (Section 5.1)
- Enabling data provenance through easy access to relevant information about data and its attributes to improve assessment of its utility (Section 5.2)
- The improvement in access to relevant information on available data to maximise its use and wider efficiency of FCERM (Section 5.2)

2.3 Application to the FCERM system

In order to apply the principles of objective-led information management in FCERM, it is necessary first to employ a tool/technique, termed ontology (see Box 2.3.1 for definition). Ontology dissects data, information and knowledge management in FCERM into concepts, rules and relations.

A widely recognised interpretation of ontology is,

> 'A formal explicit specification of a shared conceptualisation of a domain of interest,' (Gruber, 1993).

In other words, reality (domain of interest) is dissected into concepts, relations and rules, which are agreed between knowledge users.

Further details on the origin and evolution of ontology can be found in FD2323/TR1.

Box 2.3.1 Definition of Ontology

Competency questions (Noy and McGuiness, 2003) define and limit the scope of ontology:

- What is the domain that the ontology will cover?
- For what are we going to use the ontology?
- For what type of questions should the information in the ontology provide answers?

Ontology for FCERM data, information and knowledge management considers the following issues (concepts):

1. Why do we/others need data/information?
2. Who needs it?
3. What do we/others need?
4. Where does it come from?
5. How is it exchanged and transferred?
6. How is it stored?
7. To what standard is it available?

Then relationships between the concepts can be systematically represented to:

- Identify the organisations with a FCERM remit (Section 3.1)
- Identify the data required to produce the required information to secure the delivery of the FCERM remit (Section 3.1)
- Identify the standard of data needs (Section 3.2)
- Identify the development and optimisation of data needs (Section 3.3)
- Understand and map the information exchange between organisations (Section 4.2)
- Identify data documentation and sharing (Section 4.3)
- Identify data and information access and management (Section 4.4)

This page is purposefully blank

3 Data needs and justification

3.1 Data needs for FCERM

3.1.1 Drivers and responsibilities

The context, in this case, is the improvement of Flood and Coastal Erosion Risk Management (FCERM). It involves the management and reduction of risk to people, property and environment, while also encouraging sustainable development. This risk in FCERM can be considered as four areas (estuarine and coastal, inland watercourses, rural land management and urban environment) whose boundaries overlap each other in differing degrees. For further details on these areas refer to Section 3 in FD2323/TR1.

Management of these areas in England and Wales are governed by legislation and policies imposed by the UK Government and European Union, whereby duties, powers and responsibilities are ascribed to particular organisations, see Table 3.1.1. Legislation can be considered as either a direct or an indirect driver for FCERM data, information and knowledge. Direct drivers specifically address FCERM issues and include the following:

- Coast Protection Act 1949;
- Local Government Act 1972;
- Reservoirs Act 1975;
- Highways Act 1980;
- Water Act 1989 and 2003;
- Land Drainage Acts 1991 and 1994;
- Water Industry Act 1991;
- Water Resources Act 1991;
- Environment Act 1995;

Indirect drivers do not necessarily relate to FCERM issues but have implications for it and will exert an influence on the nature of knowledge required and hence data and information needs to provide this knowledge. These include:

- Habitats Directive (1992)
- Water Framework Directive 2000/60/EC
- European Directive 2001/42/EC (commonly known as the Strategic Environmental Assessment Directive)
- Bathing Water Directive

The frameworks for FCERM in England and Wales are established in the form of policies set by UK Government departments and the Welsh Assembly Government (WAG) respectively. The main departments involved in England are:

- the Department for Environment, Food and Rural Affairs (Defra)
- the Office of the Deputy Prime Minister (ODPM)

Policy for flood and coastal defence is determined by Defra, including setting policy aims, objectives and targets for the operating authorities, providing guidance, funding a Research and Development programme and grant aiding eligible works. The most significant piece of strategic guidance from Defra for FCERM over the next 20 years is Making Space for Water. A Delivery Plan (Defra, 2005a) has been published setting out the strategic direction to implement the outcomes of the Government's 'First Response to *Making Space For Water*, taking the new strategy forward' (Defra, 2005b). The strategy aim and approach are presented in Box 3.1.1. WAG intends to make a similar strategy for flood and coastal defence for Wales.

Making Space for Water strategy aim is,

'To manage the risks from flooding and coastal erosion by employing an integrated portfolio of approaches which reflect both national and local priorities, so as:

- to reduce the threat to people and their property; and
- to deliver the greatest environmental, social and economic benefit, consistent with the Government's sustainable development principles

To secure efficient and reliable funding mechanisms that deliver the levels of investment required to achieve the vision of this strategy' (Defra, 2005b).

The approach will,

'involve taking account of all sources of flooding, embedding flood and coastal risk management across a range of Government policies, and reflecting other relevant Government policies and operations of flood and coastal erosion risk management' (Defra, March 2005).

Box 3.1.1 Defra's Making Space for Water strategy aim and approach

The cross government nature of the strategy's Delivery Plan signifies an increase in the involvement of other government departments, in particular DfT and ODPM. Defra are also working closely with HM Treasury to consider the resource implications of the proposed direction of travel and possible other sources of funding.

ODPM is responsible for setting policy on development (land-use) planning and the Town and Country planning system. Defra and ODPM work together to establish a coherent policy on development and flood risk. Planning Policy Statement 25 (PPS25) from ODPM also denotes that it will be influential when it supersedes Planning Policy Guidance 25 on 'Development and Flood Risk' in April 2006 with a more strategic approach. WAG published a similar policy, Technical Advice Note 15 (TAN15) on 'Development and Flood Risk' in 2004.

In order to secure the delivery of FCERM strategy objectives, Defra also sets out High Level Targets (HLTs) and Service Delivery Agreements (SDAs). Details of these can be found on the Defra website as well as in FD2323/TR1 (Defra, 2006). Some superseded HLTs have been absorbed into authorities' corporate plans.

The delivery of FCERM is carried out by operating authorities who have powers to make or maintain works for the drainage of land, notably the Environment Agency, Local Authorities and Internal Drainage Boards. The Environment Agency manages flood risk through its Regional and Local Flood Defence Committees. The government is working towards the Environment Agency taking an overarching strategic role across all forms of flooding and coastal erosion risks, in order to facilitate a holistic approach that is risk-driven (Defra, 2005a). Following on with the philosophy of MSFW, in terms of considering all forms of flooding, other organisations already play a role in FCERM, such as water service providers and water sewage companies, collectively called the Water Industry, which is regulated by the Water Services Regulatory Authority.

Table 3.1.1 summarises the organisations with FCERM responsibilities and the associated legislation, policies and targets (collectively referenced as drivers). Riparian land owners/occupiers have limited responsibilities according to case law to take reasonable action to maintain watercourses and accept flow. They are also allowed to protect their properties from flooding but not to the detriment of others. Further details of the duties and powers transferred by the drivers can be found in FD2323/TR1 (Defra, 2006).

The review in FD2323\TR1 identified grey areas within FCERM where formal frameworks do not exist. These relate, in particular, to rural land use management and its generation of flooding, as well as pluvial flooding in rural and urban areas. Appropriate frameworks are expected to be developed, under the MSFW programme, assigning responsibilities and so data needs. Existing data and new data being created in these fields will need to be managed in an effective manner to support the delivery of the eventual framework. This can be achieved following the philosophy, concept and practicalities in Section 4 on data sharing and information management tools.

Table 3.1.1 Organisations with FCERM responsibilities

Organisation	FCERM Responsibilities	Driver (s)
Environment Agency	Duty to exercise a general supervision for all matters relating to flood defence Includes granting approvals and payment of grant for capital schemes undertaken by Local Authorities and Internal Drainage Boards	Environment Act 1995 Water Resources Act 1991 Land Drainage Act 1991
	Develop policies and regulate activities alongside, in, on and over watercourses/coast. Also discourage inappropriate developments in floodplains. Report to Defra and ODPM on development plans and their response to planning applications on flood risk grounds	PPS 25 (superseding PPG25) TAN 15 High Level Target 5
	Empowered to maintain, operate and improve existing flood defences including construct new works, drainage consents and emergency flood response	Environment Agency Corporate Plan Water Resources Act 1991
	Duty to carry out surveys of areas where it carries out flood defence functions and to copy the results to Local Planning Authorities to inform development planning and their development control functions	Water Resources Act 1991 DoE Circular 30/92
	Empowered to provide flood warning service	Environment Agency Corporate Plan Water Resources Act 1991
Local Authority	Power to incur expenditure to avert, alleviate or eradicate the effects or potential effects of any emergency disaster	Local Government Act 1972
	Permissive power to carry out coast protection works to protect against erosion and encroachment from the sea	Coast Protection Act 1949
	Powers to make or maintain works for drainage of land and provide prevention, mitigation and remedy flood damage including risk from sea flooding	Land Drainage Act 1991 and 1994
	Control development both in the floodplain, where it may be directly affected by flooding or affect flooding elsewhere, and elsewhere in river catchments, where changes in runoff characteristics may increase flooding downstream	PPS 25 (superseding PPG25) TAN 15
	Empowered to prevent the occurrence of an emergency and reduce, control or mitigate the effects of an emergency. Co-ordinate emergency plans of local bodies responding to major flood emergencies	Civil Contingency Act 2004 Land Drainage Act 2004 High Level Target 1
	Empowered, as the Highway Authority, to construct, maintain or cleanse drainage systems in the highway or on adjoining/nearby land, for the purpose of drainage or prevention of surface water on the highway	Highways Act 1980
Internal Drainage Board	Duty to exercise a general supervision for all matters relating to drainage in their districts	Land Drainage Act 1991 and 1994
	Empowered to undertake works (maintain, operate and improve flood defences) to secure drainage within their districts	Land Drainage Act 1991 and 1994
	In conjunction with the Environment Agency, respond to flood emergencies and participate, where necessary, in exercises to develop and test emergency response procedures in their districts	High Level Target 1

Table 3.1.1 Organisations with FCERM responsibilities (cont.)

Organisation	FCERM Responsibilities	Driver (s)
Water Industry (includes water service providers and water sewage companies)	Provide, improve and extend such a system of public sewers (whether inside its area or elsewhere) so to cleanse and maintain those sewers as to ensure that the area is and continues to be effectively drained (without causing flooding)	Water Industry Act 1991 Water Act 1989
	Minimise the impact of developments on existing sewer system	Water Industry Act 1991
	Management of upland water storage and abstractions with influence on flooding	Reservoir Act 1975
Water Services Regulatory Authority (formerly OFWAT)	Powers to enforce water industry to carry out their responsibilities under the Water industry Act 1991	Water Act 1999 and 2003

3.1.2 Derivation of FCERM data needs

Following the objective-led approach, one needs to understand the links from the overall objectives and drivers through to data required to fulfil them. The process to achieve this is described below and illustrated in Figure 3.1.1.

First the context and FCERM responsibilities (business objectives) of an organisation are identified, and then activities (and sub-activities as necessary) to achieve the objectives are set out. The activities and sub-activities are made up of different tasks. Within these tasks, information is required to carry out the tasks. Consequently, the data required can be derived from knowing the required information.

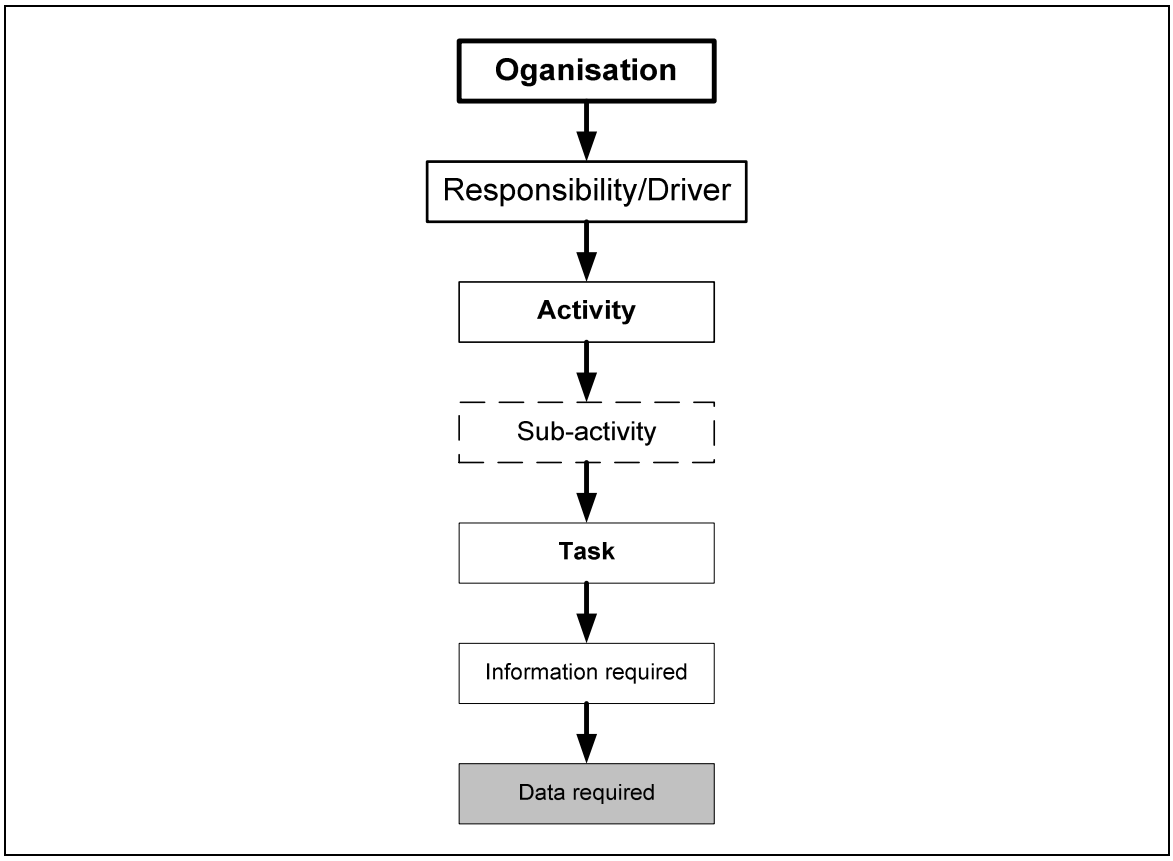


Figure 3.1.1 Objective-led flow chart to determine information and data requirements

The links are developed for the FCERM industry to a certain extent within FD2323/TR1, where the general format follows the style in Figure 3.1.2. Charts developed for key FCERM authorities are provided in Appendix A. In order to link up FCERM sub-activities and tasks to the charts, there is a need to develop further detailed links for each business area. The charts in Appendix A provide a starting point.

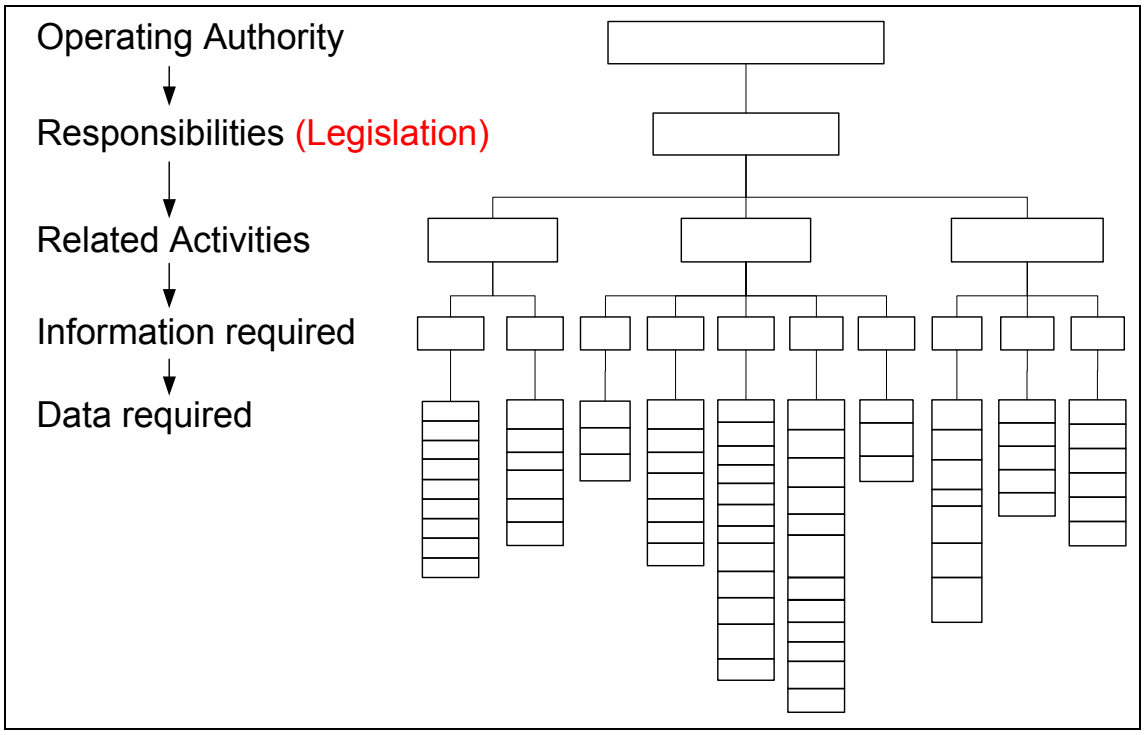
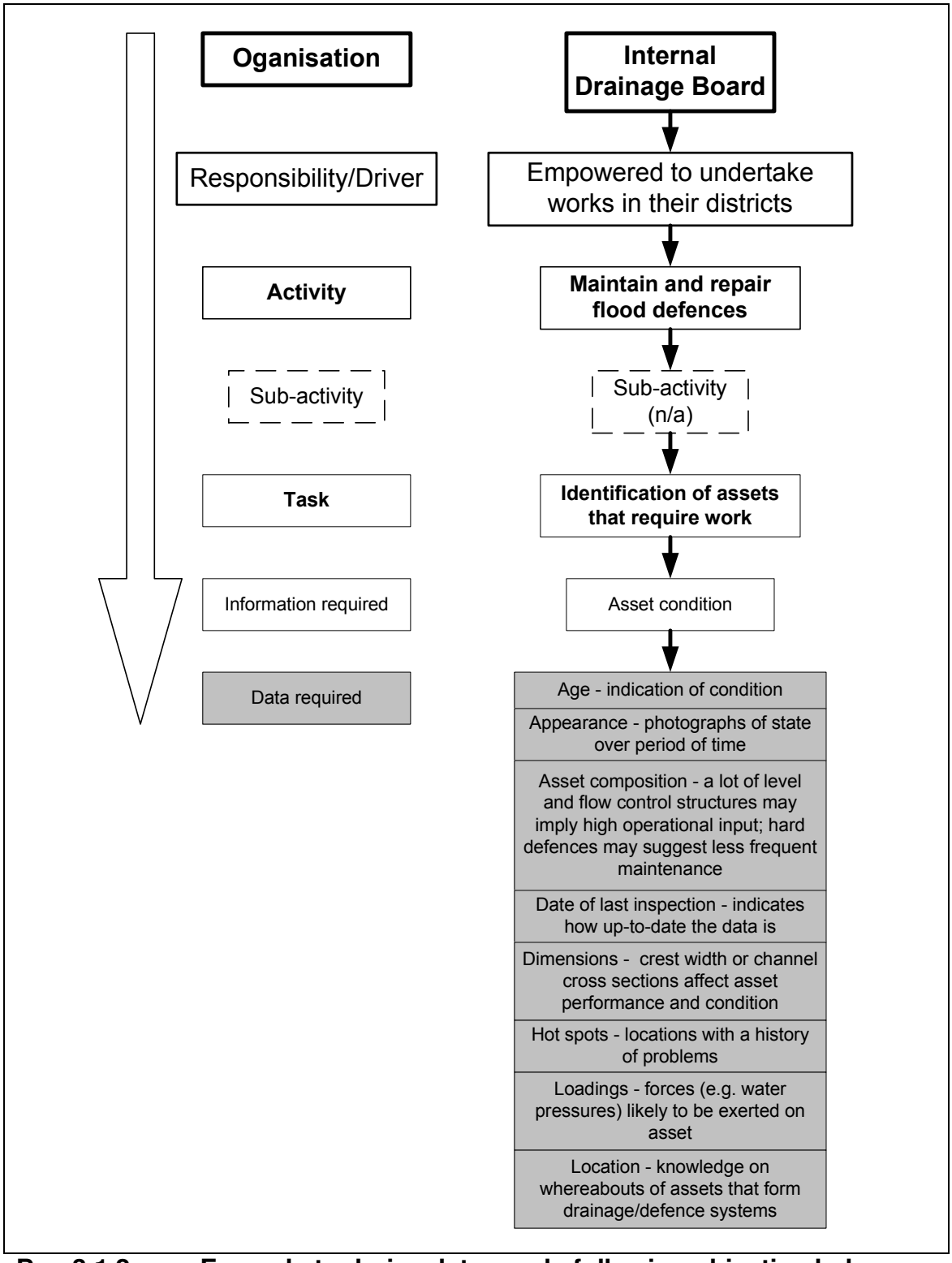


Figure 3.1.2 Objective-led process employed to identify information and data needs

An example is followed through in Box 3.1.2 for an Internal Drainage Board to derive data needs following the process.

It is important to note that some responsibilities have not been allocated, clearly defined or integrated yet. These areas generally relate to current or future issues such as urban drainage, pluvial flooding, muddy flooding and groundwater flooding. Operating authorities and the government tend to sponsor or contract research to improve understanding and also to fulfil their own FCERM responsibilities. So it is possible to trace back the business objectives for such areas even when explicit legislation does not exist.



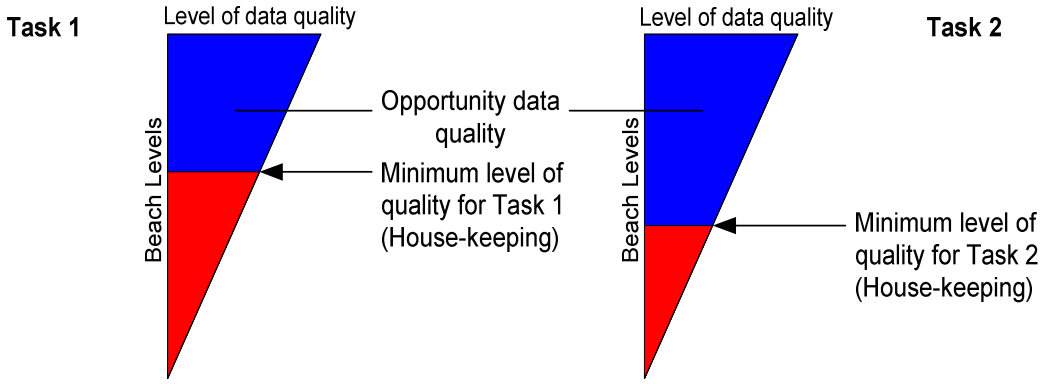
Box 3.1.2 Example to derive data needs following objective-led process

3.2 Data justification

For every FCERM business role, a task is performed that requires a minimum level of data quality to make an informed and intelligent decision. This level of data quality is termed House-keeping data and its need is justified by the requirement to competently carry out a FCERM business role. House-keeping data is not only fundamental for the task, but also for the wider FCERM business. The risk of not having this core data will affect the ability to manage the business and ultimately the integrity of the FCERM business. The minimum required quality differs between tasks, as illustrated in Box 3.2.1. Data beyond this House-keeping level is known as Opportunity data that enriches and improves business decisions. As this is in addition to House-keeping data, its collection requires justification.

Task 1: Managing a sea defence wall requires information on the variability of the beach in front of the wall. Therefore beach levels are required, among other data such as waves and water levels. In this case, beach levels might be required every 50m and taken every 3 months (House-keeping data).

Task 2: Strategic planning of a coastal sub-cell requires an understanding of the sediment system, not just the area of the sea wall, and so beach levels are required among other data such as waves and water levels. As a minimum necessary level, annual topographic data might be required less frequently spatially (every 100m), with a greater spatial coverage (House-keeping data).



NB In this case quality is being judged on frequency

Box 3.2.1 Examples of different levels of House-keeping data

In applying the concept of House-keeping and Opportunity data, it is important that a collective understanding and agreement of house-keeping data for each business activity is developed. This, when used with the principles of data appraisal (Section 3.3), will help reduce duplication of efforts on data gathering. It will also focus justification effort only on collection of optimum opportunity data.

The quality of data (or dataset) is described by its associated attributes that define its provenance. Knowledge of the data attributes allows a judgement on its appropriateness for a task. The attributes considered as the most useful and important for the FCERM business are highlighted in Box 3. 3.1.

Accuracy	description of the method/technique used to collect and analyse the data and associated quality procedures. It is defined as the closeness to reality (CIRIA C541, 2000).
Age	reveals how old the data is.
Competence	relates to the skill of the data's originator. Data collected or processed by a trained and experienced person conveys more confidence in its use than if carried out by an inexperienced or untrained person.
	Where the quality of datasets is being considered additional attributes are involved, including:
Temporal duration	description of length of series of repeated data records
Spatial coverage	description of the extent of data. It indicates the completeness of data.
Spatial resolution	description of the frequency of recording data in space (i.e. how dense is the data coverage. This can be vertically or horizontally.
Temporal resolution	description of the frequency of recording data over time, such as hourly, daily, monthly or annually.

Box 3.3.1. Important data attributes for the FCERM business

Data quality scores can be assigned to some of the attributes to aid the decision on whether existing data is 'fit for purpose'. These are described in the following sub-section. Also Section 4 advises on the use of metadata to record the attributes of the data thus providing provenance on the data and providing relevant information about data existence or quality to others who may wish to use the data.

3.3 Data appraisal

Since resources (money, staff and time) are not unlimited in many cases, it is important to seek efficiencies when obtaining, collecting and improving House-keeping and Opportunity data. Decisions to allocate or focus resources on particular data will invariably take away resources from another area. In order to reach an informed decision, it is necessary to consider the following principles:

- Data quality;
- Data coherence;
- Data optimisation;
- Data knowledge awareness;
- Data appraisal methodology.

Once an understanding of these is gained, an appraisal of the data can be carried out. An appraisal framework has been developed (Section 3.3.6) that incorporates these principles and the objective-led approach. Further details on the principles and practices can be found in FD2323/TR4.

3.3.1 Data quality

While the quality attributes reside with the data, it is the objective or purpose for which the data is required that determines its value and whether or not it is of sufficient quality i.e. its fitness for purpose as illustrated in Box 3.3.2.

Considering an urban watercourse and its area benefiting from defences (ABD), an engineer wants to know the extent of flood inundation for a particular flow scenario once the floodwalls are overtopped. LiDAR is available for the area, which has a vertical accuracy of +/- 25mm and a spatial resolution of measurements made every 2 metres. This is of sufficient quality for the mapping of the floodwaters.

Considering the same site, however, the engineer needs to know at what level water will start to overtop the floodwalls. LiDAR's vertical accuracy is too variable and also its spatial resolution is not fine enough to capture the floodwall levels and any low points. For this purpose, a more detailed survey of the floodwall is necessary.

Box 3.3.2 Examples of data fitness for purpose

As part of the appraisal process, it is necessary to assess if existing data is suitable for use otherwise data might be duplicated and resources needlessly expended. Also while waiting for data to be improved, existing data may be suitable for particular tasks to gain an initial understanding. Knowledge of the data quality (attributes and properties of data) aids this judgement. Similarly knowledge of the origin (provenance) of data also imparts confidence in its use. Not knowing the quality of data reduces its value and makes decision-making more risky. At worst, incorrect decisions may be made on the basis of invalid data. The use of metadata to record the attributes of data, gives information on the data to potential users. A metadata standard for FCERM data is presented and explained in Section 4.3.

A process called data quality flagging should be employed where scores are assigned to particular data attributes that help indicate if data is 'fit for purpose'. When used with a knowledge management tool (Section 4.4) the scoring of data can help to rank and so filter data, ensuring that only information on relevant data is obtained. Data quality scores can also aid the process of data optimisation (see Sub-section 3.3).

In order to minimise the scope for subjectivity in assigning a value to data, the number of categories within a flag should ideally be three but no more than five. Recommended scores and further elaborations are shown in Box 3.3.3.

It should be noted that these quality flags are there to indicate a level of quality attribute. By no means do they indicate the quality of a data or dataset, as this is dependent on the required objective of the user and therefore is user defined. It only helps to characterise the data provenance and hence allow the user to compare available quality attributes to their required quality.

Accuracy
Accuracy scores can relate to the technique in either collecting the data or analysing the data. A descriptive set of values, such as ones in the table below (developed by J.B. Chatterton Associates and Haskoning), are more self-explanatory than High, Medium Low descriptions.

DQS	Description	Explanation
1	'Best of Breed'	No better available, unlikely to be improved on in near future
2	Data with known deficiencies	Data should be replaced as soon as improvements are made
3	Gross assumptions	Not made up but deduced by the project team from experience or related literature/data sources
4	Heroic assumptions	No data sources available or yet found

Age
The scoring bands for age may vary depending on the data, however, data older than 3 years could be considered out of date and beyond its prime. Suggested bandings are below.

DQS	Description
1	< 5 years
2	5 – 15 years
3	15 – 50 years
4	> 50 years

Competence
Competence scores relate to the skill of the data's author. Data collected or processed by an experienced person has more value than if an inexperienced person collected it, even if a 'Best of Breed' technique had been employed. Although most operating bodies and contractors should be competent, it is important to record and know. Proposed categories are listed below.

DQS	Description	Explanation
1	High	Experienced and trained
2	Medium	Experienced only/ Trained only
3	Low	Neither experience nor training

Temporal duration
This attribute only shows its value when describing monitored data such as water levels, beach profiles, waves and rainfall. The greater the length of the record, the more likely that trends/patterns can be observed or carry out more accurate extreme analysis. For example, having a 30 year record of river water levels gives more confidence in calculating a 100 year flood level than a short record of 5 years. Suggested scores are given below.

DQS	Description
1	> 50 years
2	15 – 50 years
3	5 – 15 years
4	< 5 years

It is difficult to assign scores to spatial coverage/resolution or temporal resolution as there are too many units to sensibly create scores consisting of less than 5 categories. Also an additional category (DQS) could be added where the attribute is unknown.

Box 3.3.3 Data quality flagging

3.3.2 Data coherence

The concept of data coherence is fundamental to assessing what is baseline housekeeping data, and then in assessing opportunities for improving aspects of the data. In addressing this, coherence may be considered from two aspects: the need to derive good information and the awareness of how individual data sets are used throughout the FCERM structure (i.e. used in generation of different information). The latter aspect is touched on in this sub-section and developed further in Section 3.3.4. The focus of this section is in relation to understanding the principles of data coherence in the production of information for a single user or role.

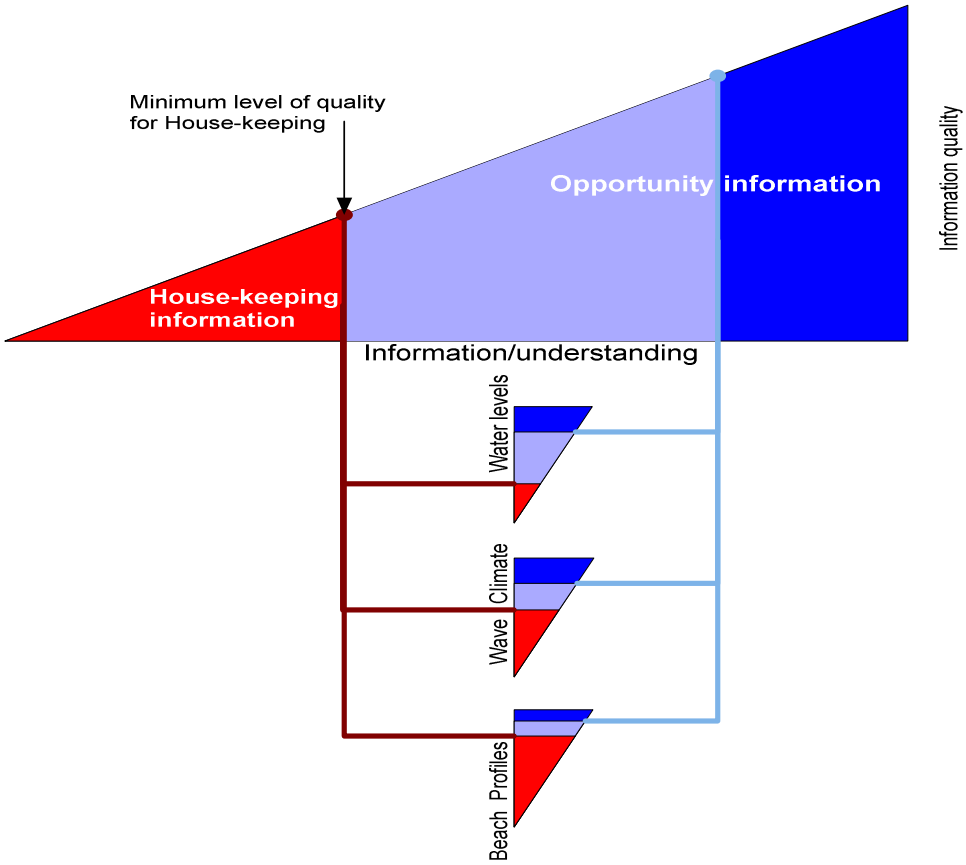
The level of information quality is determined by the differing quality levels of datasets. A House-keeping level of information is reached when the constituting data is of a house-keeping level. However, when assessing opportunities for improving the information, improvements in particular data might be more critical than others. Fundamentally, such an assessment decision has to be defined in terms of the use of information, not its nature (Box 3.3.4). This, more than the pure attributes of data quality reinforces the need for objective led decision making in appraisal of data collection.

The development of the National Flood and Coastal Defence Database (NFCDD) is a clear example of how there is a good understanding of the need for coherent data sets if a system is to deliver competent information on defences. Knowing whether a wall is in good or bad condition needs to be considered in conjunction with other data if ones' role is in assessing probability of damage (e.g. whether the wall is 5m high and is exposed to severe conditions, rather than being merely 0.5m high set at the back of a healthy beach). If one is considering this from a role of planning maintenance, other associated data may be more important.

Box 3.3.4 Example of data coherence dependent on its use

It is rarely seen that decisions are made on the basis of one data set. A decision to improve the Thames barrier would not be made simply on the basis of numbers of properties at risk below the 5 metre contour in London. Other key data like surge tide levels and frequencies, and asset condition of the existing infrastructure must be evaluated as part of the decision making process. It is an understanding of the perceived quality of the key data attributes in association with all other data attributes that influences the overall robustness of the decision making process.

The main “slide” (set horizontally) represents the variation in information quality being produced by a specific role within the FCERM structure, in this instance, the assessment of coastal behaviour. The generation of this information is based on a set of three independent data sets; the quality of each being represented by the three vertical “slides”.



The minimum (house-keeping) level for understanding of the coastal behaviour is indicated on the main slide. To achieve this minimum level of information, there may be a need for high quality long term beach profile data. Associated with this may be a need for general information on wave climate (determining net sediment movement) and a basic assessment of extreme water levels. The data quality to achieve this for each data set is highlighted in red on the vertical slides. The combination of these data sets gives the minimum quality of information for the role, or task, to be performed.

Assessment of the need for improving the information being produced; for example improving the assessment of probability of erosion under specific conditions, requires thought about the critical choices which are going to be made based on that information. In particular, whether improving this information or improved knowledge about the coastal system is actually going to result in different outcomes for management. To improve the information then requires consideration of how that information may be improved. An improvement level in information is shown on the main “slide”, its need being driven by the value of the improvement in decision making. To achieve this improvement, each data set has then to be considered. There may be little need to improve the quality of beach profiling (a move to collect quarterly rather than annual data). There may, however, be a need to significantly improve the quality of wave and water level data (a change from statistical analysis to time series data) and hence increase the effort put into obtaining this data. There may even be a need to introduce other data sets.

Box 3.3.5 Illustration of data coherence

Unravelling the complexity of appraisal through sound management of data quality will greatly facilitate sound investment decisions but only goes so far. This discussion of data coherence aims at ensuring thought is given to where effort needs to be put in to improving information through the relative improvement of data quality over a range of data sets. Box 3.3.5 illustrates an example as a guide to this thinking.

A step change in improvement of information quality may be obtained from little improvement in quality of one data set. Similarly, there may be little improvement in information (and ultimately in decision making) through improvement in one set of data without also improving the quality or introducing other data. The process of optimisation of data is discussed in Section 3.3.3.

The sources of the datasets are invariably found elsewhere within an organisation or even with other organisations. The mapping of the flow of FCERM information reveals a large selection of the organisations involved in the FCERM industry (Section 4.2). This also highlights the importance of advertising effectively the availability of FCERM data and information, and improving the ability to share it through the use of common standards (Section 4.3 and 4.4).

3.3.3 Data optimisation

Data is of little value unless it provides information to expedite and support decision making within the component functions of Flood and Coastal erosion Risk Management (FCERM). Inappropriate and incomplete data of poor or uncertain quality can obfuscate the process and inform poor or wrong decision-making.

Generally, for data that is relevant and of low quality, there is often significant value in investing in improvements. While making improvements, there needs to be a process of optimisation. It is important to realise that there is an optimum level and beyond this point, costs outweigh additional benefits (illustrated in Figure 3.3.1). The optimum level varies from role to role. However, damage to investment decisions is increased when the prescribed level for House-keeping data quality is compromised.

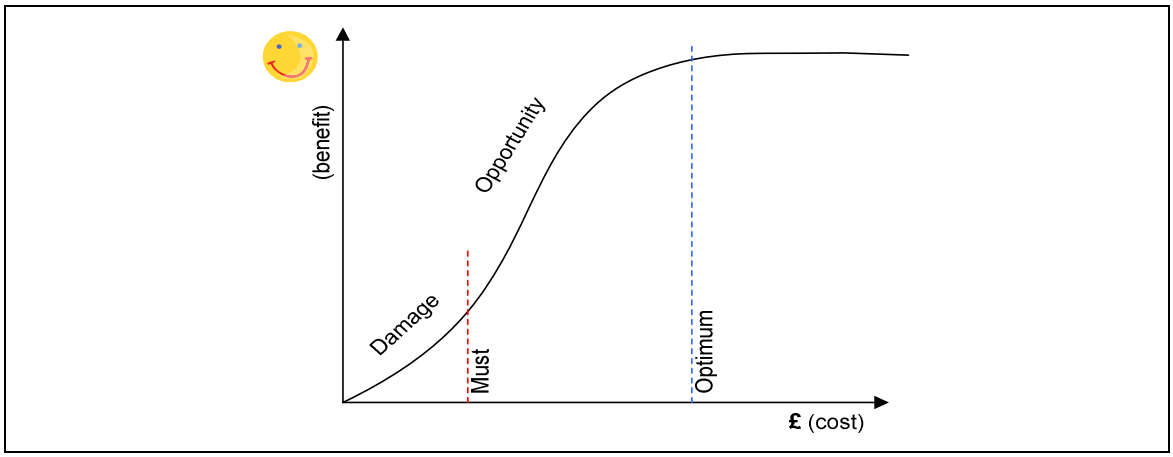


Figure 3.3.1 Data optimisation

Optimisation of data for tasks and roles can be carried out in conjunction with data quality scores through a process of data filtering. The process of data filtering is outlined in Box 3.3.6. A practical scenario using such an approach is described in Appendix B, which highlights the close link with data coherence.

The optimisation of data value in benefit cost terms must reflect optimum quality with respect to fitness for purpose. Thus there is a trade off between cost of data and data quality. Obtaining threshold surveys of every property below 5 metres in London would almost certainly be not cost beneficial, but the optimal solution (for measuring property thresholds) must be robust within the appraisal context, and must not compromise quality and therefore the correct investment decision. The example of data filtering in Appendix B reveals that further improvements in data quality, beyond a point, do not result in best value. In fact, the implication for inappropriate allocation of scare flood risk management resources is stark in this example.

Both opportunities for improvement and reduction of quality should be assessed during optimisation. However this process should not only look at tasks and roles in isolation, but evaluate all possible uses of the data (data knowledge awareness in Section 3.3.4) to ensure synergy and efficiency of collaborative or joint capture and management. Before any reduction in quality of data is carried out, proper risk assessment should be carried out and the benefits in terms of reduced cost properly assessed. Ill-considered reduction in quality can prevent future benefits to the business.

The objective is to improve the quality of the data that makes most contribution to calculated benefits. The description below is for calculating the benefits of flood risk management.

A. Data assembly and Data Quality Scores

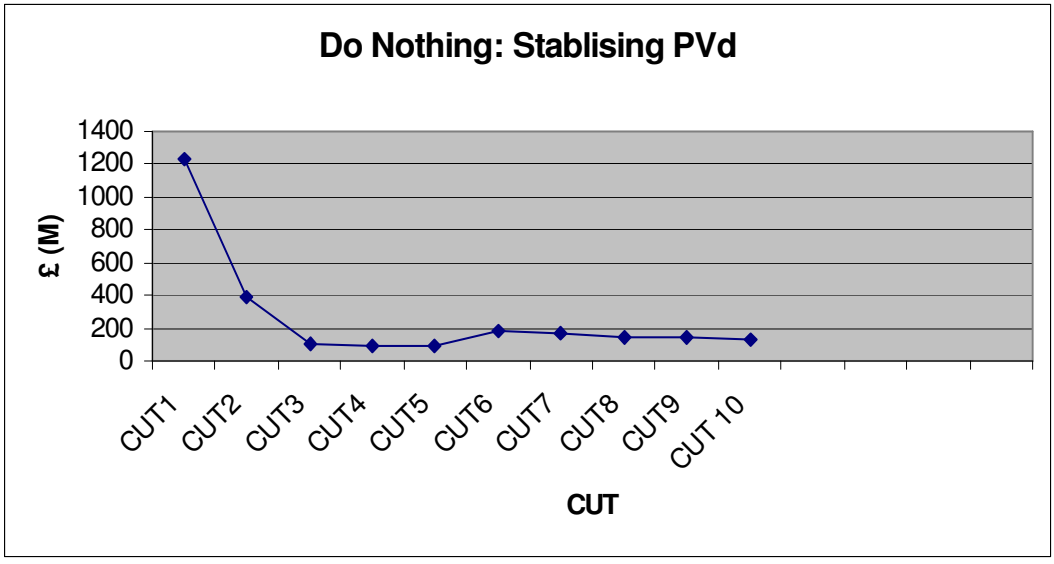
Assemble the following for each property in the benefit area. The National Property Dataset (NPD) is a useful source of land use data.

1 The land use category
2 The floor area of Non-Residential Properties (NRP) only, see Multi-Coloured Manual (MCM) Chapter 5
3 The threshold height of the property
4 The most appropriate depth/damage damage data (from the MCM CD-ROM)
5 The hydrologic/hydraulic profile data (or similar) for each return period

Assign Accuracy DQS (1-5) for each of the five elements of dataset above.

B. Procedure

1. Calculate the Present Value of damages (PVd) for each property and rank all properties by PVd;
2. 'Cap' PVd at each property's market value. Market value data sources include:
   - Residential: Land Registry website, etc, for the property's post code;
   - Non-residential: from NPD (rateable value) or from www.voa.gov.uk (rateable value); NPD indicates the yield factor to convert rateable value (NRP) to an approximate market or capital value;
3. Consider the scores assigned to each of the five types of data. If the scores are at levels 2 or 3, or (particularly) level 4, and there is evidence to suggest that data can be improved without disproportionate cost, then clearly there is cause for concern with the existing data-set;
4. Explore the impact of the lower quality of data and whether improvement will affect the final decision. This is a re-iterative process calculating total PVd for each improvement (CUT) in accuracy DQS. The graph below shows that CUT3 gives the optimum data quality for calculating damages, improvements in data quality beyond this point give more accurate damages but less value for money.



Box 3.3.6 Process of filtering using data quality scores for optimisation

3.3.4 Data knowledge awareness

Data coherence focuses on the production of information for a single user or role. However, different roles draw on common data, as illustrated in Figure 3.3.2. Gaining an understanding and awareness of the data needs of others provide the opportunity to share data and maximise its use and value. Not knowing the needs of others can lead to inefficiencies, such as duplication of effort and data. The charts in Appendix A provide a base to understanding the roles and data needs of FCERM bodies. Chapter 4 presents other organisations that have an interest in FCERM or hold FCERM related data. Tools to improve the ability to share data and information are also described in Chapter 4.

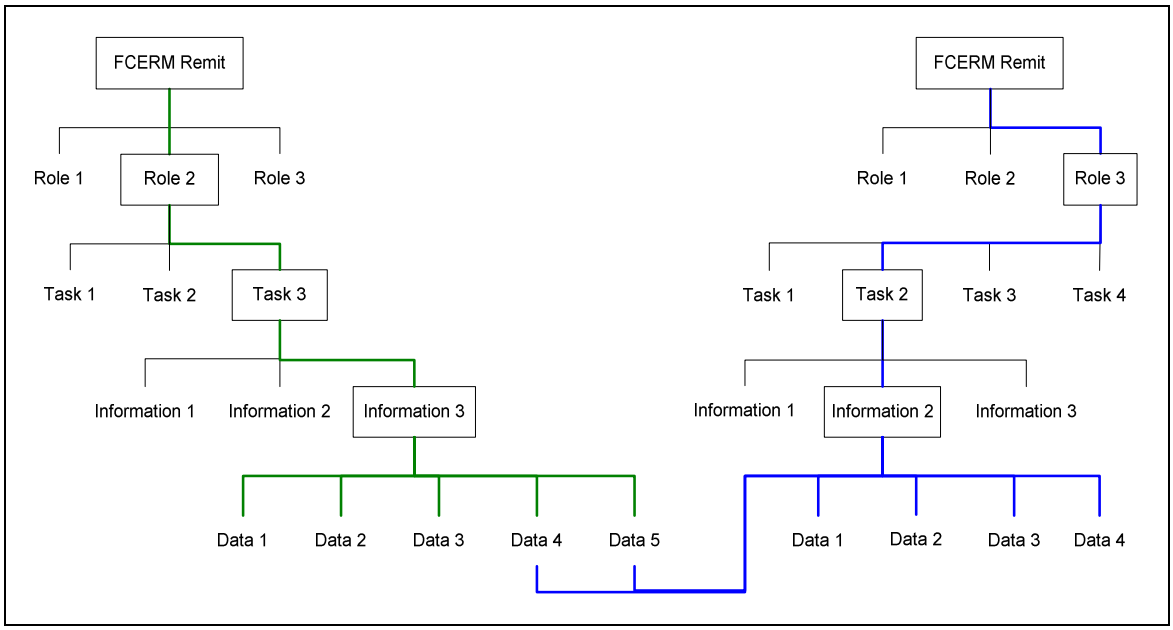
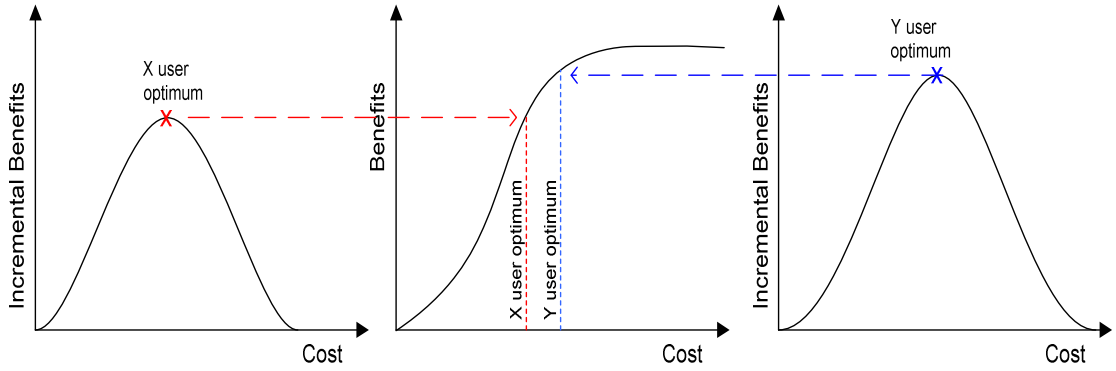


Figure 3.3.2 Data knowledge awareness within FCERM

The process of data appraisal must, therefore, ensure that data is not only shared effectively, but is 'fit for purpose' to support multiple tasks. By being aware of other users and their needs for data, efforts to collect and improve data can be optimised, see Box 3.3.7 for an example. This type of "joined up" structural coherence provides opportunities for efficiencies and avoids duplication of efforts in data capture and management. Similarly by being aware of others' requirements, then the consequences of any reductions in collection or quality (such as reduced temporal frequency) can be assessed beforehand rather than in hindsight.

For any data set there may be, associated with one role, a minimum level of quality required (House-keeping). There may be a sensible and justifiable level of improvement in that data quality associated with that role, appraised by following the principles described above. Equally, however, there may be other roles using the same data sets or sub-sets of the same data. There may, therefore be further justification in improving data as a requirement of some other role.

Two users (X and Y) may want the same type of data but whose optimum levels are slightly different due to differing purposes and objectives. It is worthwhile to improve the data to the higher optimum (standard) for the small increase in cost, which would be covered by the other user.



Box 3.3.7 Optimising data through data knowledge awareness

3.3.5 Project appraisal process

Appraisal processes for projects are well established and enshrined in good practice documents, such as 'Appraisal and Evaluation in Central Government' (known as the 'Green Book') published by HM Treasury in 2003. Data appraisal can benefit from incorporating and applying good practice techniques to evaluate data.

The set of strategic decisions on flood defence options can be applied to data appraisal:

- **Choose to Do Nothing** – To actively answer and document the question: Do we really need data to support our objective, or at least what is the minimum requirement?
- **Maintain the current level** – The base case if we are concerned with incremental value of additional data collection
- **Reduce the current level** – More cost-effective data collection, such as reduce frequency of monitoring coastline according to purpose following an assessment of potential future opportunities.
- **Expand the current level** – Improvements to data, but in keeping with the law of diminishing returns.

In applying these strategic options, a matrix of data needs and data quality requirements should be developed; demonstrating for a single role or for a community of roles what is the house-keeping level. It also identifies what, for each role, may be the benefits of expanding the current level or the damages of reducing the current level of data collection.

Within each strategic option, as in any appraisal of public sector investments, a range of options should be created and reviewed by analysing their costs and benefits. Cost Benefit Analysis or other appraisal tools (such as Contingent Valuation, Value Added Multi-criteria analysis and Willingness to Pay) can be used to evaluate the options to collect and improve data beyond the housekeeping threshold, but this has to be in a context of the overall data coherence necessary to improve information.

The benefits of collecting (and improving) data as part of a well co-ordinated investment programme are well founded and enshrined in conventional CBA procedures as adopted in Defra FCDPAG techniques. The benefits can be direct and indirect not only in economic terms but also scientific and biodiversity aspects. The procedure to calculate the economic benefits of data requires an understanding of how the data translates into information that affects decision making, see Box 3.3.8. An example of applying the Defra FCDPAG3 technique to a regional monitoring strategy is presented in Appendix C.

Combining the two sets of attributes (physical and economic) allows an understanding of the economic effect of overtopping or breaching and therefore the risk.

- Knowing the collective condition of a flood defence asset and the standard of protection afforded by the asset system will enable the likelihood of breaching or overtopping to be assessed using models such as RASP (Risk Assessment for Strategic Planning), and

- Knowing the location (geo-reference and altitude) of properties protected by an asset system will enable the impact of breaching/overtopping to be assessed.

Collecting data to improve predictions of each component of risk will assist in the reduction of property damage (loss) and especially loss of life. Also the implications of not collecting or improving data should be considered when appraising options. For example, the flood risk could be underestimated or overestimated which would affect investment decisions and subsequent costs.

Box 3.3.8 Example to calculate the economic benefits of data

However, it is acknowledged that not all benefits of data improvements and collection can be easily quantified, such as health and safety. It is widely accepted that there is not a definitive method to use as each situation is unique; however, one should be aware of the limitations and subjectivity of particular methods.

It is important to recognise that there is this housekeeping level of data which should not require an economic appraisal, beyond that notionally provided by the significance of the role within FCERM. Without this essential data, for example, location of watercourses, coastal cells and associated flood defence assets, the ability to manage the FCERM business would be fundamentally and adversely affected.

3.3.6 Data Appraisal Framework

In order to establish and formalise good practice in data appraisal, a framework has been created and developed that incorporates the principles of this section (Figure 3.3.3) and the objective-led approach. The data appraisal framework is presented in Figure 3.3.4 and is applicable to data users and suppliers.

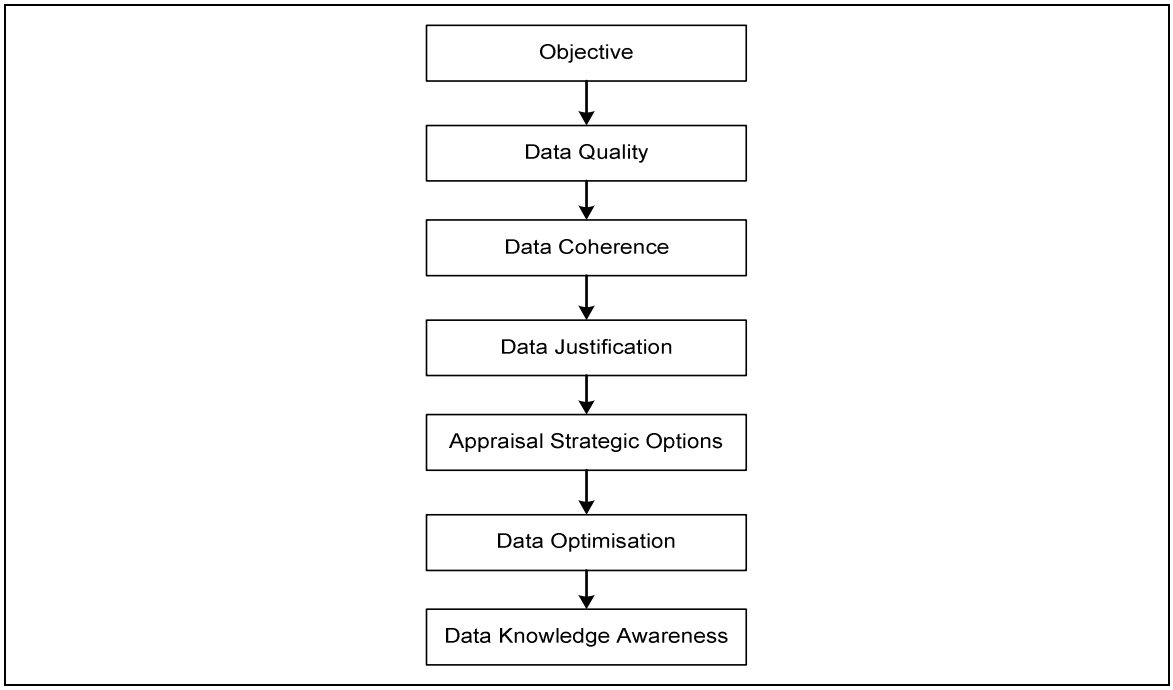


Figure 3.3.3 Principles within the data appraisal framework

First the overall objective of the data collection and the specific elements, and users need to be determined. There may be a primary role (user) needing to be satisfied or equally multiple primary roles or primary and secondary roles. From the point of view of either a single role or from that of a broader application, it is important to establish not just what the different data requirements are, but also the minimum and optimised levels of quality. The business objectives/data links discussed in Section 3.1 and charts presented in appendix A can assist with this process. In the case of the multiple roles, this would provide a matrix defining the complete range of data. Within this, it will define whether data is House-keeping or Opportunity and, for each data set, what quality level provides House-keeping.

Once the level of data quality required has been established for the task and its data cohesion understood, then a search can be carried out. Tools to improve this search and how to advertise data are described in Chapter 4. Data quality scores assigned to the existing data will help indicate if the data is “fit for purpose”. If the data exists at the required quality then there is no need for any justification since it exists. The user is then directed to an audit of the data’s use and applicability in multiple roles. The metadatabase and the knowledge management tool (see Sections 4.3 and 4.4) can assist in this search and checking if data and associated quality is fit for purpose.

Only when the data does not exist or is not at the required level, is there a need to determine if the data is House-keeping or Opportunity data. This consequently affects whether any justification is necessary to collect new data or improve existing data. If it is possible to make an intelligent judgement without the data (i.e. using more basic data), then it is Opportunity data. However, if it is not possible to make an intelligent judgement without it, then it is House-keeping data.

If the data needed is Opportunity data then, in recognition of time constraints, substitute data is sought which can bridge the gap while the needed data is not immediately available. This not only maximises the use of existing data, it can also reduce redundancies and also minimise additional data collection thus saving time and money.

When there is no substitute data or it needs to be improved further, then the data should be appraised via the cost benefit appraisal optimisation track. Again its applicability for utility within multiple roles is tested and optimised for all roles within and outside the FCERM business using data knowledge awareness. The information flow charts described in Section 4.2 can assist with this process.

The framework contains the strategic options of do nothing, and maintain or reduce or expand current level of data. It also seeks betterment of data thus potentially allowing more informed FCERM decisions to be made. However, when considering reductions, then future needs should be considered together with the implications on future FCERM decisions, which might be hindered.

The practicability of the framework and data quality flags is demonstrated in Appendix D using a fluvial and a coastal scenario.

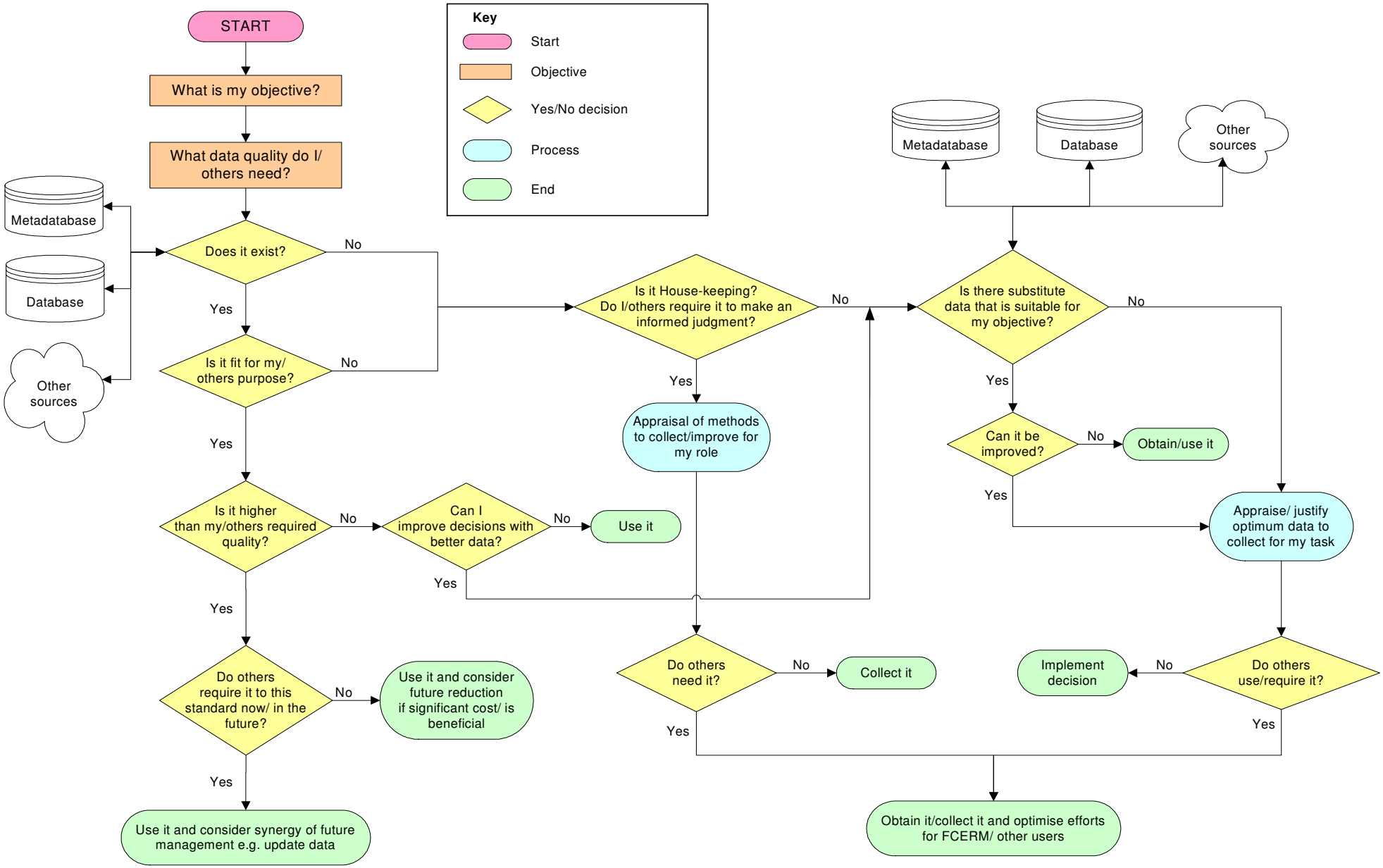


Figure 3.3.4 Objective-led data appraisal framework

This page is purposefully blank

4 Data sharing and information management tools

4.1 Whole data lifecycle management for FCERM

In a data-centric system, there are inefficiencies within the whole data lifecycle management (creation, storage, update, access, retention and deletion) that are resulting in data redundancies, inconsistent documentation, as well as limited access and links to other systems. As we approach an era of data warehouses, it is all the more important that common methodologies are applied to the management of the whole data lifecycle, which will help improve access and sharing (interoperability and re-use).

By understanding the objectives of data in FCERM, the inefficiencies within the data lifecycle management can be tackled. FCERM data is necessary to:

- Support the management and achievement of business objectives
- Inform and elucidate the perception of risk; or
- Inform technically appropriate, sound and cost beneficial investment decisions and aid prioritisation of spending.

In order to reliably achieve these, and in recognition that FCERM data spans local, national and international boundaries, it is rational that knowledge of the provenance of data should be well-documented and follow common standards (International Standards) tailored for the FCERM business (Section 4.3). Similarly, the collection, storage and maintenance of such records should follow International Standards to ensure management is carried out in a controlled and consistent manner (Section 4.4). It is important that these common standards are applied throughout the FCERM industry as it will improve the ability to not only share data but also aid retrieval (Section 4.4), thus reducing data redundancies and maximising the value of data. Tools can also be employed for effective data sharing and information management (Section 4.4). Before enabling technologies or a common standard can be applied, however, it is necessary to understand the exchange of FCERM data and information including the relationships between organisations (Section 4.2).

4.2 Information exchange

Having knowledge of the transfer of information in FCERM and those involved in supplying it, enables the identification of areas to improve efficiencies. The flow of data and information between organisations can be systematically represented by applying the ontology concept (Section 2.3).

Data and information flows into FCERM operating authorities, up their management hierarchy (local delivery to policy development) and then cascades back down again within the operating authorities. At various points in the hierarchy, information flows out of the operating authorities to other organisations with an interest in FCERM. The information flows between organisations have been mapped using diagrams, termed “Information

Fountains" according to the nature of the flow of information. The flows are developed to a certain extent within FD2323/TR1, where the general format follows the style of Figure 4.2.1. Charts developed around key FCERM authorities are provided in Appendix E. In order to understand the entire cycle of data and information, there is a need to develop further detailed flows for each business area. The charts in Appendix E provide a starting point.

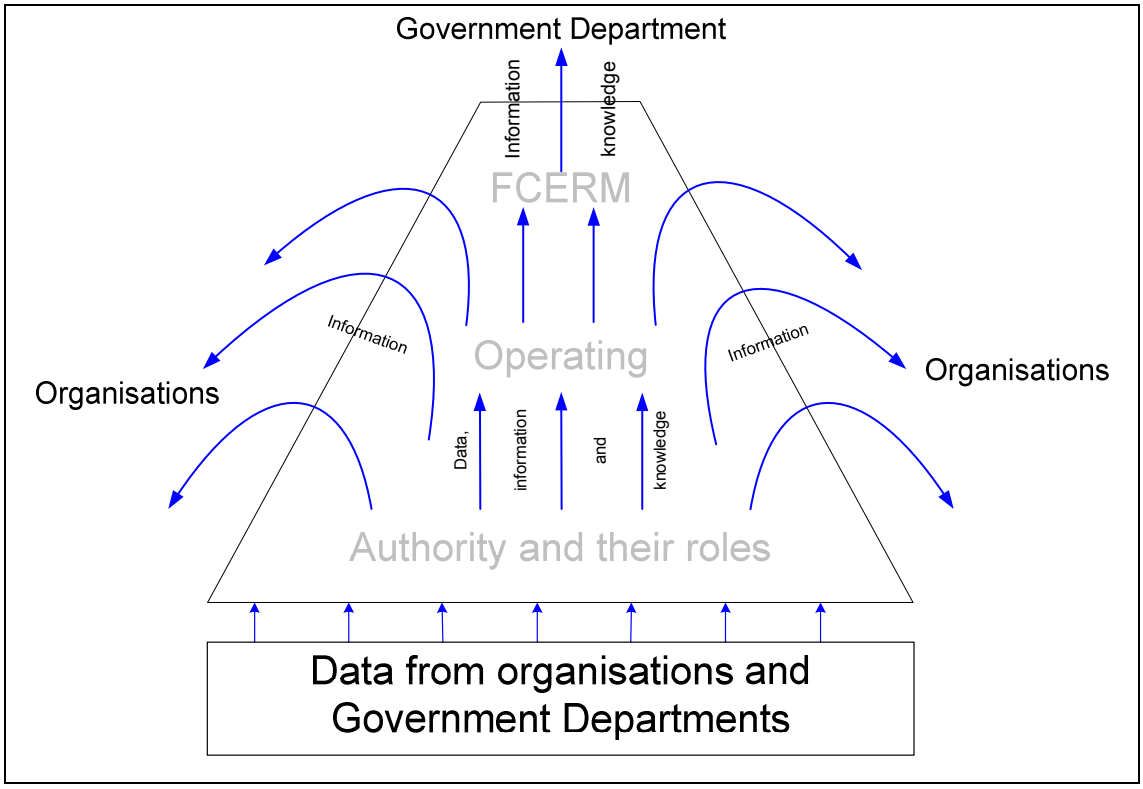


Figure 4.2.1 Illustration of the information fountain

The approach not only aids the identification of organisations with an interest in or contributes to FCERM data (Appendix F) but also highlights the initiatives and systems that store FCERM data and information (Appendix G).

4.3 Information about data

'Not knowing the quality of data can, at worst, make data worthless'

Knowledge of the provenance (origin) of data allows transparency of decisions and an improved understanding of the associated uncertainties. It is important to remember that the information that is produced for one person's purpose is also likely to be used as data for another person's purpose in the future. In other words, recording the provenance of data will not only support the decisions you make but also will serve the FCERM community and those outside of it.

The technical word for 'information about data content' is metadata (Box 4.3.1). There are significant benefits in providing metadata, which include the following:

- Provides provenance to data;

- Helps organise and maintain an organisation's investment in data;
- Provides information about an organisation's data holdings in catalogue form or to brokers, re-sellers and clearing houses;
- Accessible metadata records help to avoid duplication of effort by ensuring awareness of the existence of datasets, and promotes the availability of geospatial data beyond the traditional geospatial community;
- Users can locate all available geospatial data relevant to an area of interest or study. There is increasing pressure from customers for easier and quicker access to the right information, at little or no charge;
- Data providers are able to advertise and promote the availability of their data via online services; and
- Metadata cataloguing goes some way towards compliance with Government directives relating to easier access to information - Information Age Government, Data Protection and Freedom of Information Acts, Public Records Act, Crown Copyright, etc.

Metadata is the term used to describe the summary information or characteristics of a set of data. In the area of geospatial information, or information with a geographic component, this normally means the What, Who, Where, When and How of the data. The only major difference between geographic metadata and the many other metadata sets being created for libraries, academia, professions, etc, is the emphasis on the spatial component - the 'where' element. Just as a consumer looks at the label on a food product to determine the ingredients, nutritional value and manufacturer, so too can a user of geospatial data review a metadata record to determine whether the dataset is fit for their purpose.

Box 4.3.1 Definition of metadata

With the advent of GIS and the expanding use of digital data, the benefits and requirements for geospatial metadata are now well known. Consequently, there are recognised approaches to metadata documentation. For reference it should be stated that there are different levels at which metadata can be implemented and utilised:

- Discovery metadata - What data sets hold the sort of data I am interested in? This enables organisations to know and publicise what data holdings they have;
- Exploration metadata - Do the identified data sets contain sufficient information to enable a sensible analysis to be made for my purposes? This is documentation that is provided with the data to ensure that others use the data correctly and wisely; and
- Exploitation metadata - What is the process of obtaining and using the data that are required? This helps end users and provider organisations to effectively store, reuse, maintain and archive their data holdings.

The beauty of having metadata means that it eliminates the need to hold data in a central place. Simply knowing data exists, a description of its attributes, its whereabouts and how to obtain it (if necessary) is enough; this can be done using a metadatabase. The use of metadatabases can reduce the occurrence of data duplication.

4.3.1 Metadata documentation

Standards for the documentation and cataloguing of metadata have been produced during the last few decades. Many of these have a great deal in commonality, but vary in the degree of complexity and the level of detail required to complete an entry. Over recent years there has been a steady convergence of standards culminating in a number of publications by the International Standards Organisation (ISO). These include ISO 15836:2003 (Information and Documentation - The Dublin Core metadata element set) and ISO 19115:2003 (Geographic information - Metadata). In the UK public sector there are essentially four metadata standards that are currently used by various bodies (Table 4.3.1).

Table 4.3.1 Key metadata standards employed in the UK public sector

Standard	Description
e-Government Metadata Standard (e-GMS)	Published by the Office of the e-Envoy and is mandated for use by all public sector bodies. It aims to make cross-government searching for all information resources a reality. Currently the e-GMS has restricted spatial referencing elements. It is being developed to incorporate ISO 19115:2003.
ISO 19115:2003 Geographic Information – Metadata Standard	Published by the International Standards Organisation. It fully supports spatial referencing and should be ideal for the needs of the geographic information community within departments or agencies. However, it cannot be fully implemented as the XML Schema (ISO 19139) is not complete. Major vendors of geographic information systems have implemented ISO 19115:2003 compatible metadata systems. ISO 19115:2003 has over 400 metadata elements, making it comparatively complicated and unwieldy.
Geographical Information gateway Discovery Metadata Standard	Formerly known as National Geospatial Data Framework (NGDF). It is widely used in the UK and continues to be the standard used by the Association for Geographic Information (AGI) supported Gateway. It is essentially the Dublin Core Metadata Standard with an extension for handling spatial coordinates; however this framework has now been superseded by UK GEMINI.
UK Geo-spatial Metadata Interoperability Initiative Discovery Metadata Standard (UK GEMINI)	Developed by AGI for the Cabinet Office e-Government Unit following a rigorous process of national consultation, feedback and revision with additional representation from national and local government, and the academic community. It is a defined element set for describing geo-spatial, discovery level metadata within the United Kingdom. It is derived from ISO 19115:2003 and e-GMS and so is compliant with relevant national and international standards.

Although government policy indicated that all UK Governmental departments/ agencies should use the e-GMS, the current version (v2 - May 2003) does not support spatial referencing to a level appropriate for use with geographic information. This is a significant drawback that is recognised and has been addressed in UK GEMINI. Other organisations dealing in data management and with local government partners, such as the Channel Coastal Observatory (CCO), have expressed that they intend to migrate to the more relevant UK GEMINI in the future.

4.3.2 FCERM metadata schema

In order to allow interoperability with organisations in the public sector, the developed FCERM metadata schema adopts UK GEMINI standard since it is based on ISO 19115:2003 as well as e-GMS. However, in reviewing the elements within the standard against the needs of the FCERM community, in particular the need to capture data quality attributes, areas have been augmented using ISO 19115:2003. Where ISO 19115:2003 did not contain a suitable element, a new one was created following the guidance provided in Annex C of ISO 19115:2003. A full description of the FCERM metadata schema and its development can be found in FD2323\TR2 and the outline is shown in Appendix H (with reference to tables in Appendix A of FD2323\TR2).

The schema includes elements that allow the use of data quality flagging (Section 3.3) to aid users to determine if the data is appropriate for their purpose. It also has an element 'Frequency of update" so that notes can be made as to when the data is updated or modified. This allows the metadata to be kept up-to-date. It is recognised that some data has copyright and licensing regulations, and so there is an element called 'Access constraints' to record such restrictions.

4.4 Data storage, advertising and retrieval

The 'information fountains' (Section 4.2 and Appendix E) illustrate that there is already a significant amount of data and information travelling around the data highway. As the need for further understanding of present-day and future FCERM issues grows, so does the wealth of data and information. With this wealth of knowledge, however, comes the burden of how to store and advertise it effectively so that others can access and retrieve it. While the data can be collated into one database, separate from its source of capture, this methodology runs the risk of duplicating data and data becoming out of sync, as well as requiring a large storage capacity. Following the objective-led approach with the use of the FCERM metadata schema, knowledge of data existence can be achieved using a FCERM metadatabase. To ensure population and maintenance of the metadatabase is carried out in a consistent and controlled manner, a FCERM registry has been created in accordance with international standards (Section 4.4.1). Such a metadatabase then allows links to other Metadatabases using the ISO Standard, thus improving access to data and the advertising of it (Section 4.4.2). Metadatabase can also link up with tools that support the objective led approach, such as ontology (FD2323/TRI) and data appraisal (FD2323/TR4) through an interactive query.

This provides opportunities for improved knowledge management (Section 4.4.3)

4.4.1 Metadatabase and registration

Using the FCERM metadata schema, a metadatabase can be created to store the metadata. A prototype metadatabase has been created in MS Access since it is easy to use and distribute (see FD2323/TR2 for more details). In taking the concept forward, however, a more suitable medium should be used that can handle large amounts of data, such as Oracle or Microsoft SQLServer. The sophistication and complexity of the successful approach will vary with the needs and resources of the each organisation. To ensure that maximum value is extracted from the metadata, it should be entered in a controlled and consistent manner. As a result, proper consideration needs to be given to developing an appropriate management structure with a key user or hierarchy of users.

A suggested method of dealing with the requirements of the standard is not to try to reduce its complexity (and therefore its usefulness) but rather to create "Metadata Manager" position(s), which takes responsibility for the quality control for in-putting data. This reduces the amount of training that regular users would require. Not all users and data producers should be required to know the standard, though they should be aware of it and understand the elements of its content, which can be achieved through minimal training. In any case, a hierarchy of users with varying training needs can be developed to fit the requirements, size and skill levels of any organisation.

As a start, CIRIA C541 2000 (Box 5.4 p64,) loosely explains how to write good metadata. More recently ISO have published a standard (ISO 19135:2005) that specifies procedures to be followed in establishing, maintaining and publishing registers for items of geographic information. This has been followed to create management procedures for registers of FCERM metadata (see Appendix I). A definition of a register is described in Box 4.4.1. The roles and responsibilities within the registry are outlined in Box 4.4.2 and the relationships are illustrated in Figure 4.4.1.

A register is simply a managed list. It is easier to maintain than a fixed document, because new items can be added as needed to the register, and current items in the register can be modified or retired. The register item would have a "date stamp" that would indicate the date on which it was added to the register. For an item that is indicated as retired in the register, the item would remain in the register with an indication of the date at which it was retired. For an item that is modified in the register the original instance of the item would be rendered as superseded with a "date stamp" and a new changed item entered in the register with a new item identifier. There would be a forward reference from the superseded item to the modified item that replaced it. This means that a product specification, defined at a given date, would reference an item in the register in a table manner.

Box 4.4.1 Definition of a register

Registry Owner	The Registry Owner is the organisation that is responsible for the registry. It has the authority to host the registers and establish the policy for access.
Registry Manager	The Registry Manager is responsible for the day-to-day operation of the Registry. It is envisaged that the Metadata Registry Manager would be appointed from within the FCERM community organisations and answerable to the Control Body.
Register Owner	The Register Owner is an organisation that establishes one or more registers; has primary responsibility for the management, dissemination, and intellectual content of those registers; and may appoint another organisation to serve as the Register Manager.
Register Manager	The Register Manager is responsible for the administration of a register. This includes • Coordinating with other Register Managers, Submitting Organisations, related Control Body and Register Owner; • Maintaining items within the register; • Maintaining and publishing a List of Submitting Organisations; • Distributing an information package containing a description of the register and how to submit proposals; and • Providing periodic reports to the Register Owner.
Register User	A Register User is any person or organisation interested in accessing or influencing the content of a register.
Control Body	A Control Body is a group of technical experts (from within the FCERM) appointed by a Register Owner to decide on the acceptability of proposals for changes to the content of a register.
Submitting Organisation	A Submitting Organisation manages the submission of proposals for registration from within the respective communities or organisations. Proposed changes to the Register must meet the submission procedures established by the Register Owner.
Proposers	This group covers any stakeholders (e.g., government, industry, academia, and user groups) who submit a proposal to a submitting organisation.

Box 4.4.2 Roles and responsibilities within the registry

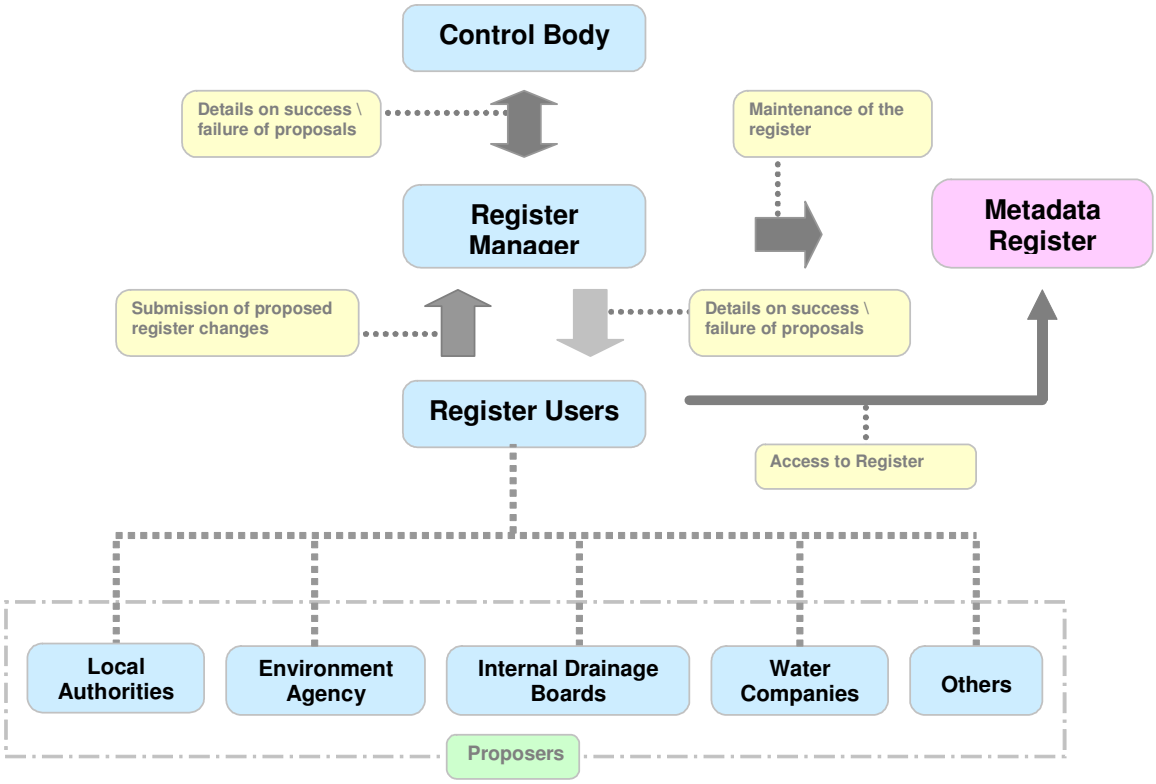


Figure 4.4.1 Registry information flow

The creation of any data is time-consuming and complicated by itself; metadata creation is therefore often considered an added burden. Studies demonstrate that even though a majority of data-producers recognise the benefits of metadata, there continues to be a reluctance to commit time to creating metadata. This is because a commitment to metadata could be seen as taking too much time away from seemingly more important or necessary responsibilities. The fact of the matter, however, is that data users cannot carry out their FCERM responsibilities effectively if they do not know the provenance of the data and information they are using. This reinforces why it is important to be aware of the FCERM needs of others and follow objective-led information management, then metadata is being developed for all data capture and entries, the benefits to the data owner and potential users has been invaluable.

It is recognised that input of datasets and aggregated or synthesised data has implications for the data quality flags. The approach taken in entering metadata and associated quality flags should consider that simply knowing data exists enough and the metadatabase should perform this function.

In order to reap the benefits of metadata, the FCERM business needs to reach a point in the near future where a metadata proforma is completed in all contracts in which data collection, storage and dissemination forms a part. This could then accompany the data, document the provenance and quality, and would be logged for entry into the metadatabase. The Registry Manager would control the management of this entry. A suitable proforma for the capture of FCERM metadata has been developed in FD2323TR2 in Microsoft Access.

This could be as an excel spreadsheet for ease of completion or in a format conforming to the organisation's system to allow a direct upload. To ensure compliance with the request for supply of metadata, the text (Box 4.4.3) should be added to FCERM project contracts and be made one of the deliverables of the project. The requirement to provide metadata with the data and/or documents within a FCERM project would be written within the 'Presentation of Data' section of the contract document.

"All data and/or resulting deliverables collected or emanating under this contract will be suitably described on the metadata proforma supplied with the contract material and will be logged with both the named contracting body and also the nominated FCERM Registry Manager."

Box 4.4.3 Text to insert into FCERM project contracts for the supply of metadata

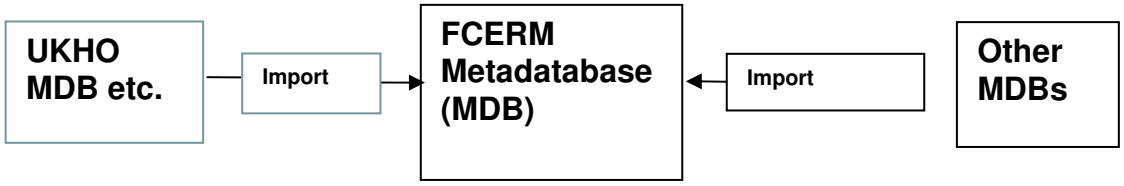
4.4.2 Interoperable systems

It is in the best interest of an organisation to create a metadatabase system that is able to interact and integrate with other similar systems, as well as being well maintained and up-to-date. Systems need to use similar 'language' to allow interoperability. Using the FCERM schema (following ISO standards) and implementing the registration will make a significant step to be in the ability to achieve this.

There are two possible ways forward to integrate the FCERM metadatabase into the wider community. These are shown in Box 4.4.4 (Option 1) and Box 4.4.5 (Option 2).

Option 1 provides duplication of effort, and requires maintenance of both the FCERM metadatabase and updates from all other metadatabases linked into the system.

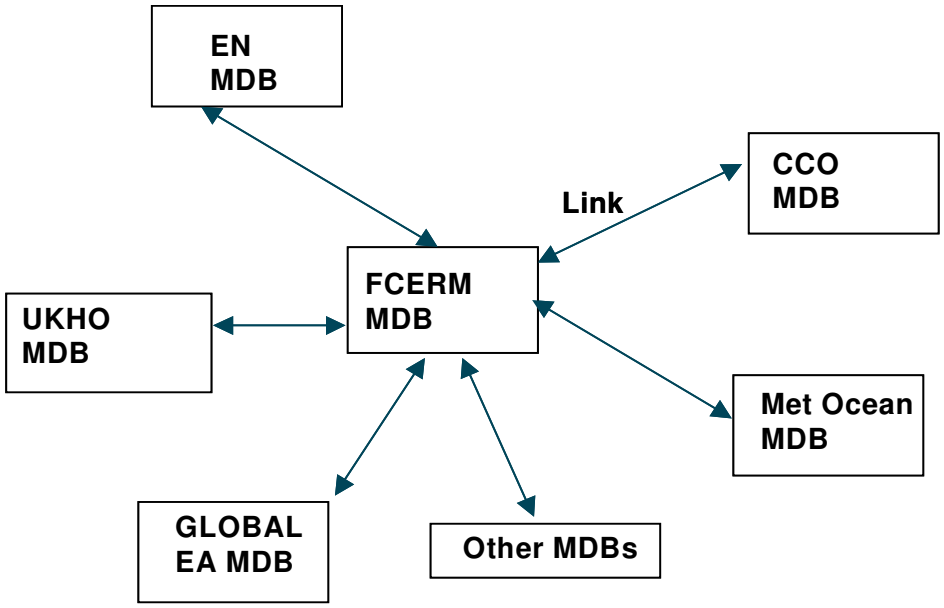
Import relevant data from other metadatabases, such as United Kingdom Hydrographic Office (UKHO), into the FCERM metadatabase so that all of the metadata is stored in the one place.



Box 4.4.4 Option 1 – Imported data from other metadatabases

Option 2 reduces effort in maintaining the information within the FCERM metadatabase but relies on trusting other organisations to regularly update their systems. Importantly the metadata links would enable two-way flow of information thus enhancing the knowledge 'web' available to the user and improving the advertising of data by producers and suppliers.

The FCERM metadatabase could link up with other metadatabases, such as United Kingdom Hydrographic Office (UKHO) and English Nature (EN). This system requires common links to be made with the other metadatabases, these would involve IT and data agreements to be put in place. In this system the metadata is held and maintained by the individual custodians while any data collected within the FCERM community would be referenced within the FCERM metadatabase.



Box 4.4.5 Option 2 - Links between FCERM and other metadatabases

4.4.3 Knowledge management tool

Enabling technologies can improve the efficiency of information access and exchange in knowledge management. The following facets of the objective-led information management have been assembled to create such an application for knowledge management:

- FCERM ontology-based data needs charts - formalising the hierarchy and links between information and business objectives (Section 2.3, 3.1 and Appendix A)
- FCERM metadatabase – access to available data and subsequent retrieval
- Data quality flags – using data attributes to determine if data is suitable for a user (Section 3.3)

The outcome is a Knowledge Management Tool that is web-enabled allowing ease of use and widespread access. The features of the application enable users to:

- Access through different entry levels depending on the responsibility of the individual or level of the enquiry - through national/regional or local need.
- Prioritise the information required for each query thus identifying whether 'key' information is missing.

- Identify who else may benefit from data being collected, both internal to the organisation and external, and so potential joint funding sources.
- Provide a link to other organisations that might have an indirect interest in the activity, such as English Nature, RSPB, emergency services.
- Identify the need for data collection.
- Assist individuals at different levels to query with set tasks and return a list of information from the metadatabase. Further examination of the metadatabase will provide detail on the information itself or associated data.

The concept systems diagram (Figure 4.4.2) shows the route through the system and highlights the levels of entry, user input and links within the application and to the metadatabase.

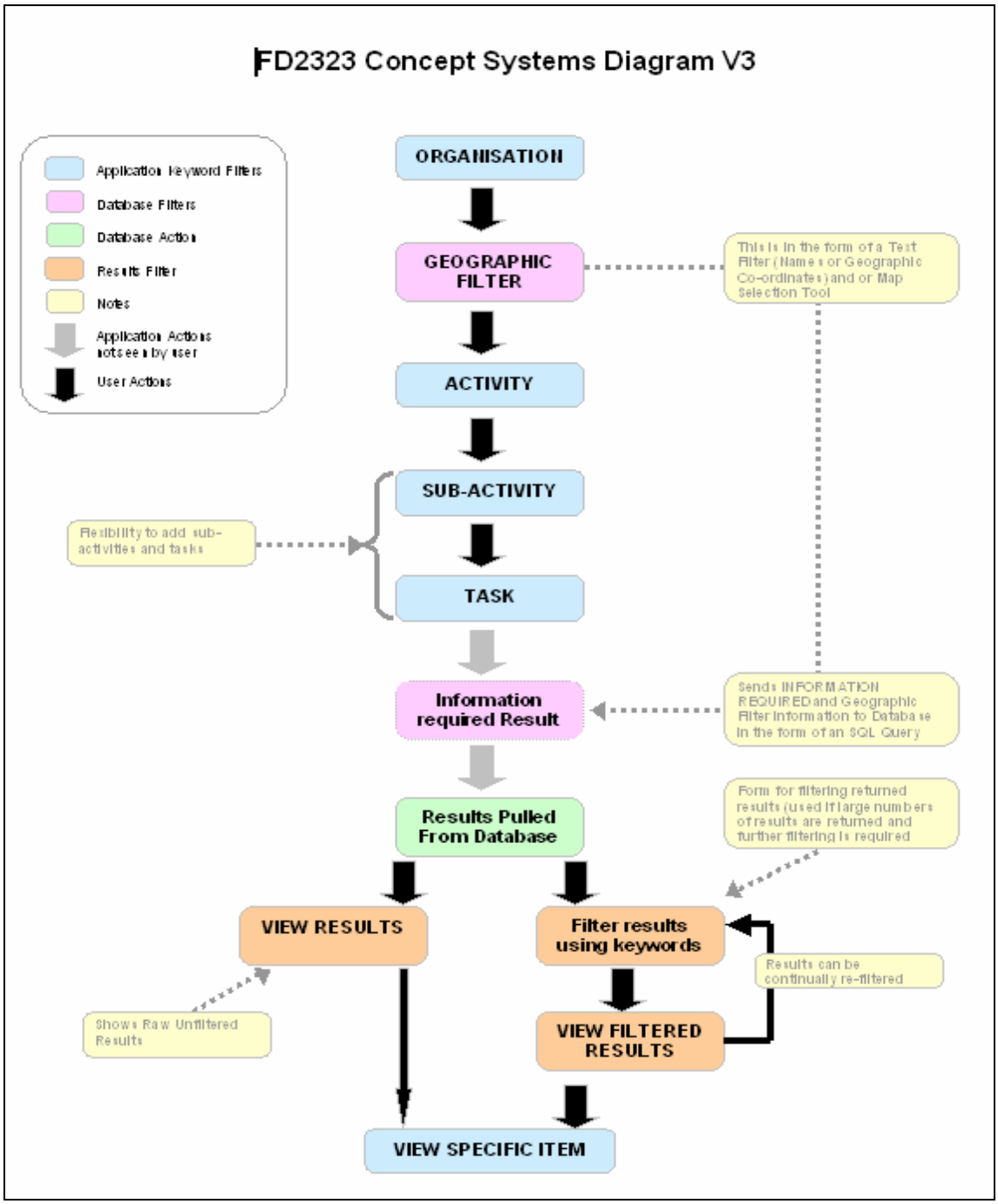


Figure 4.4.2 Concept systems diagram

As well as filtering through 'information required' and additional keywords, the results can be ranked in terms of its relevance and according to particular attributes using the data quality flags, such as accuracy, age and length of record. Information about the data quality flags is provided to enable the user to assess the suitability of available data and information for their tasks.

Figure 4.4.3 shows the application flow diagram between the Knowledge Management application and the metadatabase indicating the lines of updating, a management activity and reading, a passive activity and forms the retrieval process.

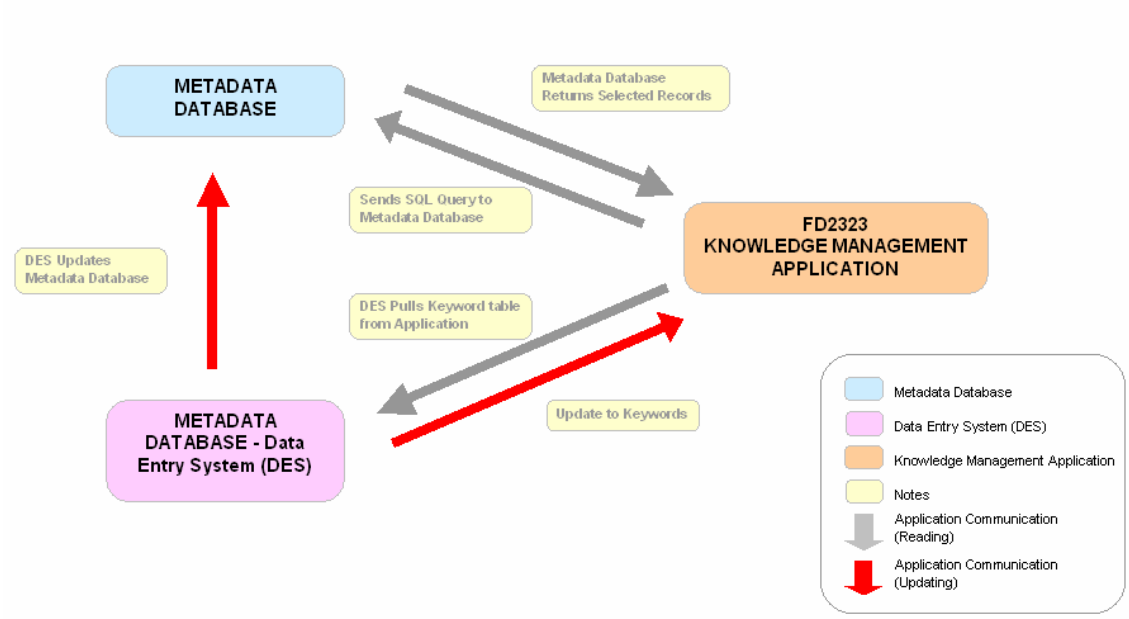


Figure 4.4.3 Knowledge Management Application interactions

The 'proof of concept' tool developed as part of the FD2323 project, together with the formats used and the content of the databases underlying the Knowledge Management application are provided in FD2323/TR3 (2006). A user guide is also provided, which is available as an interactive 'help' in the application itself, which walks the user through the various pages. The overall control and management should be handled through the ISO 19135 standard (provided within FD2323/TR2).

This page is purposefully blank

5 Route map

5.1 Plan for effective data and information management

The route to effective and integrated data, information and knowledge management is via a three point turn, that is to say, in order to change direction one needs to execute all three following actions:

1. Following an objective led process
2. Improving efficiencies in whole life data management
3. Embracing a culture change

5.2 Objective led process

A data user or supplier or manager will generally consider a perceived need to either obtain or assess data or assess the requirement for data supply. The process to achieve this in an effective and integrated manner is illustrated in Figure 5.2.1.

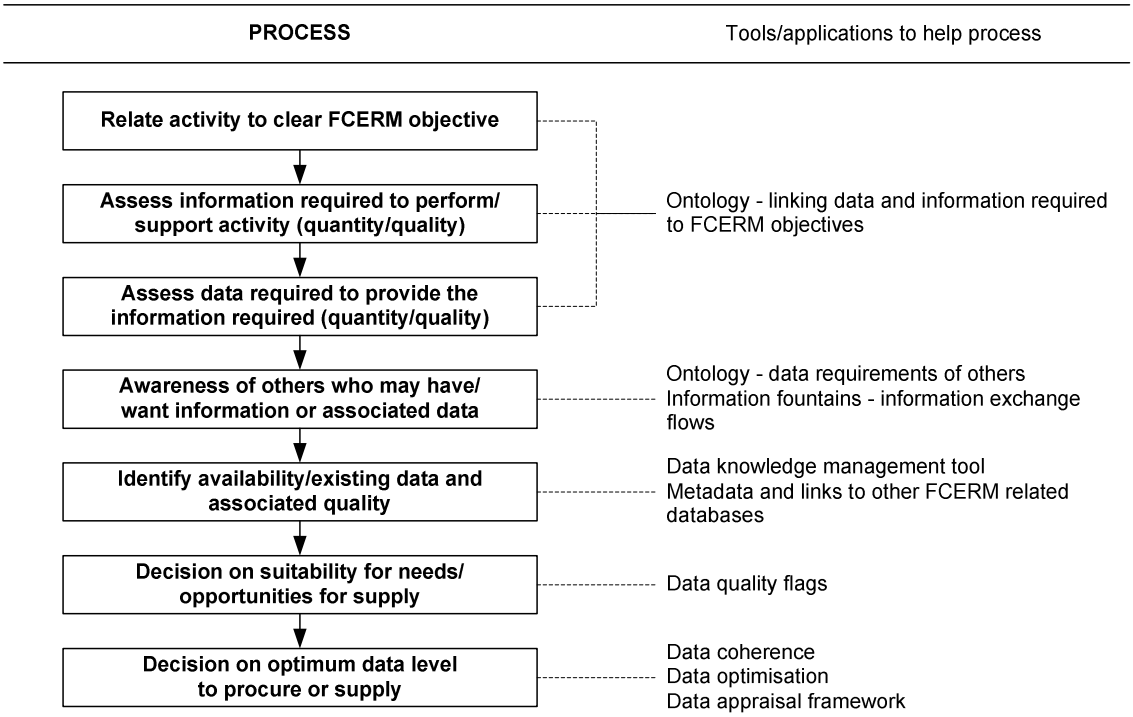


Figure 5.2.1 Objective led process

5.3 Whole life data management

In order to maximise the benefits and value of data for FCERM, there is a need to focus the management of the whole data lifecycle such that it improves the ability to share data and record its provenance. Metadata fulfils the ability to record data provenance, allowing it to be re-used by others. However, data can only be effectively shared (advertised) when everyone uses compatible languages and management procedures thus enabling interoperability between

systems. International Standards set out controlled procedures for the creation, storage, update, access, retention and deletion of metadata. The developed FCERM metadata schema and registry complies with the international standards, thus ensuring consistency and the potential to link with other systems. Figure 5.3.1 illustrates the data lifecycle that are improved through metadata and international standards.

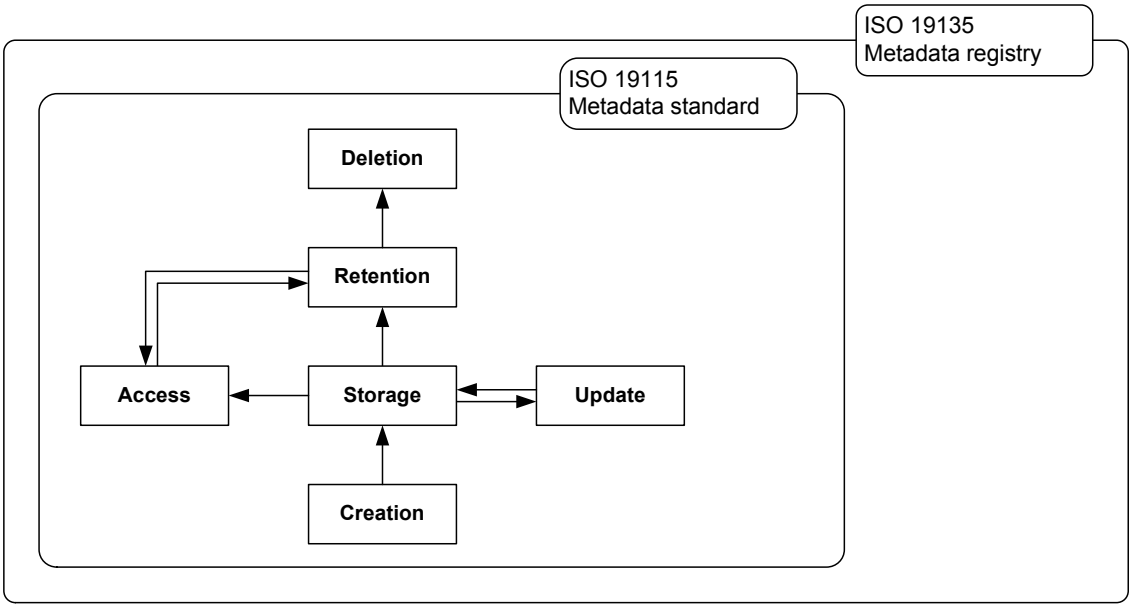


Figure 5.3.1 International standards for whole life data management

5.4 Data sharing culture

The benefits of following an objective-led process and improving the consistency of recording and managing metadata, throughout the whole data lifecycle, are likely to be limited unless there is a culture amongst the FCERM industry that embraces the principles contained within this guide. It is vital that a willingness to share data and tools enabling it to be shared, are actively encouraged and promoted in organisations. Part of this culture change should foster openness and trust leading to healthier partnerships within the FCERM community in the creation and maintenance of FCERM data.

References

Agarwal, P., 2005, Ontological considerations in GIScience, *International Journal of Geographical Information Science* Vol. 19, No 5, May 2005, 501-536.

Armstrong A. C., Davies, D. B. and Castle, D. A. 1990. 'Soil management and the control of erosion on agricultural land.' In *Soil Erosion on Agricultural Land*. (ed. J. Boardman, I.D.L. Foster and J.A. Dearing), pp. 569-574. John Wiley and Sons Ltd., Chichester, England.

Association of British Insurers, 2005. *Making Communities Sustainable. Managing flood risks in the Government's growth areas*. February 2005. ABI.

Association for Geographic Information/ Cabinet Office, 2004, *UK GEMINI Standard Version 1.0, A Geo-spatial Metadata Interoperability Initiative*, 12 October 2004.

Audi, R., 1995, *The Cambridge Dictionary of Philosophy* (Cambridge: Cambridge University Press).

Bateman, J., 2003, Liguistic Ontologies and a spatial slice. Available online at: http://www.informatik.uni-bremen.de/~roefer/rgo/1.2.pdf.

Beck, M.B. and Lin, Z., 2003. Transforming data into information, *Water Science and Technology,* Volume **147** Number 2, pp43-51, IWA Publishing 2003.

Berners-Lee, T., Hendler, J. and Lassila, O., 2001, The Semantic Web, *Scientific American* May 2001.

Bielders C. L., Ramelot C., Persoons E., 2003. Farmer perception of runoff and erosion and extent of flooding in the silt-loam belt of the Belgian Walloon Region. *Environmental Science & Policy*, **6**, Issue 1, February 2003, 85-93.

Bittner, T and Smith, B., A theory of granular partitions. In M. Duckham, M. Goodchild and M. Worboys (Eds), *Foundations of Geographic Information Science,* pp. 117-151 (London: Taylor & Francis).

Boardman J., Evans R., Ford J., 2003. Muddy floods on the South Downs, Southern England: problem and responses. *Environmental Science & Policy*, **6**, Issue 1, 69-83.

Brewster, C., Alani, H., Dasmahapatra, S. and Wilkes, Y., 2004. Data Driven Ontology Evaluation. *Advanced Knowledge Technologies*, August 2004, 164-168.

Brewster, C., Ciravegna and Wilkes Y., 2003. Background and Foreground Knowledge in Dynamic Ontology Construction: Viewing Text as Knowledge Maintenance, In *Proceedings of the Semantic Web Workshop*, Toronto, August 2003.

Cabinet Office, 2004, *Guide to GovTalk Documents Concerning Metadata & Controlled Vocabularies*, 19 March 2004.

Cabinet Office, 2005, *Which IVSP? A guide to the versions and formats available*, December 2005.
http://www.govtalk.gov.uk/schemasstandards/gcl.asp

Chambers Concise Dictionary, 1993, *Chambers Concise Dictionary*, W & R Chambers Ltd.

Chandrasekaran, B., Johnson, TR and Benjamins, V.R., 1999, Ontologies: what are they? Why do we need them? *IEEE Intelligent Systems and Their Applications*: Special Issue on Ontologies, **14,** pp. 20-26.

City of Bradford Metropolitan District Council, 2005. *Review to Consider the Future of Water Management and the Associated Problems of Flooding in the Bradford District.* Policy Development Service, City of Bradford MDC.

CIRIA, 2000, *Maximising the use and exchange of coastal data – a guide to best practice*. Report C541. CIRIA, London.

Curry, M.R., 2000, Geographical Practice and the Ontologies of Geographic Information Systems. Presented at the Annual Conference of the Association of American Geographers, Pittsburgh, PA,
http://baja.sscnet.ucla.edu/%7Ecurry/Curry-Ontology_GIS.pdf

Department of Environment Food and Rural Affairs, 2006, *SPIRE Programme Data Project, SPIRE Data Standard*, Version 1.0, 06 April 2006, SIP–DP–011.

Department of Environment, Food and Rural Affairs, 2005a, *Making Space for Water: Taking forward a new Government strategy for flood & coastal erosion risk management. A Delivery Plan.* Version 1.0 August 2005. Defra, London.

Department of Environment, Food and Rural Affairs, 2005b. *Making Space For Water. First Government response to the Autumn 2004 Making Space for Water, Consultation exercise*. March 2005. Defra, London.

Department of Environment, Food and Rural Affairs, 2005c. *Flood Risk Assessment Guidance for New Developments. Phase 2. Framework, Guidance and Tools for Assessing and Managing Flood Risk for New Development (Final Draft)*. R&D Technical Report FD2320/TR2. March 2005.

Department of Environment, Food and Rural Affairs, 2005d. *Delivery Plan for Flood Defence Service Delivery Agreements 26 and 27*. January 2005. Defra, Flood Management Division, London.

Department of Environment, Food and Rural Affairs, 2004a. *England and Wales: 2030-2100, Global Environmental Change Part B: Environmental Hazards,* Volume **5**, Issues 3-4, 51-65.
http://www.defra.gov.uk/corporate/orgchart.pdf- accessed November 24th 2004

Department of Environment Food and Rural Affairs, 2004b. *Introduction to the Modelling and Decision Support Framework.* July 2004. Rev: 9P5095/TD/Report/MDSF Handout.

Department of Environment, Food and Rural Affairs, 2004c. *Making Space for Water: Developing a new government strategy for flood and costal erosion risk management in England*, *A consultation exercise*. Defra, July 2004, London.

Department of Environment, Food and Rural Affairs, 2004d, *Procedural Guidance for Production of Shoreline Management Plans, Draft Final Guidance*, May 2004.

Department of Environment, Food and Rural Affairs, 2004e. *Position Review of Data and Information Issues within Flood and Coastal Defence* (R&D Technical Report FD2314/TR). April 2004, Defra/ Environment Agency.

Department of Environment, Food and Rural Affairs, 2003. *Delivery Plan for Implementing the Conclusions of the Flood and Coastal Defence Funding Review.* Defra, March 2003, London.

Department of Environment, Food and Rural Affairs, 2002a. *Flooding and Coastal Defence: Review of Funding*
http://www.defra.gov.uk/environ/fcd/studies/Report(All).pdf

Department of Environment, Food and Rural Affairs, 2002b. *Scheme Prioritisation System*. March 2002. Defra, London.

Department of Environment, Food and Rural Affairs, 2001, *Overview of Data Management Issues in Flood and Coastal Defence*. (W5G-007). Defra

Department of Environment, Food and Rural Affairs, 2001, Shoreline Management Plans. A guide for coastal defence authorities, June 2001

Defra, Environment Agency, Welsh Assembly Government, 2005, Catchment Flood Management Plans. Volume II - Processes and Procedures Guidance. April 2005

Eftec, 2004, *The Economics of Sustained marine Measurements*. London

Environment Agency, 2005a, Grimsby and Ancholme Catchment Flood Management Plan, Scoping Report, June 2005

Environment Agency, 2005b. *Flood Defence Data Review, Draft Project Report.*, February 2005.

Environment Agency, 2005c. *IFRM Change Programme, Phase2: Employee Guide.* January 2005, National IFRM Project team.

Environment Agency, 2004a. *Thames Estuary 2100, Data Research - Client Report.* December 2004, 04-EA-01/Reports/TE2100 – Data Research.

Environment Agency, 2004b. *Incident and Flood Risk Management Communication Plan*. November 2004.

Environment Agency, 2004c. *Incident and Flood Risk Management Handbook. Definition of roles and responsibilities resulting from Phase 1 of IFRM*. October 2004.

Environment Agency, 2004d. *National Property Dataset: Property data for England and Wales,* Halcrow in association with JB Chatterton & Associates, May 2004.

Environment Agency, 2004e. *National Flood Defence Data & Data Management Strategy.* Version1.0, February 2004.

Environment Agency, 2004f, *National Flood and Coastal Defence Database (NFCDD) Business Case for Phase 3*

Environment Agency, 2003a. *Environmental Quality and Social Deprivation. Phase II: National Analysis of Flood Hazard*, IPC Industries and Air Quality. R&D Project Record E2-067/1/PR2, September 2003.

Environment Agency, 2003b. *Strategy for Flood Risk Management 2003/4-2007/8*, Version 1.2, May 2003.

Environment Agency, 2001, *National Flood and Coastal Defence Database (NFCDD) Business Case.* Issue 1.3

Environment Agency, 2000a. *National Flood and Coastal Defence Database (NFCDD) Business Case for Phase 3*. Version 1.3, August 2003. SSUL/U7805/DOC/0005

Environment Agency, 2000b. *A Strategic Framework For Data And Information Management In The Agency*. October 2000, SATIS.

Environment Agency, 2000b. *National Flood and Coastal Defence Database (NFCDD) Business Case*. Issue 1.3, February 2000. SSUL/U7325/DOC/0003

Environment Agency, 1996, *Flood Defence Management Manual*, Bristol

EUROSTAT, 2002. *INSPIRE Reference Data and Metadata Position Paper*. October 2002.

Fonseca, F.T. and Egenhofer, M.J., 1999, Ontology-driven geographic information systems. In C.B. Medeiros (Ed.) 7th ACM Symposium on Advances in Geographic Information Systems, Kansas City, MO, pp.14-19.

Fonseca, F.T., Egenhofer, M.J., Agouris, P. and Camara, G., 2002, Using ontologies for integrated geographic information systems. *Transactions in GIS*, **6**, pp.231-257.

Foresight, 2003. *Foresight Flood and Coastal Defence Project: An Analysis of Future Risk of Flooding and Coastal Erosion for the UK between 2030-2100*. Office of Science and Technology, Dept of Trade and Industry, London. available http://www.dti.gov.uk/foresight

Fox, S. W., and Cooper, J. N., 2001. *Overview of data management issues in flood and coastal defence.* R&D Technical Report W5G-007/TR1. October 2001.

Flood Hazard Research Centre, 2004. *The Benefits of Flood and Coastal Defence: Techniques and Data for 2003*. Middlesex University - report commonly known as Multi-Coloured Manual (MCM).

Frank, A.U., 2003, A linguistically justified proposal for a spatio-temporal ontology. In Workshop on Fundamental Issues in Spatial and Geographic Ontologies, 23 September 2003. Available online at: http://www.comp.leeds.ac.uk/Brandon,cosi-t03ontology/

Gruber, T. R., 1993. A Translation Approach to Portable Ontology Specifications, *Knowledge Acquisition*, **5** (2), 199-220.

Guarino, N. and Giaretta, P., 1995, Ontololgies and knowledge bases: towards a terminological clarification. In N. Mars (Ed.), Towards Very Large Knowledge Bases: Knowledge Building and Knowledge Sharing, pp. 25-32 (Amsterdam: IOS Press).

Halcrow, 2002. *Prediction of future coastal evolution for SMP review*. FD2002. CSG15 Final Report. 2002.

Hamed, A., Preece, A. and Sleeman, D., 2004, Ontology Reconciliation, *Advanced Knowledge Technologies*, August 2004.

Harvey, F., Kuhn, W., Pundt, H., Bishr, Y. and Reidemann, C., 1999, Semantic interoperability: a central issue for sharing geographic information. Annals of Regional Science, Special Issue on Geo-spatial Data Sharing and Standardization, 33, pp. 213-232

Harvey A. M., 2001. Coupling between hillslopes and channels in upland fluvial systems: implications for landscape sensitivity, illustrated from the Howgill Fells, northwest England. *CATENA*, **42**, Issues 2-4, 225-250.

Howarth, W., 2002. *Flood Defence Law*, Shaw and Sons, pp 552.

HM Treasury, 2003, *The Green Book. Appraisal and Evaluation in Central Government*, London

HR Wallingford, 2003. *Integrated Catchment Management and Land Use Planning. Benchmark report on existing 'know-how' within the EU*. SMURF. July 2003.

HR Wallingford, 2002. *Southern North Sea sediment transport study, Phase 2. Sediment transport report*. Report EX5426. August 2002.

Institution of Civil Engineers, 1996. *Land Drainage and Flood Defence Responsibilities*. 3rd Edition, Thomas Telford.

International Standard, 2003, ISO19115:2003(E) Geographic information – Metadata.

Land Use Policy Group, 2004. *The Integration of Agricultural, Forestry and Biodiversity Conservation Policies with Flood Management in England and Wales.* Countryside Council for Wales, June 2004.

Mann, W.R., 2000, The Discovery of Things: Aristotle's Categories and their Context (Princeton, NJ: Princeton University Press).

Mayon-White, W. and Dyer B., 1997, Principles of good practice for information management, Version 2.0 IMDA, London School of Economics. British Standards Institute.

McCue, J, Millard, K, von Lany, P and Clark, M. (2004), Position *review of data and information issues within flood and coastal defence.* R&D Technical Report FD2314/TR. April 2004.

Ministry of Agriculture, Fisheries & Food, 1999a. *Flood and Coastal Defence Project Appraisal Guidance: Economic Appraisal (FCDPAG3)*. MAFF Publications, London.

Ministry of Agriculture, Fisheries & Food, 1999b. *High Level Targets for Flood and Coastal Defence and Elaboration of the Environment Agency's Flood Defence Duty*. Defra

Ministry of Agriculture, Fisheries & Food, 1993. *Strategy for Flood and Coastal Defence.* MAFF and Welsh Office Publication PB2197, London

Mizoguchi, R., Van Welkenhuysen, J. and Ikeda, M., 1995, Task ontology for reuse of problem solving knowledge. In NJ.I. Mars (Ed.), Towards Very Large Knowledge Bases, pp. 46-57 (Amsterdam: IOS Press).

Morris, C., 2004. Networks of agri-environmental policy implementation: a case study of England's Countryside Stewardship Scheme, *Land Use Policy*, **21**, Issue 2, 177-191.

Morris, J., 2003, Economic and Financial Appraisal of Flood Defence for Agriculture, in Penning-Roswell E, Johnson C, Tunstall S, Tapsell S, Morris J, Chatterton J, Coker A and Green C, (2003), *The Benefits of Flood and Coastal Defence, Data and Techniques for 2003*. Flood Hazard Research Centre, Middlesex University.

Morris, J., 1992. Agricultural land drainage: Land use change and economic performance: experience in the UK. *Land Use Policy*, **3** (9), July, 185-198.

Morris, J., Bannister, N., Hess, T. M., Gowing, D., Leeds-Harrison, P. B., Vivash, R. and Wade, M., 2004a *Integrated Washlands for Flood Defence and Biodiversity*, Report to Defra and English Nature, Cranfield University at Silsoe, Bedford - available www.silsoe.cranfield.ac.uk

Morris J., Hess T., Gill A., Howsam P., and White S., 2004b. The Water Framework Directive and Flood Management – a missed opportunity? *Proceedings of 39th Defra Flood and Coastal Management Conferenc*e, June 28th July 1st 2004.

National Audit Office, 2004. *Out of Sight – not out of mind: Ofwat and the public sewer network in England and Wales,* Report by the Comptroller and Auditor General, HC161 Session 2003-2004:16 January 2004. House of Commons.

Natural Environment Research Centre, 2003. *Environmental Information Systems for Planners: Final Report,* prepared for the Office of the Deputy Prime Minister (MP0673), October 2003.

Neath Port Talbot Borough Council, Undated. *Environment. Drains, Sewers and Riparian Land Drainage, A guide to your responsibilities,* Neath Port Talbot BC.

Noy, N. F. and McGuinness, D. L., 2001. *Ontology Development 101: A Guide to Creating your First Ontology*, Technical report KSL-01-05, Stanford Knowledge Systems Laboratory, Stanford University, Stanford, CA.

NOAA and ONR, 2000, *The Economics of Sustained Ocean Observations: Benefits and rationale for public funding*.

O'Connell, P.E., Beven, K. J., Carney, J. N., Clements, R. O., Ewen, J., Fowler, H., Harris, G. L., Hollis, J., Morris, J., O'Donnell, G. M., Packman, J. C., Parkin, A., Quinn P. F. and Rose S. C., 2004. *Review of Impacts of Rural Land Use and Management on Flood Generation*. Part A: Impact Study Report. Report to Defra/Environment Agency R&D Technical Report (FD2114).

Office of Deputy Prime Minister, 2004. *Planning Policy Guidance 25*: http://www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=3449&l=3 web page accessed in December 2004

Office of Science and Technology, 2004. *Foresight Future Flooding Executive Summary*. Office of Science and Technology.

Oxford English Dictionary, 2003, On-line Oxford English Dictionary.

Penning-Rowsell, E., Johnson, C., Tunstall, S., Tapsell, S., Morris, J., Chatterton, J., Coker, A. and Green, C., 2003. *The Benefits of Flood and Coastal Defence, Data and Techniques for 2003*. Flood Hazard Research Centre, Middlesex University.

Plate E. J., 2002. Flood risk and flood management, *Journal of Hydrology*, **267**, Issues 1-2, 2-11.

Posford Haskoning, 2002. *Estuaries Research Programme, Final Report*. December 2002.

Posford Haskoning, 2002b. *Operations and Maintenance Concerted Action Report*, December 2002. R&D Technical report W5A-059/TR/3

Price, C. and Spackman, K., 2000, SNOMED clinical terms, *British Journal of Healthcare Computing & Information Management* **17**(3):27-31.

Riedemann, C. and Kuhn, W., 1999, What Are Sports Grounds? Or: Why Semantics Requires Interoperability, International Conference on Interoperating Geographic Information Systems, Lecture Notes in Computer Science 1580, Zurich, pp. 217-229 (Berlin:Springer).

Smith, B., 1999, Ontology: philosophical and computational, http://wings.buffalo.edu/philosophy/faculty/smith/articles/ontologies.htm

Sowa, J.F., 2000, Knowledge Representation. Logical, Philosophical and Computational Foundations (Pacific Grove, CA: Brooks/Cole).

Staab, S. and Studer, R. (editors), 2003, Handbook on Ontologies, in *International Handbooks on Information Systems*, Springer-Verlag.

Studer, R., Benjamins, R. and Fensel, D., 1998, Knowledge engineering: principles and methods. *Data and Knowledge Engineering*, **25**, pp.161-197.

Swartout, B., Patil, R., Knight, K. and RUSS, T., 1996, Toward distributed use of large-scale ontologies. In Proceedings of 10th Knowledge Acquisition for Knowledge-Based Systems Workshop, Banff, Canada. Available online at: http://ksi.cpsc.ucalgary.ca/KAW/KAW96/KAW96Proc.html.

UKBAP, 2003. UK Biodiversity Website. http://www.ukbap.org.uk/ [accessed 23/07/2003].

Uschold, M. and Gruninger, M., 1996, Ontologies: principles, methods and applications. *Knowledge Engineering Review*, **11**, pp. 93-155.

WaterVoice, 2002. FAQs: Who is responsible for the drains and sewers at my property, 28/10/02, http://www.watervoice.org.uk/aptrix/ofwat/publish.nsf/Content/responsibilityFordrainsandsewers – web page accessed in April 2005.

Welsh Assembly, 2004. *Technical Advice Note 15: Development and Flood Risk* Planning Policy Wales, July 2004 (TAN 15), http://www.wales.gov.uk/subiplanning/content/tans/tan15/july04-tan15-e.pdf - Web page accessed in December 2004.

Williams, A., 2005, *Cell 11 CERMS Regional Monitoring Strategy 2005-2010*, Sefton Borough Council (lead authority on behalf of Cell 11).

World Commission on Environment and Development, 1987. *Our Common Future*, Oxford University Press, Oxford.

Van Heijst, C., Schrieber, A. and Wielinga, B., 1996, Using explicit ontologies in KBS development. *International Journal of Human-Computer Studies*, **45**. 183-292.

Websites consulted:

Http:www.abi.org.uk/housing

Http://www.defra.gov.uk/

Http://www.cefas.co.uk/wavenet/

Http://www.ceh.ac.uk/data/FEH.htm – visited 14 April 2005

Http://www.channelcoast.org

Http://www.cordis.lu/ist/

Http://www.corepoint.ucc.ie/index.php

Http:www.countryside.wales.gov.uk/fe/textonly.asp?n1=366&n2=734&n3=735 – visited 13 April 05

Http://www.eu-orchestra.org/index.shtml

Http://www.foresight.gov.uk/

Http://www.met-office.gov.uk

Http://www.nao.org.uk/publications/ nao_reports/03-04/0304161.pdf – visited 19 April 2005

Http://www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=4136&l=2 – SEA Directive visited 14 April 2005

Http://www.ofwat.gov.uk/

Http://oiled.man.ac.uk

Http://www.ontoknowledge.org/oil/

Http://www.ordnancesurvey.co.uk/oswebsite/partnerships/research/collaboration/semanticinter.html

Http://www.pol.ac.uk/ntslf/

Http://www.se.coastalgroup.org.uk

Http://www.water.org.uk/

Http://www.watervoice.org.uk/aptrix/ofwat/publish.nsf/Content/navigation-watervoice-homepage

Appendix A

This page is purposefully blank

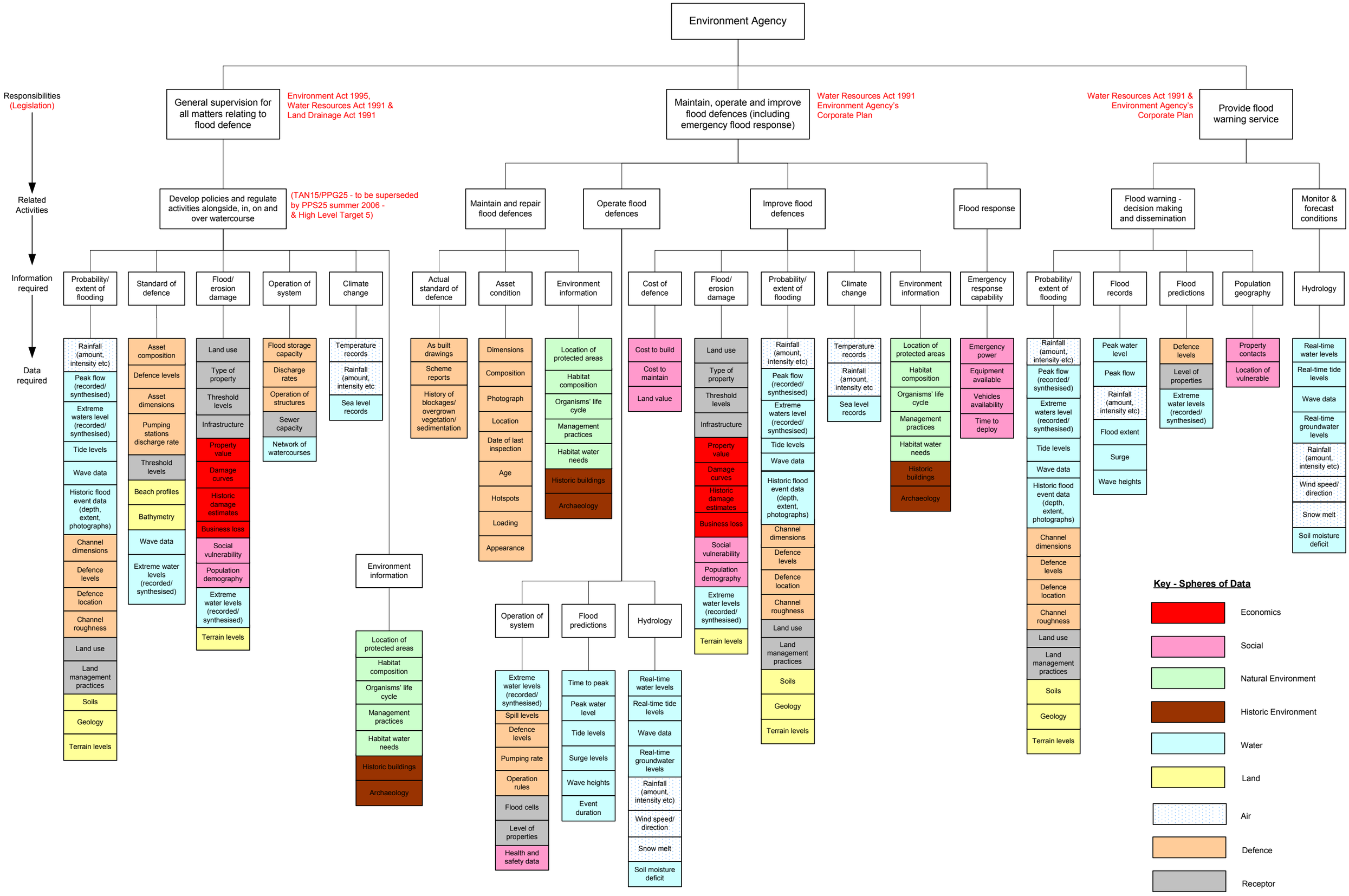


Chart A1. Environment Agency FCERM responsibilities and data requirements flow chart

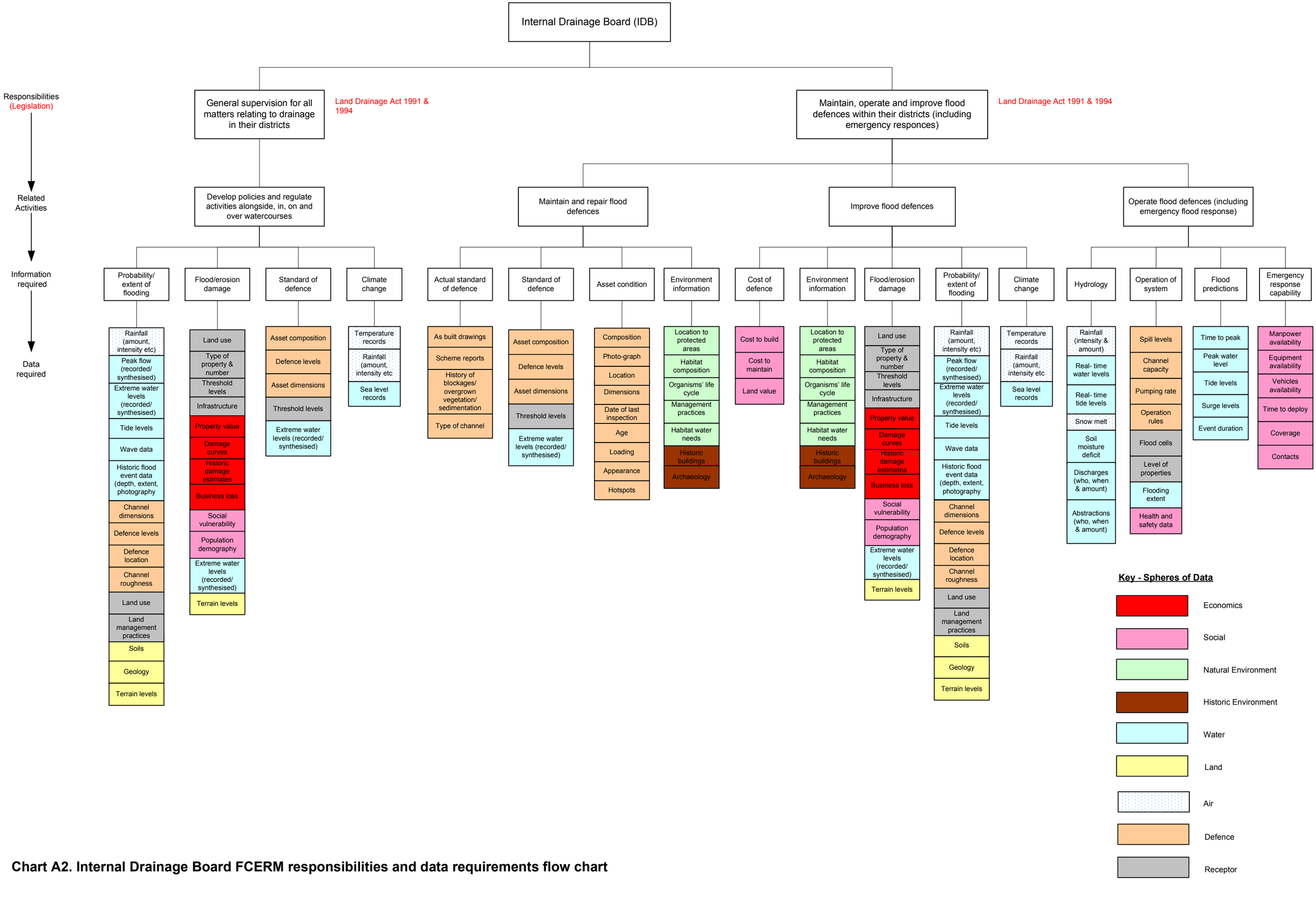


Chart A2. Internal Drainage Board FCERM responsibilities and data requirements flow chart

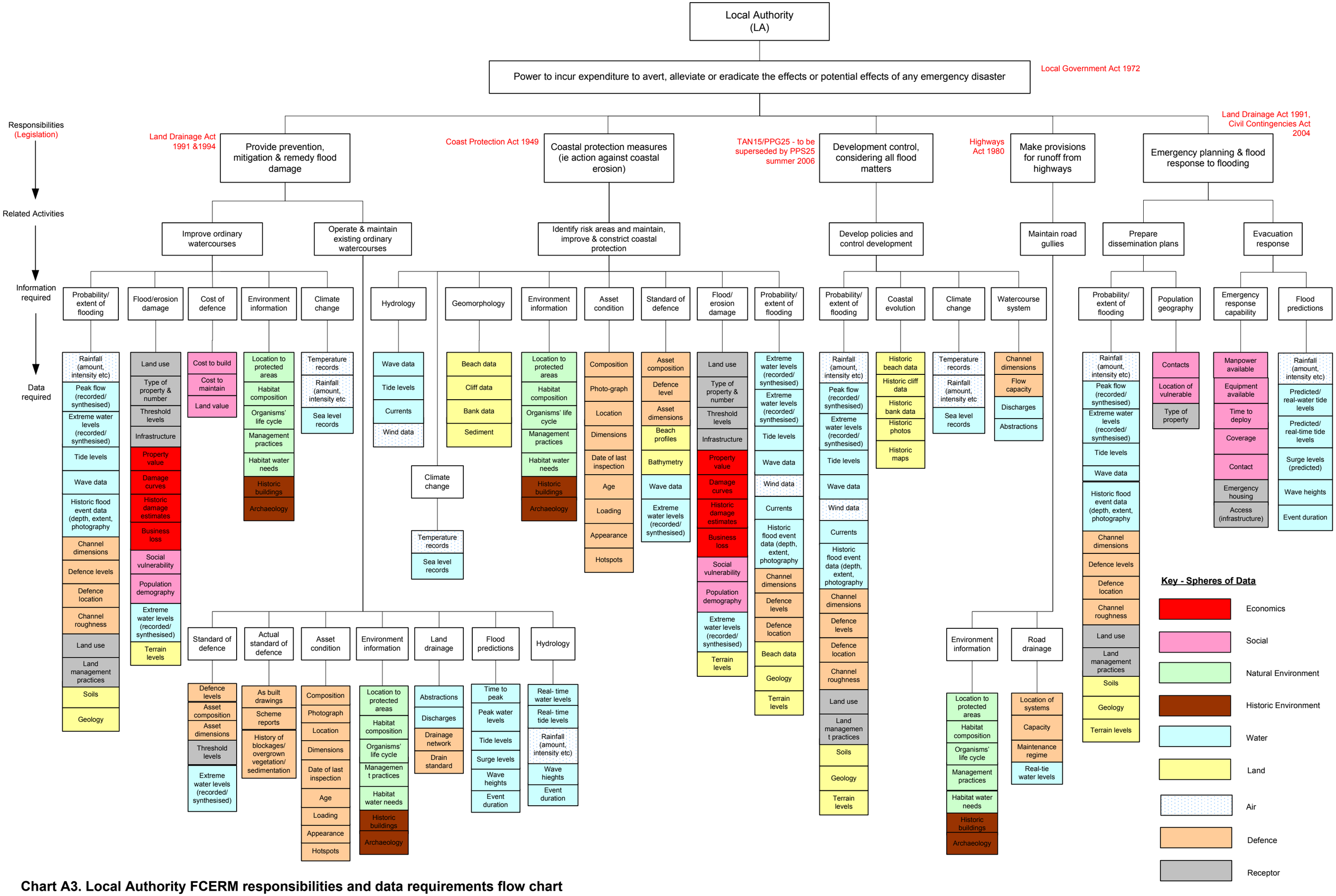


Chart A3. Local Authority FCERM responsibilities and data requirements flow chart

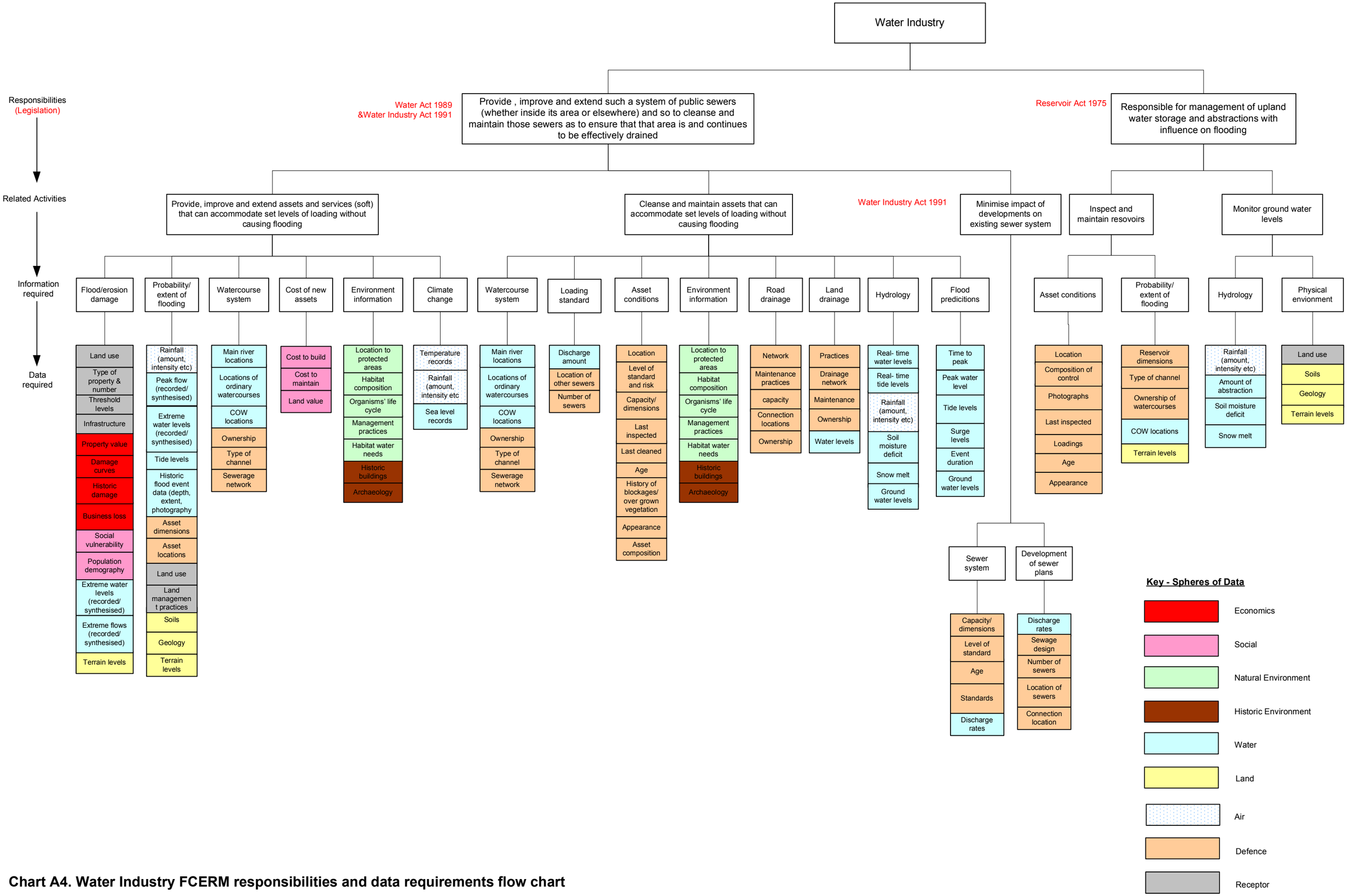


Chart A4. Water Industry FCERM responsibilities and data requirements flow chart

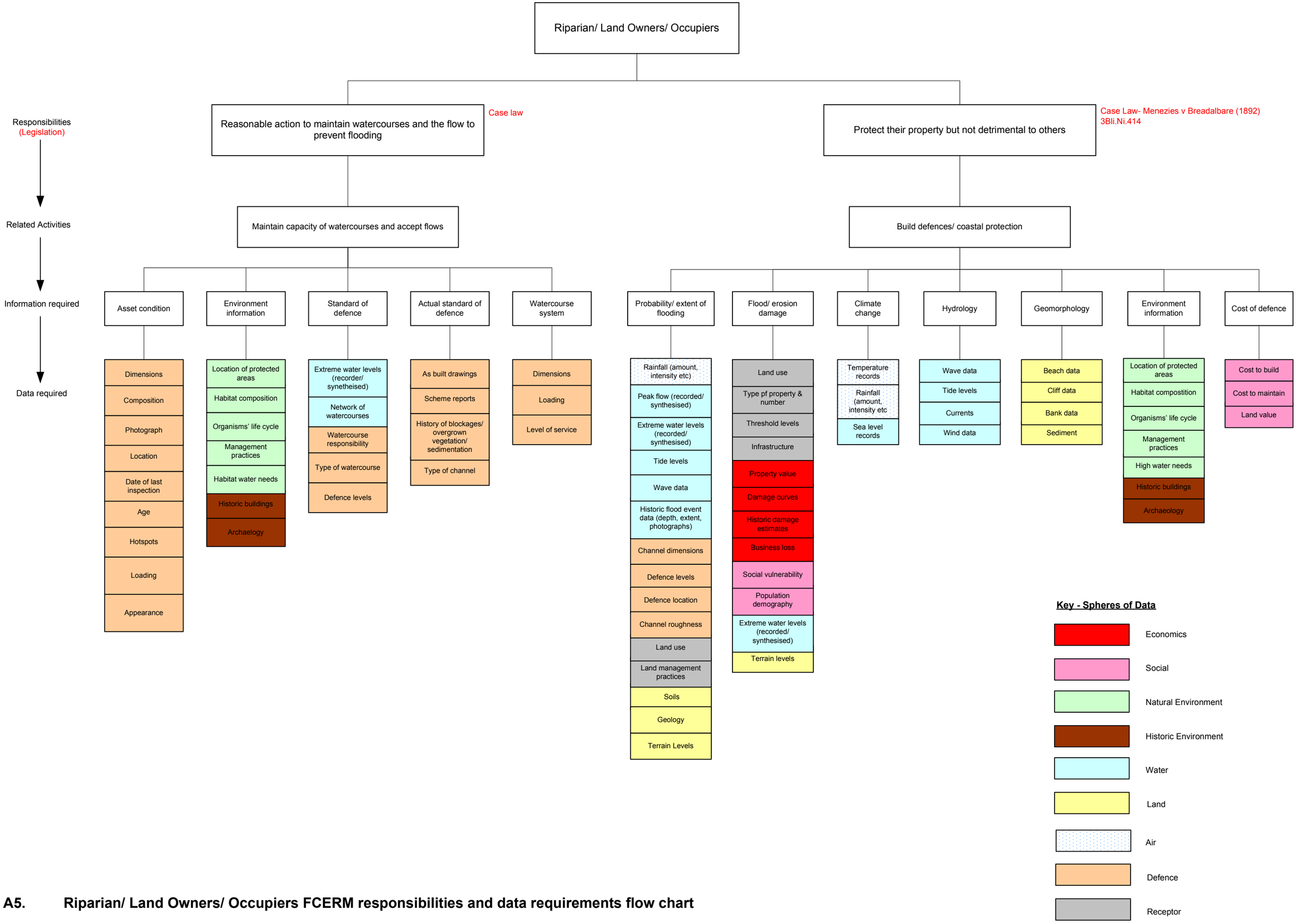


Chart A5. Riparian/ Land Owners/ Occupiers FCERM responsibilities and data requirements flow chart

Appendix B

This page is purposefully blank

Appendix B – Example of data quality flagging for optimisation

The variables that are most sensitive to investment decisions should be identified in assessing investment decision to optimise the quality of data. For example, the variation by a few millimetres in water levels for extreme tide levels in Thames Estuary (see Thames Estuary 2100 appraisals) may have a minor impact on the investment decision but inappropriate estimations of property foot prints from secondary source data relating to tens of thousands of properties may change results by an order of magnitude, and yet more money will often be spent on getting hydraulic modelling correct, perhaps with large incremental costs and possibly little incremental benefits.

Data Quality Scores are devised to measure the confidence in receptor or socio-economic data. Thus the table below (Table B1) is employed with a filtering algorithm to ensure that investment decisions are made only when data quality (for socio-economic parameters, i.e. land use, depth damage data applied, threshold levels, footprints of properties) is of such a standard that the benefits of Investment (wholly reliant on the quality of the multifarious input data) are stabilised.

Table B1 System of Data Quality Scores (DQS)

DQS	Description	Explanation
1	'Best of Breed'	No better available, unlikely to be improved on in near future
2	Data with known deficiencies	To be replaced as soon as third parties re-issue
3	Gross assumptions	Not made up but deduced by the project team from experience or related literature/data sources
4	Heroic assumptions	No data sources available or yet found; data based on purely educated guesses
5	Unknown	Accuracy unspecified

The stark significance of data quality is illustrated by the Lower Thames Feasibility study, in the Teddington, Kingston area of south west London. Data quality was systematically improved using the filtering process until 'Do Nothing' Baseline damages were stabilised at an order of magnitude below initial data assumptions, Figure B1. The data assumptions for each 'CUT' or Filter are summarised in Table B2.

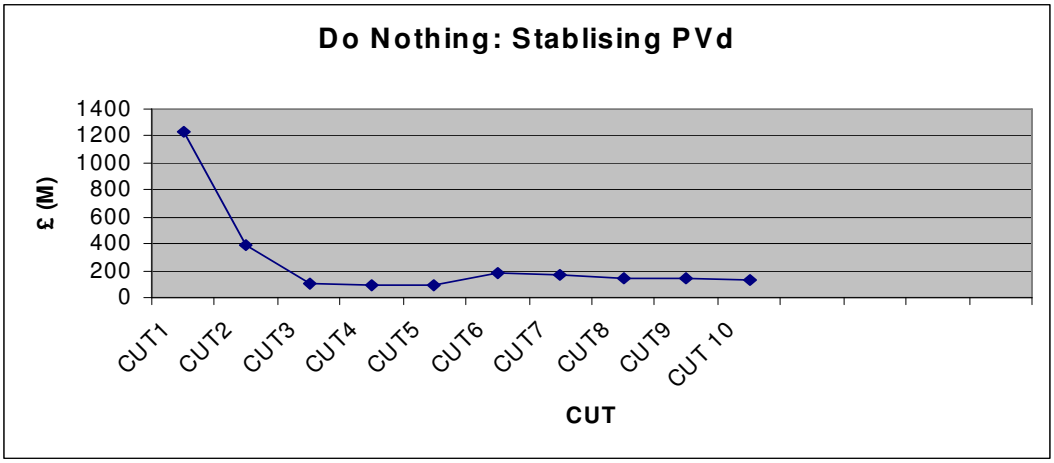


Figure B1 Stabilising PVd using filtering process

The volatility of LiDAR data for simulating property thresholds, erroneous interpretation of land use from the Environment Agency National Property Dataset (NPD) without field checks, regional (not actual) property footprints and sparse spatial representation of water surface levels with limited return period analysis combine to exaggerate significantly the Present Value of damage estimates (£1,229 million for first cut to £132 million for the preferred (stabilised) cut (Table B1).

Table B2 Data assumptions for each cut/ filter

Cut N°	PVd £ millions	Data Characteristics								
		Water Surface	**Property Threshold**	**DQS**	**Footprint Area**	**DQS**	**Land Use Code**	**DQS**	**Depth Damage Data**	**DQS**
1	1,229	2 water levels for 3 return periods; U/s level linked to D/s; with no intermediate	LiDAR	4	Areas from MDSF mean values	3	NPD, no field checks	2	NPD Approx C	Various
2	387	103 co-ordinates for 7 return periods	Mean of levelled thresholds within each of 20 sub-areas	3	OS MasterMap	1	NPD, no field checks	2	NPD Approx C	Various
3	104	103 co-ordinates for 7 return periods	Mean of levelled thresholds within each of 20 sub-areas	3	OS MasterMap	1	First Field checks	1 & 2	NPD Approx C	Various
4	90.2	103 co-ordinates for 7 return periods	Mean of levelled thresholds within each of 20 sub-areas	3	OS MasterMap	1	Further field checks, reducing properties, confirming land use	1 & 2	NPD Approx C	Various
5	91.6	103 co-ordinates for 7 return periods	Mean of levelled thresholds within each of 20 sub-areas	3	OS MasterMap	1	As 4	1 & 2	Weighted Mean of all NRP D/D in Approx C	2
6	181	110 co-ordinates for 7 return periods with increased water levels	Mean of levelled thresholds within each of 20 sub-areas	2	OS MasterMap	1	As 4	1 & 2	NPD Approx C	Various
7	175	110 co-ordinates for 7 return periods with increased water levels	Mean of levelled thresholds from increased sample	2	OS Mastermap	1	As 4	1 & 2	NPD Approx C	Various
8	139	110 co-ordinates for 7 return periods with increased water levels	Threshold adjustments from Halcrow LiDAR Analysis	1 or 2	OS Mastermap	1	As 4	1 & 2	NPD Approx C	Various
9	147	819 water Level Points for 7 return periods	Threshold adjustments from Halcrow LiDAR Analysis with corrections to spurious geo-references	1 or 2	OS Mastermap		As 4	1 or 2	NPD Approx C	Various
10	132	819 water Level Points for 7 return periods. 7 sub-areas and water profile adjustments		1 or 2	OS Mastermap	1	As 4	1 & 2	NPD Approx C	Various

Appendix C

This page is purposefully blank

Appendix C – Example of applying FCDPAG3 evaluation techniques

The Coastal Erosion Risk Management Strategy (CERMS) for Cell 11 Regional Monitoring Strategy (Williams, 2005) successfully applied Defra's PAG3 methodology to developing a business case (PAR - Project Appraisal Report) for a technically feasible and cost beneficial Regional strategy for monitoring of coastal activities.

It is recognised amongst the majority of coastal managers that monitoring of shoreline behaviour, and the natural processes influencing it, is fundamental to future understanding and hence informing sustainable management decisions both immediate and into the future.

The overall Cell 11 (Dee to Solway) regional monitoring system comprises the collection, collation, analysis, reporting and dissemination of data and information within the following generic categories:

- Defence and Shoreline Inspections
- Inter-tidal surveys - beach profiles/topographic surveys; saltmarsh surveys; sediment sampling; inter-tidal skears etc
- Hydrographic surveys - estuaries, open coast lengths
- Airborne remote sensing - inter-tidal habitats, cliffs, sand dunes, feature changes
- Primary Process Information - waves, tides, sediment movement etc
- Ecological/Biological monitoring

The report recognised that the benefits of a regional monitoring strategy broadly include:

- Scientific Benefits
- Economic Benefits, and
- Biodiversity Benefits

Scientific Benefits

The 1999 Penning-Rowsell Defra R & D committee suggested that increased research expenditure was required in relation to risk and that unless data collection was continued or improved, adequate understanding of coastal processes and morphology could not be made. In particular, the committee identified the need for:

- Continuation of accurate and up-to-date data acquisition to assist with planning design and implementation of effective flood and coastal defences.
- Improved accuracy of predictions as a result of using a longer time series of data;
- Examination of long-term, system wide, coastal and estuarine sediment and morphological processes.

- Long-term, systematic monitoring of bathymetric evolution of coastlines and estuaries.
- Long-term wave recording in coastal waters
- Monitoring wildlife habitat changes in response to flood defence implementation.

The approach identified within CERMS goes significantly towards meeting these needs and the development of CERMS will provide the following scientific benefits:

- Improved information to support risk evaluation and assessment
- Provision of data to support High Level Targets set by government
- Improved information in relation to future shoreline planning including strategy preparation, informing the on-going SMP review process etc.
- Better definition of coastal process behaviour for future coastal defence design
- Better definition and understanding of changes to natural defence forms and habitats
- Early identification of defects and problems and improved confidence in estimates of residual life expectancies for artificial defences
- Improved understanding of historical shoreline evolution and improved information to support prediction of future evolution of the shoreline to build on the information provided by “Futurecoast”
- Improved quality control and assurance of data collected

Economic Benefits

Economically, the potential benefits arising from implementation of CERMS, to both local shoreline managers and communities and to the nation as a whole, arise from the following:

- Benefits to Strategic Planning, including
    - Savings in field data collection required for studies, coastal strategies and SMPs
    - Efficiency savings in time arising from acquisition and checking of historical data
    - Cost savings arising from improved phasing of future schemes and works

- Benefits in design, construction and maintenance of capital schemes, including
    - Savings in data collection required for schemes
    - Savings due to improved confidence and efficiency of design
    - Savings arising from non-commercial supply of materials e.g. beach recharge
    - Availability of historic measured wave data for use in coastal defence studies
    - Early identification of defects and problems providing for more cost efficient maintenance

    - Reduction in damage levels to structures as a result of storms

- Improved efficiency of monitoring management, including:
    - Procurement efficiency
    - Efficiency savings in contract management
    - Economy of scale in system development and refinement
    - Maintenance of data value through preservation of data

- Benefits from the supply of information, including
    - The value of data being collected and made available for use by a wide range of bodies with different requirements and needs

Benefits for Biodiversity & Conservation

Recommendations from Shoreline Management Plans and flood defence coastal strategy studies have consistently identified a requirement for the development of coastal monitoring programmes. The current approach to biodiversity monitoring is generally piecemeal, being undertaken locally to meet the requirements of specific SMP or Strategy Plan recommendations. There is a real opportunity through this strategic approach to deliver a single, baseline of the biodiversity resource in the coastal zone of the North West Region, to provide opportunities for creation of coastal habitats and monitor losses and gains.

The benefits of a strategic approach to monitoring of the coastline are as follows:

- A regional approach to coastal biodiversity habitat monitoring will detect changes to coastal biodiversity and help ensure that coastal management is carried out with these trends in mind. This in turn will allow a more effective approach to spatial planning and ensure that there is a better understanding of the impact of climate change on the development of the coastal zone. This will result in a more sustainable approach to managing and developing the coastal zone.

- Strategic monitoring provides an opportunity to further develop partnerships across the Region and will allow the organisations to share experience, expertise and data. This contributes towards a best value approach to delivering protection and enhancement of biodiversity.

- The mapping and monitoring of coastal habitat will provide best value by achieving economies of scale and ensuring that an appropriate biodiversity monitoring programme is implemented across the North West

The Cell 11 Regional monitoring strategy followed the principles of PAG3 economic appraisal to consider the most cost beneficial (and technically feasible) option for data monitoring and applies prescription to the cost saving percentages for a wide range of activities over the project lifetime. The benefits and cost savings are summarised in Table C1.

Table C1. Economic Benefits of a Regional Monitoring Strategy

Activities	Benefits	Savings
Strategic Planning		
Savings in field data collection required for studies, coastal strategies and SMPs	Current annual expenditure on strategic studies includes a significant proportion on data collection and processing.	20% of total costs of study
Efficiency savings in time arising from acquisition and checking of historical data	Regional monitoring will provide a consistent approach to data management, an excellent searchable meta-database, a data quality control system and rapid electronic delivery of data. Users of data will be able to find, gather and assert provenance of the data very quickly.	£5,000 to £10,000 per study
Savings arising from improved phasing of schemes	Schemes are often implemented earlier than may actually be required to maintain the necessary standard of service, because there is insufficient high quality data available to enable the scheme designer to proceed with sufficient confidence that standards will be maintained.	Deferring scheme implementation by 3 Years results would result in discounted cost savings of approximately 10%; similarly, deferring scheme costs by 5 years would result in discounted cost savings of 16%.
Benefits in design and construction of capital schemes		
Savings in data collection required for schemes	Savings arise as the result of reducing the need for scheme specific monitoring, although some such monitoring will still be needed to provide more detailed data	A range of between 2-10% of the total monitoring costs is assumed to be of direct value.
Savings due to improved confidence and efficiency of design	Significant savings can arise from use of reliable models of wave climate, water levels, and foreshore response, based upon long time series of data. Risks associated with each option may be reduced, and greater confidence provided to any factor of safety applied.	1) Cost savings made by reduction in crest level of beach recharge (=5%) 2) Cost savings made by reduction in crest level of rock armour sea walls (=3%) 3) Cost savings made by reduction in crest level of concrete sea walls (=1%)
Savings due to improved confidence and efficiency of design (continued from above)	In many cases this will result in a direct saving in project costs, since the quantities of materials can often be reduced.	4) Cost savings made by reduction in crest level of earth embankments (= 5% estuary; 1% SMP)
Availability of historic measured wave data for use in coastal defence studies	1) Historic data for use in coastal defence studies: · 2) Historic data for use in climate studies: Intangible benefits 3) Near real time data for use by EA in coastal flood forecasting 4) Near real time data for use by UKMO as input to operational wave forecasting 5) Navigation and recreation benefits	Case specific

Appendix D

This page is purposefully blank

Appendix D – Demonstration of Data Appraisal Framework

The aim of the case studies is to demonstrate the Data Appraisal Framework and as part of this, illustrate the use of data quality flags for ranking data and judging if data is "fit for purpose." The framework has been described in Section 3.3.6 of the guide.

(a) Fluvial

Environment Agency carrying out a CFMP within Ancholme and Grimsby catchments – Would like to assess ground levels every 2 metres in order to calculate flood damages.

(b) Coastal

Sefton District Council carrying out coastal defence management planning – Would like to assess change in shoreline to help plan maintenance

(a) Fluvial

Q. What is my objective?
A. To calculate flood damages for Ancholme and Grimsby CFMP.

Q. What data quality do I need?
A. I need to have ground levels every 2 metres.

Q. Does it exist?
A. No, it does not exist. Searched a metadatabase (see print out below).

Q. Is it House-keeping? Do I require it to make an informed judgement?
A. No, it is not house keeping as an informed judgement can be made using coarser ground level data.

Q. Is there substitute data that is suitable for my objective?
A. Yes, SAR data exists for the area

Quality Flags Scores:	Accuracy:	2 (Data with known deficiencies)
	Age:	1 (< 5 years old)
	Spatial resolution	every 25m

Resolution seems out of proportion. Contacted distributor who advised that it is an error; it should say every 5 metres. This is an acceptable level to carry out task. Also the data was collected recently and so there is less risk that terrain has altered. Manhole cover levels data also exists that has a higher accuracy rating than SAR. This could be used to calibrate SAR levels to gain more confidence in ground levels.

Organisation selected:	Environment Agency
Scale selected:	Local / Anglian - Northern
Activity selected:	Develop policies & regulate activities alongside, in, on & over the watercourse
Sub-activity selected:	Develop Catchment Flood Management Plan (CFMP)
Task selected:	Identify large-scale urban development issues

Number of results:	3
Information required used in search:	«Flood/erosion damage»
Additional keywords used in search:	«Topography» «Elevation Data»

Back Reset

Metadata available:

Title: North Lincolnshire SAR
Alternative Title:
Abstract: Digital topographical data (Synthetic Aperture Radar) which is a coarse version of LiDAR
Distributor: Environment Agency

Accuracy: 2 - Data with known deficiencies
Reason For Decision On Accuracy: Not quite best of breed
Age Of Data: <5 years old
Spatial Resolution: Captured every 25m
Temporal Duration: <5 years Start: 01/10/2003 End: 01/10/2003
Relevance Ranking: 1(«Flood/erosion damage»)

Title: Ordnance Survey 1:50K maps
Alternative Title:
Abstract: 50K maps for West Lindsey District
Distributor: Ordnance Survey

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Robust methodology
Age Of Data: <5 years old
Spatial Resolution: 50m
Temporal Duration: <5 years Start: 01/09/2003 End: 01/09/2003
Relevance Ranking: 1(«Flood/erosion damage»)

Title: Anglian Water Manhole covers
Alternative Title: North Lincolnshire Assets
Abstract: Digital maps showing elevation and location of manhole covers in North Lincolnshire
Distributor: Anglian Water

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Ground survey with GPS
Age Of Data: <5 years old
Spatial Resolution: precision +/-50mm
Temporal Duration: <5 years Start: 05/06/2003 End: 05/06/2003
Relevance Ranking: 1(«Flood/erosion damage»)

Q. Can it be improved?
A. Yes, but not required for my purpose

Outcome: Obtain both pieces of data and use them.

Discussion: At a catchment scale, ground levels every 2 metres were needed for use in a Catchment Flood Management Plan (CFMP). This was deemed to be opportunity data since lower quality data could be used. Although this data did not exist, substitute data existed at a lower spatial resolution which was appropriate for the task. Therefore existing data was maximised and additional efforts reduced.

(b) Coastal

Q. What is my objective?
A. Coastal defence management planning for Sefton District Council

Q. What data quality do I need?
A. Long record of shoreline change to help plan maintenance.

Q. Does it exist?
A. Yes, annual beach profiles exist. Searched metadatabase (see print out below).

Q. Is it fit for my purpose?
A. Yes. It has been recorded since 1996 and so is fit for purpose.

Q. Is it higher than my required quality?
A. No.

Q. Can I improve my decision with better data?
A. Yes, I could improve my decisions if had a longer record. The beach profiles date back to 1996 and have been assigned an accuracy flag of 1 since the technique used is GPS, and so are the best available data. However, should ensure that data is collected to the same standard in the future.

Outcome: Obtain and use them.

Discussion: If the profiles had been entered as a single entry then the "Length of record" (Temporal duration) would have returned a useful value. This would have helped determine the appropriateness of the data. The value of data in this case is the monitoring of the beach, therefore this value can be used to justify the continued programme of profiles. Also once the data has been viewed, a decision can be made to take profiles more frequently should the user discover that the coastline is particularly dynamic from using other data (considering the data coherence principle).

Metadata available:

Title: 2004profileline
Alternative Title: 2004 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: <5 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/2004 End: 01/08/2004
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 2003profileline
Alternative Title: 2003 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: <5 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/2003 End: 01/08/2003
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: Futurecoast
Alternative Title: Shoreline Behaviour Statements
Abstract: Consists of three elements: 1. Coastal Behaviour Statement. 2. Assessment of shoreline behaviour. 3. Local-scale Shoreline Response Statements
Distributor: Defra

Accuracy: 2 - Data with known deficiencies
Reason For Decision On Accuracy: road Scale datasets assembled at a national level
Age Of Data: <5 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/10/2002 End: 01/10/2002
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 2002profileline
Alternative Title: 2002 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: <5 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/2002 End: 01/08/2002
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 2001profileline
Alternative Title: 2001 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/2001 End: 01/08/2001
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 2000profileline
Alternative Title: 2000 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/2000 End: 01/08/2000
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 1999profileline
Alternative Title: 1999 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/1999 End: 01/08/1999
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 1998profileline
Alternative Title: 1998 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/1998 End: 01/08/1998
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 1997profileline
Alternative Title: 1997 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/1997 End: 01/08/1997
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

Title: 1996profileline
Alternative Title: 1996 Beach Profiles
Abstract: Point data of Sefton Coast beach profile topographic surveys recorded using GPS
Distributor: Sefton Council Coastal Defence

Accuracy: 1 - Best of Breed
Reason For Decision On Accuracy: Technique uses GPS
Age Of Data: 5 - 10 years old
Spatial Resolution:
Temporal Duration: <5 years Start: 01/08/1996 End: 01/08/1996
Relevance Ranking: 2(«Geomorphology»«Coastal evolution»)

This page is purposefully blank

Appendix E

This page is purposefully blank

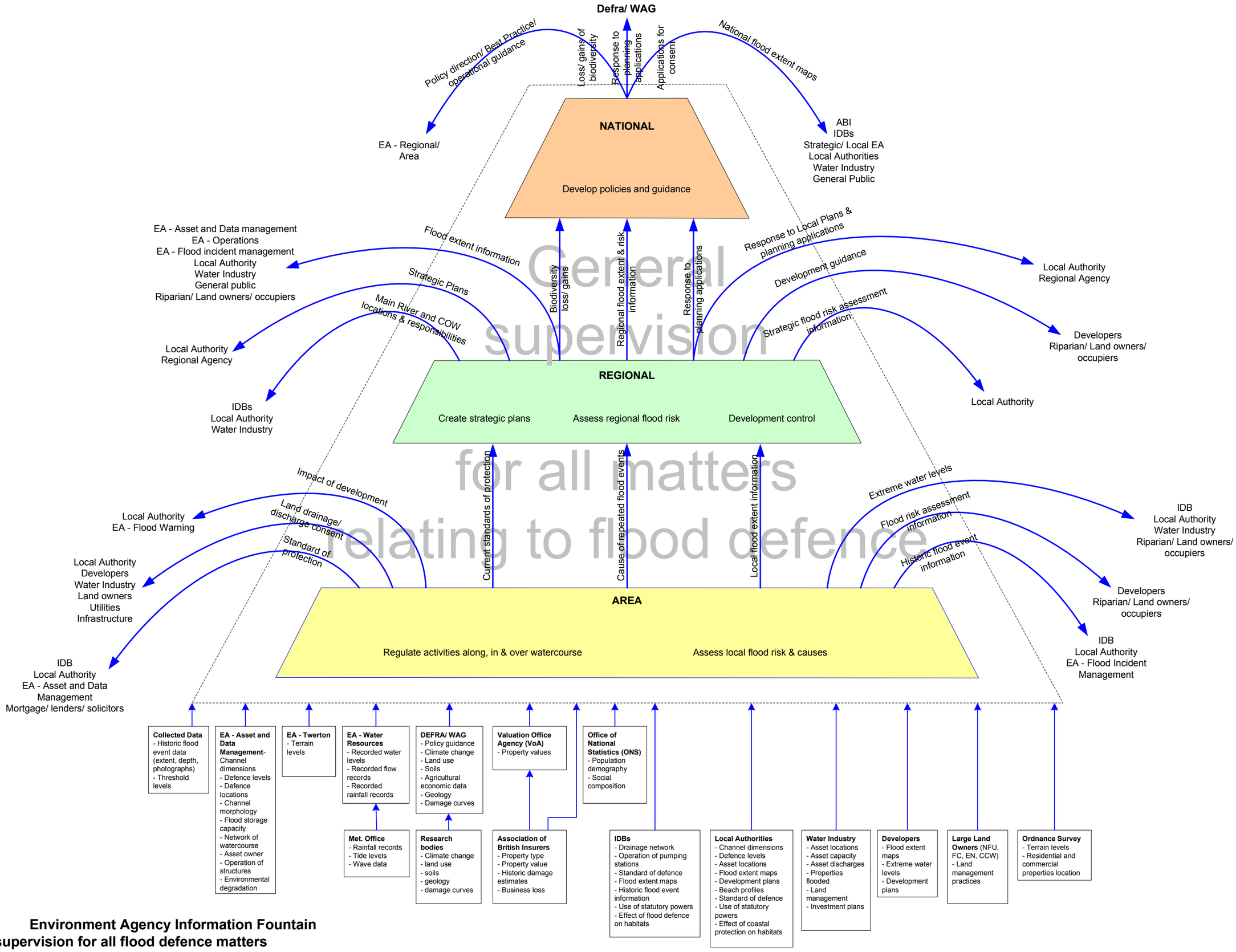


Chart E1. Environment Agency Information Fountain - General supervision for all flood defence matters

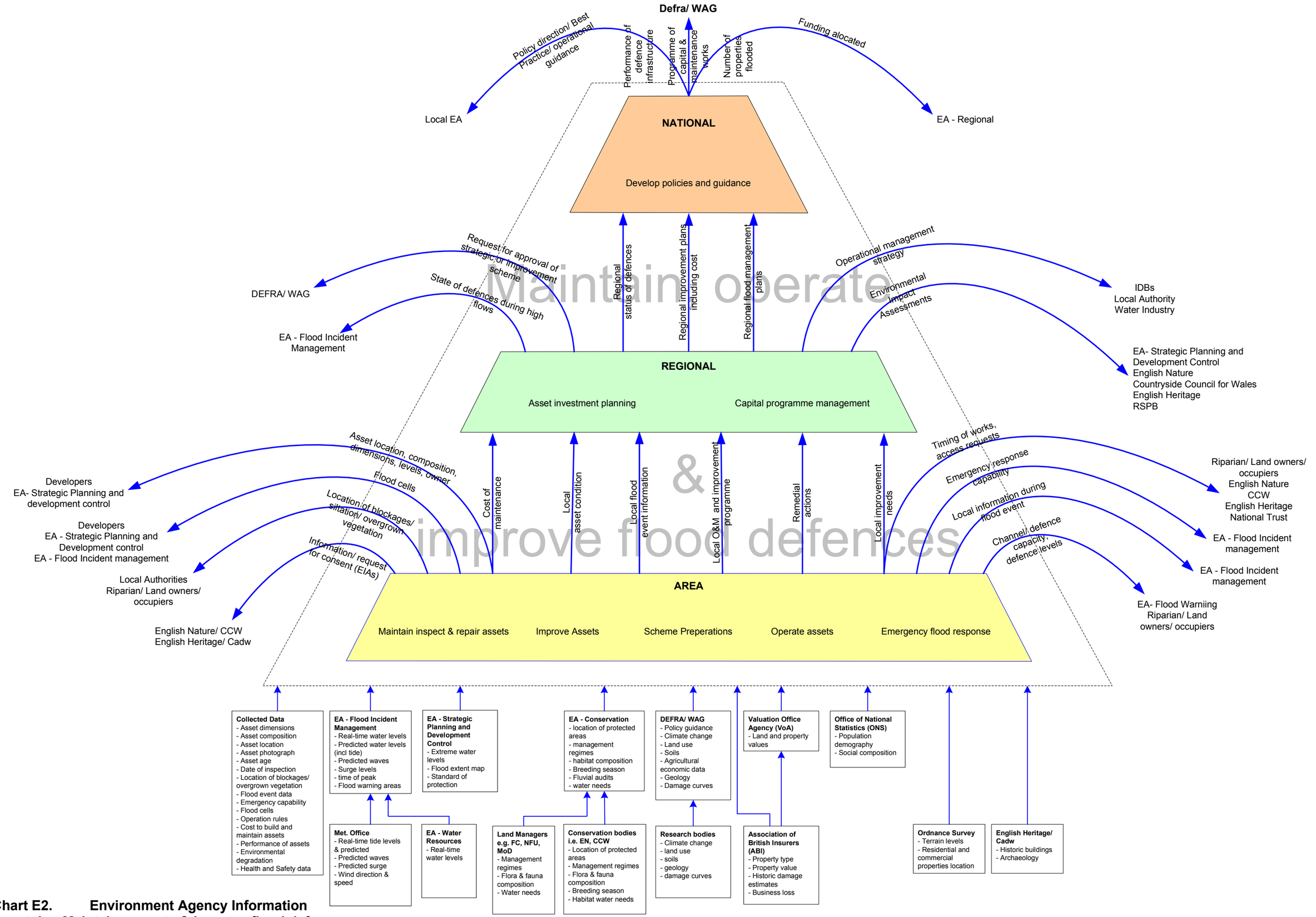


Chart E2. Environment Agency Information Fountain - Maintain, operate & improve flood defences

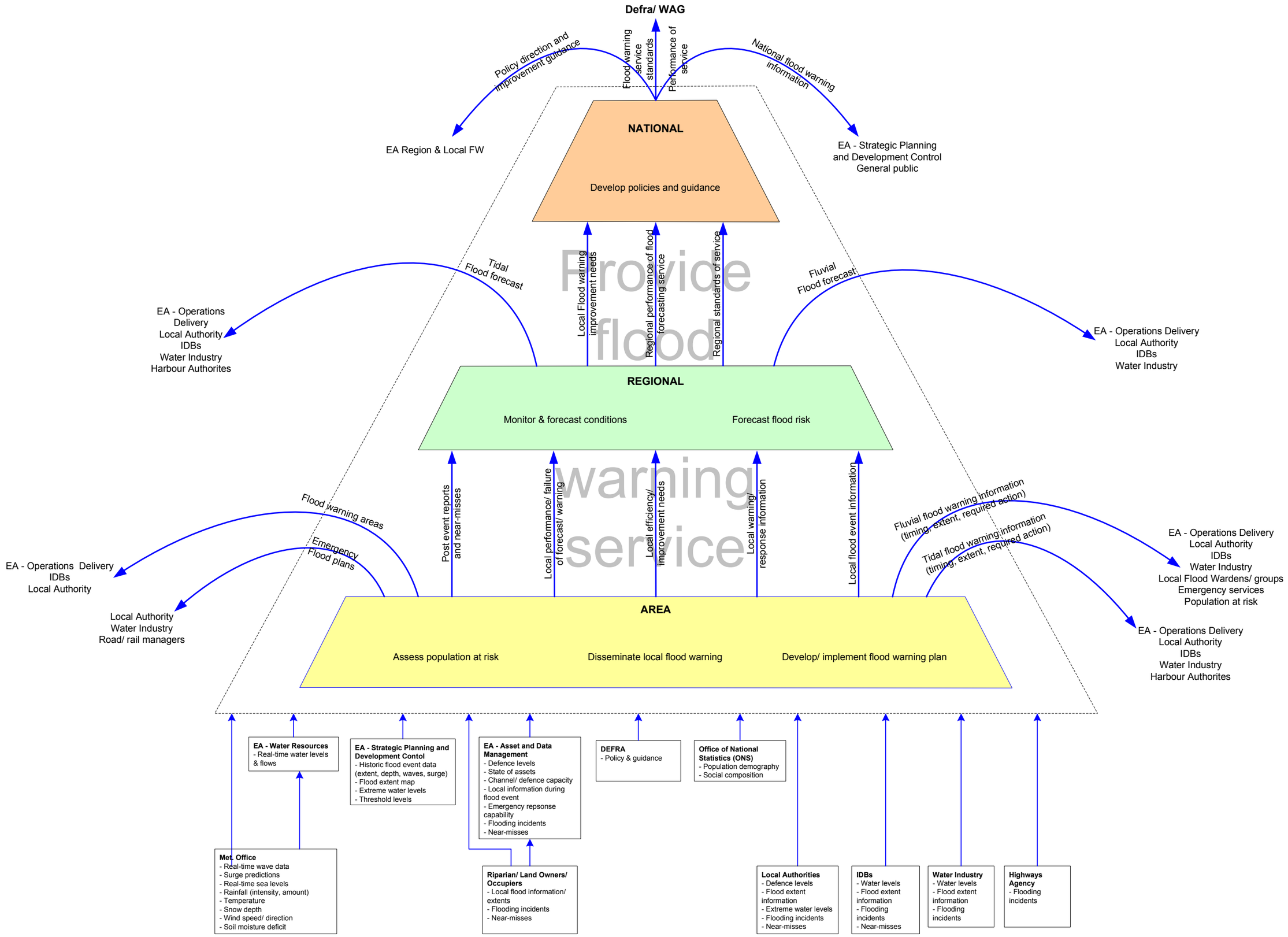


Chart E3. Environment Agency Information Fountain - Provide flood warning service

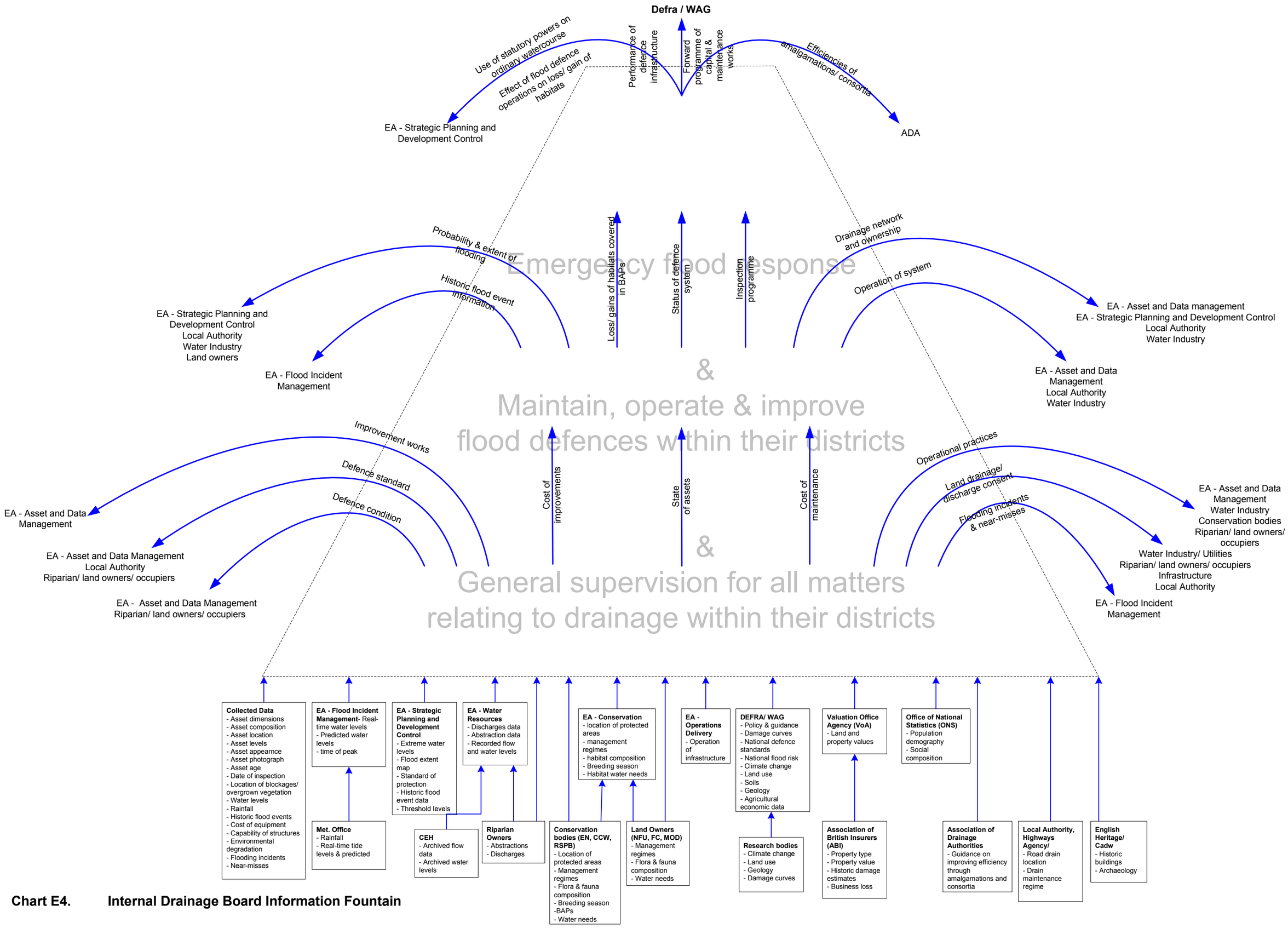


Chart E4. Internal Drainage Board Information Fountain

Defra / WAG

Planning applications where EA sustained objections/ where coastal erosion considered

Expenditure plans for maintenance & capital works

Risk of coastal erosion

Progress remedying coastal erosion deficiencies

Use of statutory powers on ordinary watercourses

Effect of coastal protection operations on loss/ gain of habitats

Defra / WAG
OPDM

EA - Strategic Planning and Development Control

Development control

&

Coastal protection measures

&

Keep roads free from flooding

&

Emergency planning & response to flooding

&

Provide prevention, mitigation & remedy flood damage

EA - Strategic Planning and Development Control
EA - Flood incident management
Developers
Riparian/ Land owners/ occupiers

Probability & extent of flooding

EA - Flood Incident Management
Emergency Services
Riparian/ Land owners/ occupiers

Emergency Flood Plans

EA - Strategic Planning and Development Control

Development plans

Loss/ gain of habitats covered in BAPs

Coastal evolution

Inspection programme of coastal protection assets

Coastal erosion areas

EA - Strategic Planning and Development Control
Conservation bodies
English Heritage/ Cadw
Riparian/ land owners/ occupiers

New connections to public sewers

Water Industry

Operation and maintenance practices

EA - Asset and Data Management
IDBs
Water Industry
Conservation bodies
Riparian/ land owners/ occupiers

Emergency response

EA - Flood Incident Management
Water Industry
Emergency Services
Riparian Owners

Flooding incidents, near-misses

EA - Flood Incident Management

Defence standard, Condition of defences

EA- Asset and Data Management
Riparian/ land owners/ occupiers

Coastal erosion areas

Status of coastal protection assets

Cost of maintenance & new works

Cliff recession

Conservation bodies
English Heritage/ Cadw
Riparian/ land owners/ occupiers

Asset levels

EA - Asset and Data Management

Watercourse responsibility

Riparian/ land owners/ occupiers

Collected Data
- Asset dimensions
- Asset composition
- Asset location
- Asset photograph
- Asset age
- Asset levels
- Asset appearance
- Date of inspection
- Location of blockages/ overgrown vegetation
- Beach profiles
- Cliff profiles
- Environmental degradation
- Flooding incidents
- Near misses

EA - Asset and Data Management
- Channel surveys
- Crest levels
- Location of blockages, siltation, overgrown vegetation
- Operation of defences
- Watercourse maintenance responsibility

EA - Strategic Planning and Development Control
- Extreme water levels
- Flood extent map
- Standard of protection
- Historic flood event data
- Threshold levels
- Planning consent
- Development impacts
- Watercourse responsibilities
- Flood risk assessment

EA - Flood Forecasting
- Real-time water levels
- Predicted water levels (incl tide)
- Predicted waves
- Surge levels
- time of peak

Met. Office
- Rainfall
- Real-time/ predicted/ archived tide levels
- Predicted & archived waves
- Predicted surge
- Wind direction & speed

EA - Conservation
- location of protected areas
- management regimes
- habitat composition
- Breeding season
- water needs

Conservation bodies (EN, CCW, RSPB)
- Location of protected areas
- Management regimes
- Flora & fauna composition
- Breeding season
- BAPs

Land Owners (NFU, FC, MOD)
- Management regimes
- Flora & fauna composition
- water needs

DEFRA/ WAG
- Policy & guidance
- Damage curves
- National defence standards
- National flood risk
- Climate change
- Land use
- Soils
- Geology
- Agricultural economic data

Research bodies
- Climate change
- Land use
- Geology
- Damage curves

Valuation Office Agency (VoA)
- Land and property values

Association of British Insurers (ABI)
- Property type
- Property value
- Historic damage estimates
- Business loss

Office of National Statistics (ONS)
- Population demography
- Social composition

United Kingdom Hydrographic Office
- Tide tables
- Bathymetry (Admiralty charts)

IDBs
- Flood extent maps
- Extreme water levels
- Drainage network
- Operation of pumping stations

Water Industry
- Asset location
- Asset ownership
- Asset capacity
- Discharges
- Standard of assets
- Properties at risk

Emergency services
- Manpower available
- Equipment available
- Coverage
- Time to deploy

English Heritage/ Cadw
- Historic buildings
- Archaeology
- Heritage coasts

Developers
- Flood extent information
- Extreme water levels
- Development proposals
- Sewer connections

Chart E5. Local Authority Information Fountain

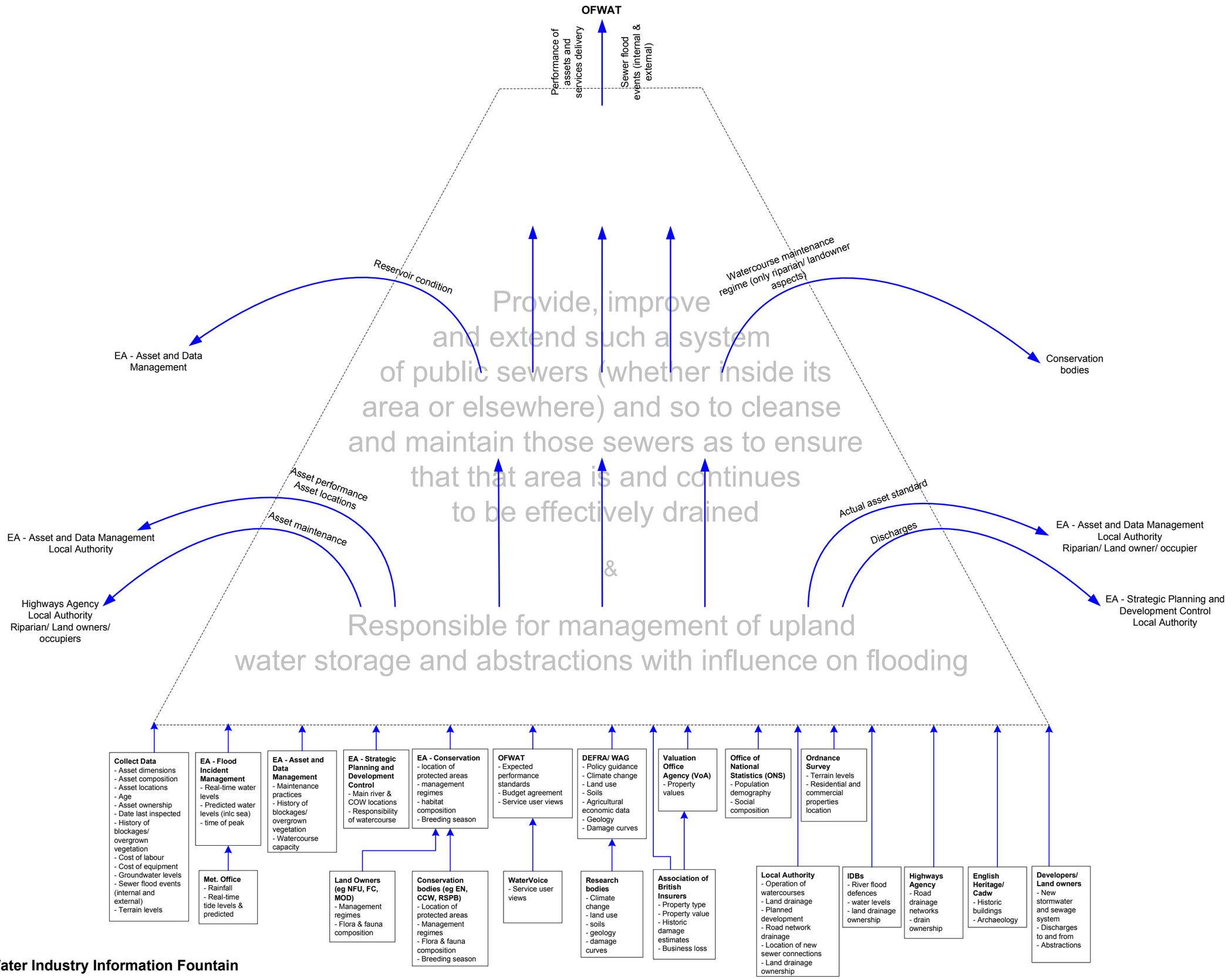


Chart E6. Water Industry Information Fountain

Appendix F

This page is purposefully blank

Appendix F – Key organisations with an interest in or contribute to FCERM data

<table>
<tr><th></th><th>User Organisations</th><th>Producer Organisations</th></tr>
<tr><td>Source</td><td>Government Departments and Offices
(e.g. Office of Science & Technology)
Universities/ Academic organisations</td><td>British Atmospheric Data Centre
British Oceanographic Data Centre
Meteorological Office
United Kingdom Hydrographic Office
Universities/ Academic organisations</td></tr>
<tr><td>Pathway</td><td colspan="2">British Waterways
Centre for Environment, Fisheries and Aquaculture Science
Centre for Ecology and Hydrology
Countryside Council for Wales
English Nature
Forestry Commission
Highways Agency
Joint Nature Conservation
National Farmers Union
Aggregate Dredging Companies
Engineering Institutions
Local Port and Harbour Authorities
Universities/ Academic organisations</td></tr>
<tr><td rowspan="2">Receptor</td><td colspan="2">Cadw (Historic environment agency within the WAG)
Countryside Council for Wales (CCW)
English Heritage
English Nature (EN)
Forestry Commission
Joint Nature Conservation (JNC)
Ministry of Defence (MoD)
National Farmers Union (NFU)
National Trust
Railtrack
Royal Society for the Protection of Birds (RSPB)
Emergency Services
Government Departments and Offices (e.g. Office of Science and Technology, Department of Transport)
Insurance companies
Universities/ Academic organisations</td></tr>
<tr><td>Highways Agency
Regional Government Office
Energy companies
Land managers/owners/occupiers
Mortgage companies
Utility companies</td><td>British Geological Society
Office for National Statistics
Ordnance Survey</td></tr>
</table>

This page is purposefully blank

Appendix G

This page is purposefully blank

Appendix G - Initiatives and systems that store FCERM data and information

It is important to recognise the role played by initiatives and management systems. In many cases these initiatives and systems are run by one or, more often, a number of the organisations discussed in the preceding sections. In some cases the initiatives are part of the fulfilment of the legislation obligations of FCERM organisations and in other cases the data management systems may be used to display data that is commercially available.

The table (below) shows initiatives and management systems that hold FCERM data and information. Since different (quality) levels of data and information are required for different levels of decisions, the systems have been grouped according to the spatial scale (resolution) that the data and information are gathered. 'Large' scale refers to greater than 1:25,000; 'Medium' scale is from 1:25,000 to 1:250,000; and 'Small' scale refers to data smaller than 1:250,000 (INSPIRE, 2002). Coverage concerns the extent of the initiative – Local, Regional and National. For example, HiFlows contains high flow measurements from gauging stations on a large scale, but the system contains records for stations for the whole of England and Wales i.e. the system has a National coverage. It is worthwhile to note that data can be grouped by other attributes to help differentiate levels of data. For instance, resolution can also be defined temporally (such as data collected daily or monthly). Work Package 2 defines the attributes that can describe data.

Some of the systems relate directly to data and information collected / collated for the benefit of FCERM, however, some systems are outside of the direct realm of FCERM but do yield useful data and information. The purpose of the system and the sources are noted and, where possible, a website. Features of the initiatives are summarised by the format and coverage. Where a number of similar initiatives exist, an example has been provided in the table to show the types of data and information held. For instance, an example of a monitoring programme in the UK is given for the South East and an example of a regional sediment study is the Southern North Sea.

While the list of initiatives and systems is comprehensive, it is important to realise that new ones will be created and so users, and indeed suppliers, should maintain their awareness by subscribing to FCERM newsletters produced by FCERM organisation.

Scale	System/ Initiative	Data	Owner/ Source(s)	Purpose/ Comments	Electronic	GIS-based	Coverage		
							Local	Regional	National
LARGE	RAINARK	Archived rainfall (amount and intensity)	Met Office, Environment Agency		✓				✓
	Telemetry	Real-time water levels & flows	Environment Agency		✓	✓			✓
	Telemetry	Real-time water levels & flows	IDBs	Not all IDBS have telemetry	✓	✓		✓	
	WISKI	Archived water levels, flows, groundwater, rainfall and current meter gaugings	Environment Agency		✓	✓			✓
	National Water Archive	Archived rainfall (accumulations with return periods), Archived river flows, Archived groundwater levels	NERC; www.nwl.ac.uk/ih/nrfa/		✓				✓
	National River Flow Archive (NRFA)	Daily and monthly flow, monthly catchment rainfall	CEH; www.nwl.ac.uk/ih/nrfa/	Now has Spatial Catchment Information for 1200 gauged catchments on elevation, geology, land use and rainfall	✓	✓			✓
	National Groundwater Level Archive	Groundwater levels and hydrographs	BGS; www.nwl.ac.uk/ih/nrfa/groundwater/index.htm		✓	✓			✓
	WellMaster	Hydrogeological data (recorded groundwater levels)	BGS/ CEH	Historic value for modelling of water resources and climate change in the UK	✓	✓			✓
	HiFLOWS	Rating curves, Peak flows (POTs)	DEFRA/ Environment Agency	Aim to improve data for estimating peak flood flows by FEH methods	✓	✓			✓
	National Abstraction Licensing Database (NALD)	Abstractions and impounding license data (who, where, quantity)	Environment Agency	The system is based on Oracle and can produce certain standard reports	✓	✓			✓
	National Flood and Coastal Defence Database	Main River location, COW locations, asset location, asset type, asset dimensions, asset elements, asset composition, asset photograph, asset owner, Flood storage area, Flood watch area, Flood warning area, Flood zones, Defended areas, flood risk area, Flood event outlines, Flood event probability, flood event photograph	Environment Agency	National dataset. See subsection for more explanation	✓	✓			✓

Scale	System/ Initiative	Data	Owner/ Source(s)	Purpose/ Comments	Electronic	GIS-based	Coverage		
							Local	Regional	National
LARGE	CMMS	Operational structures	Environment Agency	Computerized maintenance management system	✓				✓
	WSP asset database	WSP asset information (position, condition, category)	Water Companies		✓	✓			✓
	UK Estuaries Research Programme (ERP1)	Bathymetric profiles, historical bathymetry, CASI false and true colour composite images, CASI intertidal classification, Instantaneous water levels, Current data, Saltmarsh boundaries, Water quality, Wave data, Tide gauge data; Beach profiles, Salinity and nutrient data, Environmental data, Sediment properties/ texture	DEFRA/ Environment Agency	Aid research of 6 estuaries: The Humber, Blackwater, Southampton Water, Tamar, Mersey and Ribble	✓	✓		✓	
	South East Regional Monitoring Programmes	Land based topographic surveys (baseline beach surveys, beach profiles, post storm beach surveys), Airborne remote sensing topographic surveys (annual beach monitoring survey, aerial surveys and photogrammetric profiling, digital aerial photos, LiDAR surveys of cliffs and saltmarshes), Bathymetric surveys of nearshore sub-tidal zones (hydrographic surveys, bathymetric survey techniques), Waves (measured nearshore bouys, synthetic offshore and modelled nearshore wave data), Tidal measurement	CCO; www.channelcoast.org	Regional pilot model that may later be applied to other regions of the UK. Datasets collected determined on a 'risk basis', where more data is collected for sites that are most vulnerable.	✓			✓	
	Land Cover Map 2000 (LCM2000)	Land cover	CEH; www.ceh.ac.uk/data/lcm/LCM2000.shtm	Computer classification of satellite scenes	✓	✓			✓
	Port of London	Navigation data, environmental sites and legislations	Port of London; www.portoflondon.co.uk		✓			✓	
	National Marine Monitoring Programme	Physico-chemical and environmental variables	CEFAS; www.cefas.co.uk	Long-term trends in the quality of the marine environment	✓	✓			✓
	SeaZone	Locational Data (raster and vector data, wrecks and obstacles, oil and gas installations, bathymetry, practice and exercise areas (PEXA), lights and buoys, and maritime jurisdiction), Sedimentary and Temporal Data (seabed sediments, tides and oceanographic features)	UKHO, OS; www.seazone.com	Hydrospatial baseline data for use in asset management, decision-making and environmental modelling applications	✓	✓			✓

Scale	System/ Initiative	Data	Owner/ Source(s)	Purpose/ Comments	Electronic	GIS-based	Coverage		
							Local	Regional	National
LARGE	Irish Sea Pilot	geophysical, hydrographical, nature conservation, ecological and human use data	DEFRA; JNNC; www.jnnc.gov.uk	Help develop a strategy for marine nature conservation that could be applied to all UK waters		✓			✓
	Countryside Survey 2000 (CS2000)	Habitats, plants landscape features and land types	CEH; www.cs2000.org.uk	Includes surveys over last twenty years	✓	✓			✓
	National Biodiversity Network (NBN)	Biodiversity datasets (species, habitats and sites)	JNNC; www.searchnbn.net	Search engine to help find biodiversity information published on the websites of partners	✓	✓			✓
	National Monuments Records	Historic Environment	English Heritage		✓	✓			✓
	Historic Environment Records	Designations (historic, listed)	Local Authority		✓	✓	✓		
	National Property Database (NPD)	Property type, Property location, Property value	DEFRA		✓				✓
	Multi-Coloured Manual (MCM)	Flood damage/ coastal erosion costs to property, infrastructure and environment. Intangible (social) impacts	Flood Hazard Research Centre (FHRC)	Data and techniques for assessing the benefits of flood alleviation and coast protection					✓
	DG5 register	Number of properties at risk from sewerage flooding	OFWAT		✓	✓			✓
	National Statistics	Population demography, social deprivation	ONS; www.statistics.gov.uk		✓				✓
MEDIUM	Rain Radar	Rainfall (intensity)	Met Office, Environment Agency	There are 15 radars in the UK, each with a 75km range	✓	✓			✓
	Land Information System	Soil and soil related information (geology, ecology, land)	NSRI	National computerised database	✓				✓
	CORINE Land Cover Map 2000 (CLC2000)	Land cover and Land use classes representing the major surface types across Europe	European Commission	Designed to be used at 1:100,000 scale	✓	✓			✓
	Agricultural Land Classification	Land use	DEFRA		✓	✓			✓
	UK Estuaries Research Programme (ERP1)	Bathymetry, River monitoring sites, detailed estuarine coastlines, tidal characteristics, Estuary properties, chart datum & ordnance datum offsets, Environment Agency LiDAR coverage polygons	DEFRA/ Environment Agency	National datasets	✓	✓			✓

Scale	System/ Initiative	Data	Owner/ Source(s)	Purpose/ Comments	Electronic	GIS-based	Coverage		
							Local	Regional	National
MEDIUM	FutureCoast	Bathymetry, Physical controls, tidal data, seabed sediment, seabed features, offshore sediment transport trends, inshore wave data, onshore geology (drift and solid), nearshore sediment transport, backshore and inter-tidal geomorphology, estuary limits, EA indicative coastal floodplain mapping, built defences, historic shoreline movement, historic foreshore change, future shoreline and foreshore change. Oblique aerial photographs	DEFRA	Help provide predictions of coastal evolutionary tendencies over the next 100 years to feed into next phase of Shoreline Management Plans	✓				✓
	Regional Sediment studies	Mobility and transport of sediment around UK coast	Environment Agency; Local Authorities; www.sns2.org (Southern North Sea)	Inform existence of relevant literature and data sources	✓	✓		✓	
	Multi-Agency Geographic Information for the Countryside (MAGIC)	Soilscape data, Landscape data, Environmental schemes, Environmental designations	DEFRA; Environment Agency; English Nature; English Heritage; Countryside Agency; Forestry Commission; ODPM; www.magic.gov.uk	National and regional levels. Website provides links to relevant section of other organisations	✓	✓			✓
SMALL	National Tidal & Sea Level Facility	Tide Gauge data (archived and real-time). Monthly mean, surge and extreme values also available	POL; www.pol.ac.uk		✓				✓
	WaveNet	Real-time wave data in areas of known flood risk	CEFAS; www.cefas.co.uk/wavenet/	Strategic long-term wave monitoring of England and Wales	✓			✓	

This page is purposefully blank

Appendix H

This page is purposefully blank

Appendix H – The FCERM metadata schema

Key: M Mandatory element, in which case a value must be provided
O Optional element
1 single valued
N multi-valued

Element number	Element name	Element Description	Obligation	Number of occurrences	Data Type/Domain	Source	Short Name
1	Title	Name given to the dataset (N.B. this should not be the digital filename)	M	1	Free Text	UK GEMINI ISO 19115 360	*resTitle*
2	Alternative title	Short name, other name, acronym or alternative language title by which the cited information is known e.g. SSSI for Sites of Special Scientific Interest etc	O	N	Free Text	UK GEMINI ISO 19115 361	*resAltTitle*
3	Dataset language	Language(s) used in the dataset e.g. ENG for English.	M	N	Free Text (see Table 3, Appendix A)	UK GEMINI ISO 19115 39	*dataLang*
4	Abstract	Brief narrative summary of the dataset This should be a clear statement of the content of the dataset and give details on what, how, why, where and when, not general background information	M	1	Free Text	UK GEMINI ISO 19115 25	*idAbs*
5	Topic category	Main theme(s) of the dataset e.g. environment or oceans.	M	N	Class/Code list (see Table 4, Appendix A)	UK GEMINI ISO 19115 41	*tpCat*
6	Subject*	Topic of the content of the dataset - typically it will be expressed as keywords or key phrases or classification codes that describe the main subject of the dataset. Other terms may also be added, however it is recommended best practice to select a value from a controlled vocabulary/ thesaurus).	M	N	Free Text (see Table 5, 6a - 6o in Table 2, Appendix A)	UK GEMINI ISO 19115 53	*Keyword*
7	Date	Time period covered by the content of the dataset (N.B. not its creation or publication date)	M	N	Class (see Table 2 Elements 7a -7b for domain reference)	UK GEMINI ISO 19115 351	*exTemp*
8	Dataset reference date	Reference date for the dataset (Notional date of 'publication' of the dataset, rather than the actual date of the currency of the data)	M	1	Date format DD/MM/YYYY	UK GEMINI ISO 19115 362	*ResRefdatae*
9	Originator	Person or organisation having primary responsibility for the intellectual content of the data	O	N	Free Text	UK GEMINI ISO 19115 29	*idPoC*

Element number	Element name	Element Description	Obligation	Number of occurrences	Data Type/Domain	Source	Short Name
10	Lineage	Information about the events or source data used in the construction of the dataset. Dataset history i.e. how the dataset was created or any processes used to create the dataset. Could include the scale of capture and how the digital dataset was created	O	1	Free Text	UK GEMINI ISO 19115 83	*Statement*
11	West bounding coordinate	Western most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Real (WGS84 Decimal Degrees)	UK GEMINI ISO 19115 344	*westBL*
12	East bounding coordinate	Eastern most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Real (WGS84 Decimal Degrees)	UK GEMINI ISO 19115 345	*eastBL*
13	North bounding coordinate	Northern most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Real (WGS84 Decimal Degrees)	UK GEMINI ISO 19115 347	*northBL*
14	South bounding coordinate	Southern most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Real (WGS84 Decimal Degrees)	UK GEMINI ISO 19115 346	*southBL*
15	Extent*	Extent of dataset by subdivision of country by Government Regions, Authorities and Environment Agency Regions, Districts	M	N	Class - (See Tables 15a -15d, Appendix A)	UK GEMINI ISO 19115 349	*GeoDec*
16	Vertical extent information*	Vertical domain of the dataset - to include lowest vertical extent, highest vertical extent, vertical units and the origin from which the elevation values are measured	O	N	Class and Free Text (see Table 2, Elements 16a - 16d, Appendix A)	UK GEMINI ISO 19115 354	*VertExtent*
17	Spatial reference system	Name or description of the system of spatial referencing, whether by coordinates or geographic identifiers, used in the dataset e.g. National Grid of Great Britain, Regional Sea.	M	1	Class/Code list- (see Table 8, Appendix A)	UK GEMINI ISO 19115 187	*refSysId*
18	Spatial resolution	Measure of the granularity of the data (in metres) For data captured in the field, it will be the precision to which the data is captured. For image data, it will be the resolution of the image. For data taken from maps, it will be the positional accuracy of the map	O	1	Real	UK GEMINI ISO 19115 61	*scaleDist*
19	Spatial representation type	Method used to represent the spatial aspect of the data e.g. vector, grid.	O	N	Enumerated Class/Code list - (see Table 9, Appendix A)	UK GEMINI ISO 19115 37	*spatRpType*
20	Presentation type	Mode in which the data is represented e.g. digital map, digital table etc	O	N	Enumerated list/Code list - (see Table 10, Appendix A)	UK GEMINI ISO 19115 368	*presForm*
21	Data format	Format in which the digital data can be provided e.g. ArcView Shapefile.	M	N	Free Text	UK GEMINI ISO 19115 284	*geoObjType*

Element number	Element name	Element Description	Obligation	Number of occurrences	Data Type/Domain	Source	Short Name
22	Supply media	Type of media in which the data can be supplied e.g. CD or online.	O	N	Enumerated list/Code list - (see Table 11, Appendix A)	UK GEMINI ISO 19115 292	*medName*
23	Distributor*	Details of the organisation(s) from which the resource can be obtained	M	N	Class - (see Table 2 element 23a -23g for domain reference)	UK GEMINI ISO 19115 279	*Distributor*
24	Frequency of update	Frequency with which modifications and deletions are made to the data after it is first produced - revision regime of the dataset	M	1	Enumerated list/Code list - (see Table 12, Appendix A)	UK GEMINI ISO 19115 143	*maintFreq*
25	Access constraint	Restrictions and legal prerequisites for the access of the data e.g. copyright, license etc	O	N	Enumerated list/Code list - (see Table 13, Appendix A)	UK GEMINI ISO 19115 70	*accessConst*
26	Use constraints	Restrictions and legal restraints on using the data - as above	O	N	Enumerated list/Code list - (see Table 13, Appendix A)	UK GEMINI ISO 19115 71	*useConst*
27	Additional information source	Source of further information about the dataset - may include a reference (e.g. URL) to external information	O	1	Free Text	UK GEMINI ISO 19115 46	*suppInfo*
28	Online resource	Information about the online sources from which the resource can be obtained - may be a URL	O	N	Free Text	UK GEMINI ISO 19115 277	*onLineSrc*
29	Browse graphic	Graphic that illustrates the data - this may be the address, or a pointer to, a picture or a sample of the data	O	N	Free Text	UK GEMINI ISO 19115 31	*graphOver*
30	Date of update of metadata	Date on which the metadata was last changed - this is the date at which the metadata can be considered current, rather than the dataset itself	M	1	Single Date DD/MM/YYYY	UK GEMINI ISO 19115 09	*mdDateSt*
31	Metadata standard name	Name of the metadata standard (including profile name) used	O	1	Free Text	UK GEMINI ISO 19115 10	*mdSName*
32	Metadata standard version	Version (profile) of the metadata standard used	O	1	Free Text	UK GEMINI ISO 19115 11	*mdStanVer*
33	Accuracy	Quantitative description of dataset	M	N	Class/Free text (see Table 2 Elements 33a -33b for domain reference)	ISO 19115 (created within this metadata schema)	*dqDatAcc*
34	Qualitative Data Quality Information*	Qualitative quality information	M	N	Class/Free text (see Table 2- Elements 34a -34o for domain reference)	ISO 19115 99	*DQElement*

* Additional mandatory elements to be used should this element be selected (see FD2323\TR2 Appendix A: Additional Metadata elements for geographic datasets).

This page is purposefully blank

Appendix I

This page is purposefully blank

Appendix I – Management of registers

1. Establishment of registers

Any recognised organisation can establish a register and in doing so, the following information shall be provided to the Registry Owner:

- Short description of the organisation (name, purpose, etc.);
- Point of Contact (POC);
- Register Manager and List of Submitting Organisations, Control Body; and
- Implementation of procedures for proposal approval and appeal process.

2. Processing of proposals

Submitting organisations may submit requests for addition, clarification, modification and retirement of registered items, these are done in the following ways.

Addition of registered items

Addition is the insertion into a register of an item that describes a concept not described by an item already in the register.

Clarification of registered items

Clarifications correct errors in spelling, punctuation, or grammar. A clarification shall not cause any substantive semantic change to a registered item. Otherwise it shall be treated as a modification. The Control Body shall handle editorial clarifications at their discretion. Approved clarifications shall be promulgated by the Register Manager, and shall be recorded in a note attached to a registered item as additional information

Super-session of registered items

Modification of an item is one that would result in a substantive semantic change and shall be effected by including a new item in the register with a new identifier and a more recent date. The original item shall remain in the register but shall include the date at which it was superseded, and a reference to the item that superseded it.

Retirement of registered items

The retirement of items shall be carried out by leaving the item in the register and by marking it retired and including the date of retirement.

3. Submission of proposals

The process for submitting proposals for registration of items of geographic information is as follows:

- Submitting organisations shall

    (a) receive proposals for the registration of items of geographic information from proposers within their respective communities or organisations;
    (b) ensure that all proposals are complete;
    (c) forward to the appropriate Register Manager those proposals that have the support of the submitting organisation; and
    (d) explain proposals to the Register Manager, if necessary.

- The Register Manager shall

    (a) receive proposals from submitting organisations;
    (b) review proposals for completeness;
    (c) return proposals to the submitting organisation if incomplete; and
    (d) co-ordinate proposals with other Register Managers within two calendar weeks

- The Register Manager shall use the following criteria to determine if the proposal is complete:

    (a) the submitter is not a qualified submitting organisation;
    (b) the proposed item does not belong to an item class assigned to this Register Manager; and
    (c) the proposed item does not fall within the scope of the Register.

Submitting organisations may decide to withdraw a proposal at any time during the approval process.

4. Approval process

Submitting organisations may decide to withdraw a proposal at any time during the approval process.

- The Register Manager shall:

    (a) change the proposal management *status* from ‘pending’ to ‘final'; and
    (b) change the proposal management *disposition* to ‘withdrawn’ and the value for *dateDisposed* to the current date.

- The Register Manager shall:

    (a) if the proposal is for clarification or retirement of a register item, forward the proposal to the Control Body;

(b) if the proposal is for registration of a new item or modification of an existing register item:

1) insert the new or superseding item into the register
2) assign an *itemIdentifier* to the new or superseding item
3) set the *status* of the item to ‘notValid'; and
4) forward the proposal to the Control Body.

- The Control Body shall:

(a) decide to accept the proposal without change, to accept the proposal subject to changes negotiated with the submitting organisation, or not to accept the proposal. Criteria for not accepting a proposal include:

1) the specification of the item is incomplete or incomprehensible;
2) an identical item already exists in the register or in another register of this registry;
3) the proposed item does not belong to an item class included in this register;
4) the proposed item does not fall within the scope of this Register; or
5) the justification for the proposal is inadequate.

(b) inform the Register Manager of the decision, and the rationale for the decision, within a time limit specified by the register owner.

- The Register Manager shall:

(a) serve as point of contact if there is a need for negotiations between the submitting organisation and the Control Body regarding changes to the proposal that are specified by the Control Body as a condition of acceptance; and
(b) inform the submitting organisation of the results of processing a proposal.
(c) If the decision of the Control Body is positive, the Register Manager shall:

1) complete the proposal management record with status set to ‘final’, disposition set to ‘accepted', and dateDisposed to the current date;
2) make approved changes to the content of the register item;
3) if the proposal was an addition assign a number code from the pre-allocated block for their Register to the new item; and
4) set the Register item status to ‘valid', 'superseded', or 'retired', as appropriate.

(d) If the decision of the Control Body is negative:

1) update the proposal management record by setting *status* to ‘tentative', *disposition* to ‘notAccepted', and *dateDisposed* to the current date;
2) inform the submitting organisation of the deadline for appealing the decision of the Control Body.

(e) Disseminate the results of the approval process.

- Submitting organisations shall:

(a) negotiate with the Control Body with regard to changes to their proposal that are specified by the Control Body as a condition of acceptance; and
(b) make known within their respective countries or organisations the decisions taken on proposals by the Control Body as transmitted to them by the Register Manager.

5. Appeals

A submitting organisation may appeal to the register owner if it disagrees with the decision of a Control Body to reject a proposal for addition, clarification, modification, or retirement of an item in a register. An appeal shall contain at a minimum a description of the situation, a justification for the appeal, and a statement of the impact if the appeal is not successful.

- The submitting organisation shall:

(a) determine if the decision regarding a proposal for registration is acceptable; and
(b) if not, submit an appeal to the Register Manager.
If there is no appeal by the deadline for submitting an appeal, the Register Manager shall change the *status* of the proposal management record to ‘final' and change the *dateDisposed* to the current date.

- The Register Manager shall:

(a) forward the appeal to the register owner.

- The register owner shall:

(a) process the appeal in conformance with its established procedures;
(b) decide whether to accept or reject the appeal; and
(c) return the result to the Register Manager.

- The Register Manager shall:

(a) update the proposal management record fields *disposition* and *dateDisposed*;
(b) update the register item *status*; and
(c) provide the results of the decision to the Control Body and to the submitting organisation.

- The Submitting Organisation shall:

(a) make the results of the appeal known within their organisation.

6. Registry for FCERM input

Having established the method for maintaining the register itself, the various elements need to be identified and managed. Figure 1 illustrates this relationship. The two areas considered to be managed under the FCERM programme are the inclusion of new elements to the metadata standard and to the code list (Table 1). The details are given in Appendix C in FD2323/TR2. It has already been seen through the development of the metadata standard that elements have needed to be included to capture additional information on the 'objects' being described to address quality and accuracy. Careful thoughts in the management of adding temporal datasets to the metadatabase need to be made especially with respect to whether the data is a single updated entry or multiple entries, e.g. annual beach profiles.

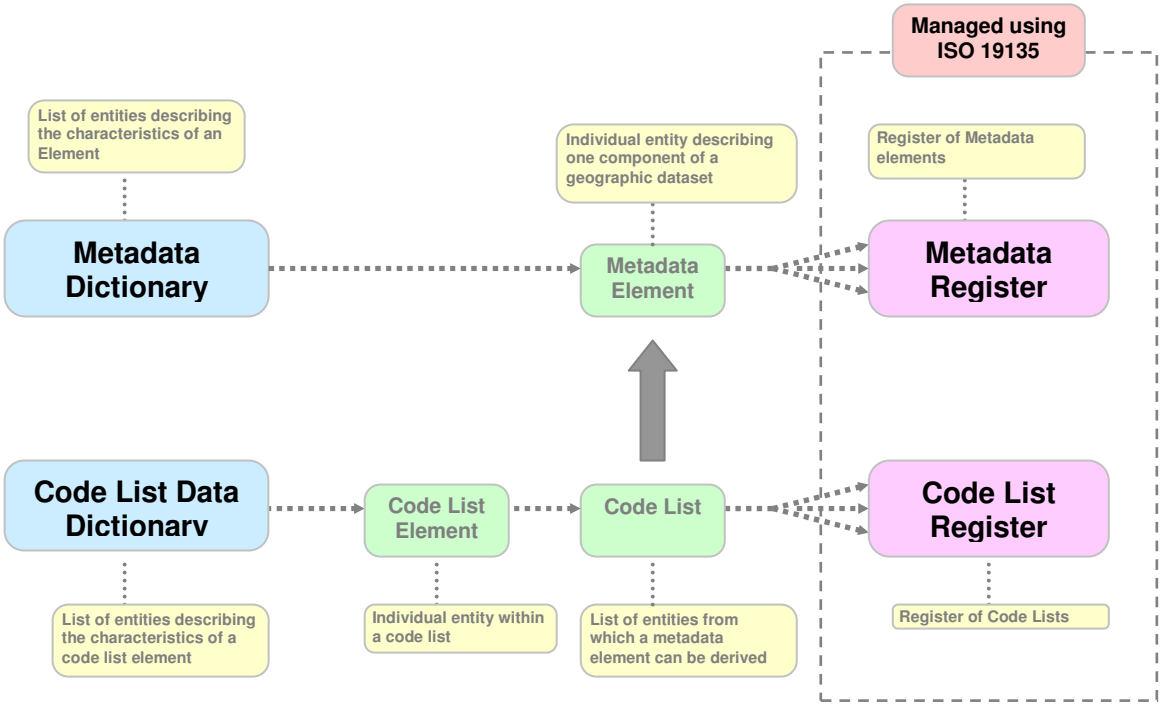


Figure 1. Relationship of Dictionaries to the Register

Previous sections have shown how the register can be managed making any additions or removals from the system universally known, thus any FCERM organisation has the ability to add new tasks to the Tool and request the need to add new keywords or 'Information required' to the system.

Table 1. Code List register

ID	Name	Short Name	Definition	Source	Source name
1	B.5.21 MD ObligationCode	*tblOblig*	Obligation of the Element or entity	ISO19115	B.5.21 MD ObligationCode
2	Table3 Dataset Language	*tblLang*	Codes for the representation of names of languages	ISO 639-2	
3	Table 4 Topic Category	*tblTpcat*		ISO19115	MD_TopicCategoryCode (B5.27)
4	Table 5 Information Required	*tblInfRec*	Descriptions FCERM Information Areas	FCERM	
5	Table 6 Vertical Unit of Measure	*tblVerUnt*	Vertical measurement unit	ISO/TS-19103 & ISO19115	UomLength(B4.3)
6	Table 7 Vertical Datum	*tblVertDat*	Parameters describing the gravity-related height to earth	ISO19115	SC_VerticalDatum (B4.9)
7	Table 8 Spatial Reference System	*tblSpatRef*	Description of Spatial reference systems used in the dataset	FCERM	
8	Table 9 Spatial Representation Type	*tblSpatTyp*	Method used to spatially represent geographic information	ISO19115	MD_SaptialRepresentationTypeCode (B5.26)
9	Table 10 Presentation Types	*tblPrsForm*	Mode in which the Data is presented	ISO19115	CI_PresentationFormCode(B5.4.)
10	Table 11 Supply Media	*tblMedCode*	Name of the Medium on which the resource was received	ISO19115	MD_MediumNameoode (B5.2)
11	Table 12 Frequency Update	*tblMaintFreq*	Frequency with which changes and additions are made to the after the initial dataset has been completed	ISO19115	MD+MaintenanceFrequencyCode (B5.18)
12	Table 13 Use\ Constraint Restrictions	*tblUseCons*	Constraints applied to assure the protection of privacy, of Intellectual Property, and any special restrictions or limitations or warnings on using the data.	ISO19115	MD_RectrictionCode (B5.24)
13	Table 14 Accuracy	*tblAcurcy*	The Quantitative assessment of the datasets accuracy	FCERM	
14	Table 15 Extent	*tblextent*	Description of the spatial coverage of datasets.	ISO3166-1\ ISO3166-2 and FCREM	

PB 12527/19

Ergon House
Horseferry Road
London SW1P 2AL

www.defra.gov.uk