



Assess state of information systems and facilitate geo-hazard  
Information sharing among GoB and NGO GIS platforms

*Report on*

**Compatibility of GIS Data and Development of guideline for  
Metadata, Data Sharing Protocol and national GIS Data Policy**



*a complimentary approach towards "Digital Bangladesh"*

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*Empowered lives.  
Resilient nations.*



*Submitted to*

**Comprehensive Disaster Management Programme (CDMP)**

**CDMP EC-Funded Component 4a**  
*Earthquake and Tsunami Preparedness*

**Assess state of information systems and facilitate geo-hazard Information sharing among GoB and NGO GIS platforms**



**September 2009, Dhaka**



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Submitted to  
**Comprehensive Disaster Management Programme**  
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September 2009



## Reviewer's Appreciation




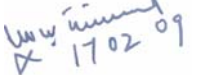
The report “Assess the state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms” covered a wide spectrum of issues related to the use of geo-hazard related spatial and non-spatial data and suggested possible measures to address those. Important issues like spatial data sharing, uniform map projections and datum, and national GIS data policy guidelines have been incorporated in this report. The report recommends a common projection system with common parameters and datum to avoid data duplication, incompatibilities among datasets and wastage of resources. It also gives emphasis on the formulation of a national data framework that integrates value of cooperation and sharing among the organizations for the sake of GIS development more efficiently.

As reviewers of this report, we can imagine a tremendous opportunity for sharing geographical data and applications among groups of organizations, if the Government and commercial agencies implement recommendations laid down in this reports. We are happy to note that once the recommendations acknowledged and adopted by the Government as a national policy the GIS users will be greatly benefited from sharing and using indisputable spatial and related non-spatial data for planning, research and field-level applications. We are also confident that the report would be of immense value to the GIS communities as well as policy and development planners to devise a national GIS data platform that includes rules and framework to streamline GIS activities towards the sustainable progress of the country.

Finally, we would like to extend our earnest thanks to CDMP and CEGIS for conducting this timely study to address the issues of data compatibility, metadata status and data sharing process and protocols.

It is highly expected that the Government will take necessary steps in implementing the ‘**Digital Bangladesh**’ goal through this project work.

Last but not the least, being reviewers, we feel greatly honoured to be the part of project.

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This report is an interim deliverable of the study “Assess the state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms” conducted by the Center for Environmental and Geographic Information Services (CEGIS) for the Comprehensive Disaster Management Programme (CDMP), under the Disaster Management Bureau (DMB), with financial assistance from UNDP, DFID-B, and the European Commission (EC). The methodology of the study has been presented before the project’s Technical Advisory Group (TAG) of CDMP. This was reviewed by the TAG members: Professor J. R. Choudhury, Vice Chancellor, BRAC University, Professor Dr. A.M.M. Safiullah, Vice Chancellor, BUET, Professor Monirul Hoque, Vice Chancellor, Darul Ehsan University, Dr. Aftab Alam Khan, Professor, Department of Geology, DU, Dr. Mehedi Ahmed Ansary, Professor, Department of Civil Engineering, BUET, and Dr. Khaled Hasan, Associate Professor, Department of Geology, DU. CEGIS acknowledges their guidance and advices with deep appreciation. CEGIS also recognizes the timely support from Mr. Ian Rector, Chief Technical Advisor, CDMP, Dr. Maksud Kamal, National Expert, Earthquake and Tsunami Preparedness, CDMP and Dr. Mustafa Alam, National Expert of CDMP. Mr. Giasuddin Ahmed Choudhury, Executive Director of CEGIS has also contributed greatly through providing guidance and by participating in important events (workshop, consultation meeting etc.) of the project.

The main task of this assignment is to conduct an assessment of the state of Geo-hazard information in Bangladesh and prepare a metadata standard and guidelines for the National GIS Data Policy and geo-hazard data sharing protocol. CEGIS recognizes the contribution of the relevant officials of LGED, R&H, SoB, SPARRSO, WARPO, BARC, SRDI, BADC, DLRS, BMD, BWDB, BIWTA, BBS, DWASA, DoF, FD, DCC, GSB, IWM, BUET, DU, JU, RU, KDA, KU, BCAS, CARE, CNRS and some other organizations in terms of providing information, opinions and advices.

For wider participation of relevant experts, CEGIS involved the Bangladesh Society for Geo-Informatics (BSGI) and BUET in this study. The President of BSGI Dr. Amanat Ullah Khan, Professor, Department of Geography and Environment, University of Dhaka and Dr. A.K.M Saiful Islam, Associate Professor, IWM, BUET contributed a lot in this study, specially in preparing guidelines for the National GIS Data policy, Metadata standard and Data sharing protocols. Both of them have also reviewed the whole report.

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Mr. Mollah Md. Awlad Hossain, Head, GIS Division, CEGIS guided the overall project activities and contributed in technical assessment, analysis, management and documentation. Mr. Motaleb Hossain Sharker, Principal GIS Specialist, CEGIS worked as the Project Leader and was responsible for activity management. Mr. Ahmadul Hassan, Head, R&D and Training Division, Mr. Sultan Ahmed, Head Business Development Division, Ms. Iffat Huque, Head, Remote Sensing Division, Mr. Ehsan Hafiz Chowdhury, Head, Quality Management Division, and Mr. Malik Fida Abdullah Khan, Head, Database/IT Division extended their supports in conducting the National Workshop. Other key persons from CEGIS involved in this study are (1) Ms. Pia Afreena Khaleda Huq, Senior GIS Specialist, (2) Mr. Firoz Alam, GIS Analyst, (3) Mr. Md. Habibur Rahman, GIS Analyst, (4) Mr. Sonkor Chandra Sinh, Data Analyst, and (5) Mr. Mohammad Shahriar Khan, Junior Professional. Several other senior experts of CEGIS have also contributed in the whole process and developments. Mr. Sayeefur Rahman Rizvi, Graphics Expert, CEGIS, helped in report formatting. CEGIS also recognizes the contributions of five additional questionnaire surveyors.

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## Glossary

## Acronyms

ADB	Asian Development Bank
ANZLIC	A Spatial Information Council for Australia and New Zealand
ASCCI	American Standard Code for Information Interchange
ASDD	Australian Spatial Data Directory
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BCL	Bangladesh Consultants Limited
BD	Bangladesh
BETS	Bangladesh Engineering and Technological Services
BHWDB	Bangladesh Haor and Wetland Development Board
BIDS	Bangladesh Institute of Development Studies
BIIF	Basic Image Interchange Format
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
BNGDI	Bangladesh National Geographical Data Infrastructure (Proposed)
BNUS	Bangladesh Network Office for Urban Safety
BPDB	Bangladesh Power Development Board
BR	Bangladesh Railway
BRRRI	Bangladesh Rice Research Institute
BSCIC	Bangladesh Small and Cottage Industries Corporation
BSGI	Bangladesh Society of Geoinformatics
BTM	Bangladesh Transverse Mercator
BUET	Bangladesh University of Engineering and Technology
BUTM	Bangladesh Universal Transverse Mercator
BWDB	Bangladesh Water Development Board
CADD	Computer Aided Design and Drafting
CARE	Cooperative of Assistance and Relief Everywhere
CCC	Chittagong City Corporation
CCD	Climate Change Database
CDA	Chittagong Development Authority
CDMP	Comprehensive Disaster Management Programme
CDSP	Char Development and Settlement Project
CEGIS	Center for Environmental and Geographic Information Services
CEN	Creative Environment Network
CERP	Coastal Embankment Rehabilitation Project
CGIAR	Consultative Group on International Agricultural Research

CNRS	Center for Natural Resources Studies
CPA	Chittagong Port Authority
CRA	Community Risk Assessment
CSDGM	Content Standard for Digital Geospatial Metadata
CWASA	Chittagong Water and Sewerage Authority
DAE	Department of Agricultural Extension
DCC	Dhaka City Corporation
DDC	Development Design Consultants
DEM	Digital Elevation Model
DFID-B	Department for International Development - Bangladesh
DIGEST	Digital Geographic Information Exchange Standard
DLRS	Department of Land Records and Survey
DMB	Disaster Management Bureau
DMIC	Disaster Management Information Cell
DoE	Department of Environment
DoF	Department of Fisheries
FD	Forest Department
DLS	Department of Livestock Services
DPC	Developing Planning Consultants
DPHE	Department of Public Health Engineering
DU	University of Dhaka
DWASA	Dhaka Water and Sewerage Authority
EC	European Commission
EGIS	Environmental and Geographic Information Services
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization
FAP	Flood Action Plan
FFWC	Flood Forecasting and Warning Center
FGDC	Federal Geographic Data Committee
FME	Feature Manipulation Engine
FPCO	Flood Plan Coordination Organization
GIS	Geographic Information System
GML	Geography Markup Language
GO	Government Organization
GoB	Government of Bangladesh
GSB	Geological Survey of Bangladesh
GSRC	Geographical Solutions Research Center
HTML	Hyper Text Markup Language
ICA	International Cartographic Association
ICIMOD	International Centre for Integrated Mountain Development
ICRD	Integrated Coastal Resources Database

ICT	Information Communication Technology
IHO	International Hydrographic Organization
IIB	Indian Zone Grid
IPR	International Panel of Research
ISO/TC	International Organization for Standardization/ Technical Committee
ISPAN	Irrigation Support Project for Asia and Nearest
IT	Information Technology
ITRF	International Terrestrial Reference Frame
IUCN	International Union for Nature Conservation
IWM	Institute of Water Modelling
IWFM	Institute of Water and Flood Management
IWMI	International Water Management Institute
JU	Jahangirnagar University
KDA	Khulna Development Authority
KML/KMZ	keyhole Markup Language/ keyhole Markup Language Zipped
KU	Khulna University
LCC	Lambart Conformal Conic
LGED	Local Government Engineering Department
LIS	Land Information System
LRA	Land Records Administration
MES	Meghna Estuary Study
MoFDM	Ministry of Food and Disaster Management
MoL	Ministry of Land
MoSICT	Ministry of Science Information and Communication Technology
NGCI	National Clearinghouse for Geo Information
NGO	Non Government Organization
NMIDP	National Minor Irrigation Development Project
NSDI	National Spatial Data Infrastructure
NWRD	National Water Resources Database
OCHA	Office for the Coordination of Humanitarian Affairs
OGC	Open Geospatial Consortium
OGIS	Open Geo-data Interoperability Specification
RHD	Roads and Highway
RAJUK	Rajdhani Unnayan Kartripakkha
RDA	Rajshahi Development Authority
REB	Rural Electrification Board
RFP	Request for Proposal
RRI	River Research Institute
RU	Rajshahi University
SAIF	Spatial Archive and Interchange Format
SDTS	Spatial Data Transfer Standard

SMMS	Spatial Metadata Management System
SoB	Survey of Bangladesh
SoI	Survey of India
SoW	Scope of Work
SPARRSO	Space Research and Remote Sensing Organization
SRDI	Soil Resources Development Institute
STD	Standard
SWMC	Surface Water Modelling Centre
TAG	Technical Advisory Group
ToR	Terms of Reference
TVP	Topological Vector Profile
UML	Unified Modeling Language
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
URP	Urban and Rural Planning
USAID	United States Agency for International Development
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
WARPO	Water Resources Planning Organization
WB	World Bank
WFC	World Fish Center
WFP	World Food Programme
WHO	World Health Organization
WRE	Water Resource Engineering
XML	Extensible Markup Language
MoA	Ministry of Agriculture
MoWR	Ministry of Water Resources
MoD	Ministry of Defense

## Executive Summary

Ministry of Food and Disaster Management (MoFDM) is implementing a programme named Comprehensive Disaster Management Programme (CDMP) with support from the United Nations Development Programme (UNDP), UK Department for International Development - Bangladesh (DFID-B) and the European Commission (EC). The CDMP has been designed to strengthen the Bangladesh disaster management system and more specifically to achieve a paradigm shift from reactive response to a proactive risk reduction culture.

CDMP has adopted a holistic approach, embracing processes of hazard identification and mitigation, community preparedness and integrated response efforts, where relief and recovery activities are planned within an all-risk management framework. CDMP aims to raise the capacities of communities at-risk and to lower their vulnerability to specific hazards.

Under Component 4a, CDMP aims to prepare an information base for Geo-hazard assessment. The GIS information of different organizations in Bangladesh are in different formats. Their quality and levels of precision are different as well. CDMP undertook an effort to assess the state of GIS data, metadata and the data sharing modalities in the country under a study project. The project also included activities to develop national GIS data policy, guidelines for metadata standards, and data sharing protocols between different spatial data user and producer organizations. CDMP assigned the work to Center for Environmental and Geographic Information Services (CEGIS) under a contract. CEGIS conducted a questionnaire survey to assess the present state of geo-hazard related GIS data in Bangladesh under this project. It also reviewed all such previous studies. CEGIS also took helps from Bangladesh Society for GeoInformatics (BSGI) and Bangladesh University of Engineering and Technology (BUET) for the assessment and development of Metadata and National GIS policy guidelines.

Information on GIS data compatibility issues, metadata standards, data sharing processes and protocols were collected through a questionnaire developed by CEGIS. Information on how these issues are dealt with in other advanced countries came from the Internet. The authors carried out extensive online surveys to study the experience of the advanced countries. The study found, (1) the major problems concerning the data compatibility in Bangladesh are due to use of different projection systems, variable data and metadata standards and the absence of quality standards; (2) the majority of the organizations use ESRI Software e.g. ArcGIS, ArcInfo, ArcView and their extensions in preparing their GIS data; (3) the majority of the surveyed organizations use BTM projection. The survey found that out of 31 surveyed organizations, 24 use the BTM, 7 use UTM, 7 use the LCC projection system with the Everest 1830 Datum; Survey of Bangladesh is uses the BUTM. (BUTM is the same as BTM but with exception of only one parameter, -2000,000 False Northing); (4) more than 20 organizations have no metadata standards and only six organizations follow any metadata standards, and these are not common between the organizations; (5) a few organizations found to follow strict guidelines for capturing, processing and quality control of GIS data. Data documentation lies only in tiny chapters of the relevant project reports; (6) majority of the organizations do not have standard rules or regulations to disseminate and share the GIS data. Some organizations disseminate/share data following their own guidelines.

After the assessments the study recommended that (1) all the organizations in Bangladesh should follow a common projection systems and parameters to make the GIS data compatible among the GIS user organizations. BUTM projection system with WGS-1984 datum could be taken as a standard for Bangladesh, since most of the organizations are using BTM but Easting and Northing should also be

revised due to obligation to UNCLOS and the extension of maritime boundary. Further study should be carried out on this issue with the participation from all major GIS user organizations; (2) there should be a common and standard data capturing, processing and development system of GIS data; (3) a national common metadata standard, a national GIS policy and a well-defined data sharing protocol is required. Regarding metadata, ISO 19115:2003 standard is recommended which has already been accepted and practiced by wider communities in USA, Australia and Europe; (4) community profile for each GIS data category and user group should be prepared following the ISO 19115:2003 specifications. This should be done in harmony and co-operation with relevant frontline GIS organizations; (5) GeoNetwork could be used as metadata and data sharing tool to keep compatibilities with ISO and other regional scientific organizations (e.g ICIMOD, IWMI); (6) a national GIS Data policy should be prepared which will guide the GIS data holding and user organizations in terms of data preparation, standards, data description, quality, management and sharing; (7) Awareness workshop/training should be taken up to make understand the GIS user organizations on the usefulness of metadata and national GIS data policy guidelines. (8) Bangladesh National Geographical Data Infrastructure (BNGDI) should be established to implement the GIS data policy, GIS data standards, metadata standard and data sharing protocol for the shake of national interest and different planning activities.

# Chapter 1

## Introduction

### 1.1 Background

Ministry of Food and Disaster Management (MoFDM) is implementing a programme named Comprehensive Disaster Management Programme (CDMP) with support from the United Nations Development Programme (UNDP), UK Department for International Development - Bangladesh (DFID-B) and the European Commission (EC). The CDMP has been designed to strengthen the Bangladesh disaster management system and more specifically to achieve a paradigm shift from reactive response to a proactive risk reduction culture.

CDMP has adopted a holistic approach, embracing processes of hazard identification and mitigation, community preparedness and integrated response efforts, where relief and recovery activities are planned within an all-risk management framework. CDMP aims to raise the capacities of communities at-risk and to lower their vulnerability to specific hazards.

CDMP is a high profile multi-hazard, multi-sector and multi-stakeholders programme through which a substantial capacity building programme is being implemented to facilitate field level operations associated with Community Risk Assessments (CRA).

#### Scope of the works under Component 4a

Under the CDMP framework, there are several components. Component 4a-Earthquake and Tsunami Preparedness is one of them. This component recognizes growing urban vulnerability to earthquakes caused by increasing population densities and unplanned development. Another relevant item is responds to the tsunami risk, which drawn attention after tsunami of 2004. Hence, this component aims to facilitate the preparation of earthquake emergency plans with a view to strengthen the capacity of the city dwellers to face, manage and operate the plan effectively in the event of earthquakes. At the same time, the component also aims to prepare coastal dwellers against the impact of tsunamis and to understand the vulnerability of areas to tsunami events.

In order to accomplish the activities of component 4a, the works below have been identified by CDMP (the bold texts are relevant to this report):

- Assess status of earthquake contingency planning, design interim plans and ultimately finalize them;
- **Assess the state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms**
- Catalog geological data sources;
- Prepare regional fault maps, urban geology engineering maps and seismic hazard maps;
- Strengthen capacity of non-technical decision-makers to use these resources;
- Update available information of cyclone shelter management for tsunami and storm surge preparedness;
- Prepare tsunami and storm surge inundation risk maps for the entire coastal region;

- Evaluate tsunami and storm surge-vulnerable infrastructure and its adaptation to serve in a tsunami event; and
- Appraise economic exposure of coastal livelihood to tsunami and storm surge events

Above activities have been clustered into groups of work packages to maximize the synergy in the execution of related activities, minimize needs for inter-agency communication and project management complexities as follows:

- Contingency planning with regard to earthquake hazard
- **Information inventory and data sharing**
- Seismic hazard and vulnerability mapping
- Generation of the tsunami inundation risk maps for the infrastructures and economic exposures of the coastal districts of Bangladesh
- Training, advocacy and Awareness with regard to earthquake and tsunami hazard

These five work packages were offered in five RFPs (RFP I, **RFP II**, RFP III, RFP IV and RFP V).

The RFP II was further sub divided into two RFPs such as, RFP II.1 and RFP II.2. CEGIS has been selected and awarded both of the sub packages, and this report is made for sub-package II.1, titled as “Assess state of information systems, and facilitate geo-hazard information sharing among the GoB and NGO GIS platforms”. As per contract agreement, CEGIS produced this report describing the activities on compatibility of GIS data, metadata, data sharing protocol and national GIS policy following the TOR in the contract agreement and as per the suggestions of the component manager. The TOR is presented in Appendix 1.1.1.

## **1.2 Scope of work under this contract**

It is understood from the ToR of the contract document provided by CDMP that, CEGIS will carry out an assignment to assess the state of information systems and facilitate geo-hazard information sharing among government and non-government organizations based on GIS platforms.

Many government agencies such as LGED, BARC, IWM, CEGIS, BWDB, SRDI, BBS, and SPARRSO have GIS databases and datasets and GIS systems. These organizations have been building up geographical databases over the years but with different projection system and geo-referencing, which created incompatibilities amongst GIS Users.

During the execution of the project, the important issues will be addressed are (i) the status of GIS data compatibility, (ii) metadata and metadata standard (iii) data sharing protocol, and (iv) a national GIS Data policy to facilitate information access/dissemination for disaster management.

To fulfill the objectives of the project, the major works identified are as follows:

- Assessment of compatibility of GIS data and metadata standard in the relevant organizations.
- Assess and develop metadata and metadata standard.
- Develop draft data sharing protocol to facilitate geo-hazard information sharing among GoB and NGO GIS platform.
- Prepare of the draft national GIS data policy guideline, metadata standard, data sharing protocol and inventory report of GIS data.

- Collect digital data so far developed by the front line GIS user organizations will also be carried out and will be stored in the CDMP's Data Management and Information Centre (DMIC).

### 1.3 Background of Spatial Data in Bangladesh

The use of spatial data in public administration, revenue collection and development planning began in Bangladesh during the early British rule in 1760s by the then Surveyor General of Bengal, Major James Rennell. The first detailed atlas of the then Bengal and Bihar was published in Nov 1779. The establishment of Survey of India (SoI) and the Land Records Administration began the use of spatial data in this region. SoI completed the topographic mapping of the whole area that included Bangladesh long before establishment of the Survey of Bangladesh (SoB). In parallel the LRA completed the preparation of detailed land parcel ownership data for the whole of the country long before the Department of Land Records and Survey (DLRS) started working in Bangladesh. A large spatial data archive already existed before the emergence of Bangladesh and before the computerized spatial database system in the form of GIS/LIS emerged. The data were however, in paper map form.

The introduction of GIS technology in this country dates back to the early 1990s when the Bangladesh Flood Action Plan (FAP) project set up a GIS facility under the Irrigation Support Project for Asia and the Near East (ISPAN) with funds from USAID. The GIS was set up to provide technical support to the country's flood disaster mitigation efforts. The success of ISPAN-GIS eventually helped the spread of the GIS technology to the other government departments, national and international NGOs, the universities and to the private sector. Since the early 1990's GIS was introduced in different universities in Bangladesh. GIS education and training facilities were setup in all the major universities of the country. Modern GIS labs were developed at the University of Dhaka, Bangladesh University of Engineering & Technology, Jahangirnagar University, Rajshahi University and the Khulna University. This has contributed to the development of a substantial GIS professional class who led the GIS database development efforts in various Government and Non-Government Organizations. Apart from that, at present, numerous organizations have developed their own GIS capability and are producing significant amount of digital spatial data covering areas like local government administration and management, natural resource management, natural disaster mitigation, utilities management, education and health care facility location, transport, communication and marketing.

Critical masses of highly skilled GIS professionals have gradually emerged. The growing acceptance of GIS technology in different organizations has led to the availability of a substantial amount of spatial data on various themes produced in different GIS platforms. This proliferation of spatial data in Bangladesh, like in many other countries, has happened in a decentralized and uncoordinated manner. There is no central depository/clearing house for spatial data. Each agency or organization produced its own data, using their own platform, standards and formats being unaware of the existence of the same data with other agencies. The result is duplication, wastage, and difficulties in interoperability.

### 1.4 Rationale of this project

Different organizations in Bangladesh have different pieces of data that would be useful for planning and responding to disaster management. Many agencies such as LGED, BARC, IWM, CEGIS, BWDB, SRDI, BBS, and SPARRSO have GIS setups and are maintaining valuable spatial databases which are being developed progressively over the years. Unfortunately, those data (both GIS and tabular) are not always compatible across the organizations. In case of GIS data, the incompatibility mainly arises due to the differences in projection system and geo-referencing. Some organizations are using LCC projection system,

some are using UTM and some are using BTM. This is happening mainly because of the absence of policy direction, absence of data standard, lack of co-ordination among the organizations, choice of foreign and local experts etc. The extent and standard of the metadata have not yet been determined in Bangladesh at national level.

Therefore, in order to make the GIS data compatible among the data generator and data user agencies and to determine the standard of metadata, a national GIS and metadata policy and as well as data sharing protocol is required. This project is targeted to address these issues. The implementation of GIS policy will bring the GIS data from a heterogeneous to homogenous format. This will help the users in obtaining data with good precision and timely access employing minimum resources and efforts.

### **1.5 Objectives**

The main objective of the project is to assess the state of information systems (i.e. national metadata standards and GIS compatibility issues), and facilitation of geo-hazard information sharing among GoB and NGO GIS users. The specific objectives of the project are as follows:

- a) To assess the compatibility of GIS data and metadata standard in the relevant organizations;
- b) To develop metadata standards;
- c) To develop data sharing protocol among GoB and NGO in GIS platform;
- d) To prepare guidelines for the development of a National GIS Data Policy.

### **1.6 Output and Deliverables**

According to the Terms of Reference provided by CDMP the outputs and deliverables of the project are mainly as follows:

- 1 Inception report - containing the literature review, highlighting the scope of work, methodology, resources, outputs and schedule of the assignment.
- 2 Report on the compatibility of GIS data, metadata standard, data sharing protocols and draft national GIS policy guidelines.
- 3 Validation and implementation exercises of GIS regulations and protocols.

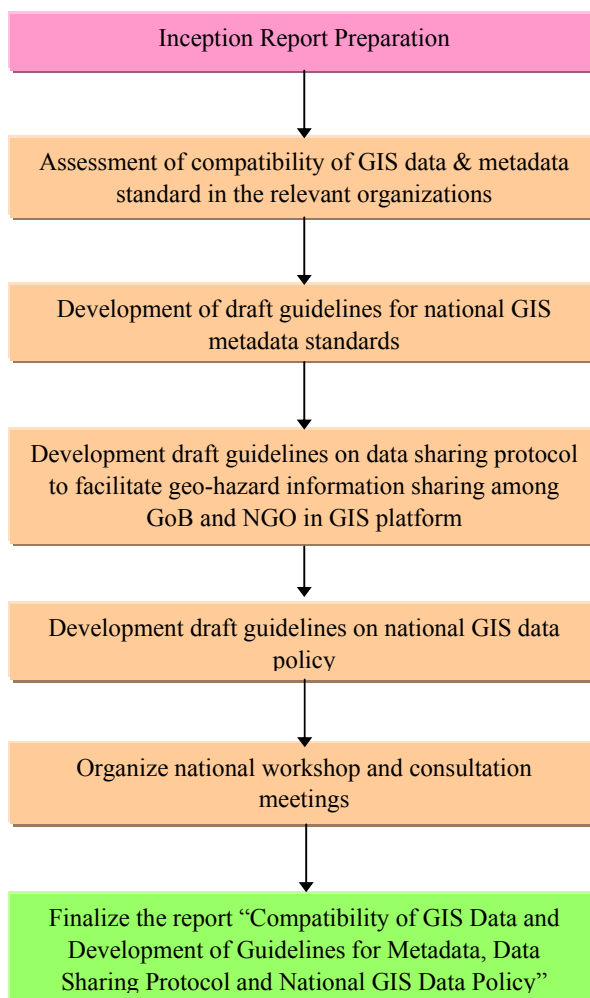
### **1.7 Structure of this report**

According to the contract agreement, this report will focus on the assessment of compatibility of GIS data, metadata and metadata standard, data sharing protocol and a draft national GIS policy guideline. The Project Activities are outlined in the Chapter 2. The assessment of GIS data compatibility among the GIS user organizations in Bangladesh is presented in Chapter 3. Metadata and different metadata standards including guidelines for geospatial metadata standards for Bangladesh has been described in Chapter 4. Chapter 5 contains the data sharing protocols of different countries and as well as proposed data sharing protocols for Bangladesh. Regarding national GIS data policy, this report will present a guideline for a National GIS Data Policy. This has been described in Chapter 6. Relevant large tables and documents have been attached in Appendices. Conclusion and Recommendations has been described in Chapter 7.

## Chapter 2

### Project Activities

To complete the project “Assess the state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms” several systematic and step wise activities were executed which is presented in Figure 2.1.1.



**Figure 2.1.1: Flow diagram of the project activities**

The brief descriptions of the different activities are given below.

**Inception Report Preparation:** The inception report has been prepared through literature review, and consultation with CDMP and other relevant organizations. A draft inception report was prepared comprising the understanding of the assignment, detail methodology, work plan, staffing etc., and was presented before the Technical Advisory Group (TAG) of CDMP for review. After taking the feedbacks from the TAG members the inception report was finalized and submitted to the CDMP for acceptance.

**Assessment of compatibility of GIS data and metadata standard in the relevant organizations:**

This activity has been performed mainly through questionnaire survey, consultation with the professionals of different organizations and preparation of matrix of GIS data regarding compatibilities. The major tasks accomplished under this activity are (i) need assessment of GIS data and metadata standard in view of CDMP, (ii) identification of organizations with GIS datasets to be assessed, (iii) literature review (document collection, review etc.), (iv) agency visits to assess the information on existing GIS data, metadata and data sharing policy/protocol in the identified organizations, and (v) preparation of matrix of GIS data, metadata and data sharing protocols of organizations to show the compatibilities, anomalies and implications. The detail description of Assessment of compatibility of GIS data is given in Chapter 3 of this report.

**Development of draft guideline for national GIS metadata standard:** This activity has been performed mainly through review of different national and international literatures and based on existing standard available at international level. The major tasks accomplished under this activity are (i) review existing IT policy of Bangladesh, (ii) review national and international documents on metadata, (iii) review ISO standards, (iv) consult with national IT, GIS and policy experts regarding the status of the existing GIS data and metadata, and (v) preparation draft GIS metadata standard guidelines. The detail description of GIS metadata standard is given in Chapter 4 of this report.

**Development draft guideline on data sharing protocol to facilitate geo-hazard information sharing among GoB and NGO in GIS platform:** This activity has been performed mainly through agency visits, consultation with the professionals of different GIS user organizations and reviewing different literature related to protocols. The major tasks accomplished under this activity are (i) agency visits to identify the data providing procedures, (ii) consultation with GIS professionals of different organizations, (iii) review literature regarding data dissemination and sharing protocols and (iv) develop a draft guideline on GIS data sharing protocol among the organizations. The detail description of GIS data sharing protocol is provided in Chapter 5 of this report.

**Development draft guideline on national GIS data policy:** This activity has been performed mainly through agency visits, consultation with the professionals of different GIS user organizations and reviewing different literature related to metadata standard, data sharing protocols and spatial/GIS related data policies. The major tasks accomplished under this activity are (i) agency visits to identify the data providing procedures, availability of metadata and metadata standards (ii) consultation with GIS professionals of different organization regarding GIS data policy matter, (iii) review of literatures regarding GIS data policy and (iv) development of a draft guideline on GIS data policy. The detail description of GIS data policy is provided in Chapter 6 of this report.

**Organize national workshop and consultation meetings:** To get feedbacks from national level wider community to finalize the guideline on metadata, data sharing protocol and national GIS data policy a national workshop and two consultation meetings were organized. The major tasks accomplished under this activity are (i) identification of national experts relevant to policy matters, IT, GIS data, metadata etc., (ii) invitation and sending draft guideline on metadata, data sharing protocol and national GIS data policy for their reviews, (iii) conduct a national workshop at LGED to get feedbacks, (iv) conduct a consultation meetings at CEGIS to finalize the received comments and (v) conduct another consultation meeting at SoB to finalize the projection parameters. The detail descriptions of the national workshop, consultation meetings and projection committee meeting are given in Appendix 2.2.1, Appendix 2.2.2, and Appendix 2.2.3 respectively.

**Finalize the guideline on metadata, data sharing protocol and national GIS data policy:** The draft guideline were presented in a national workshop, which was organized at Seminar Room, RDEC building, LGED on 22<sup>nd</sup> October 2008, The GIS experts from GO-NGO organizations, Educational Institutes/Universities and research organizations participated in the workshop and contributed with

ideas and views. Moreover, the draft policy guideline report was hosted in the website to get online comments from professionals and experts.

Later on, a national consultation meeting was organized on 23rd December 2008 at CEGIS conference room to finalize the received comments, feedbacks and criticisms obtained from the workshop and online feedback system. Finally, the draft report was reviewed by a group of experts/professionals from different front line GIS user organizations, they are (i) Dr. Shahedur Rashid, Professor, Department of Geography and Environment, Jahangirnagar University, (ii) Mr. Abed Hossain Chowdhury, Director Computer and GIS unit, BARC, (iii) Major Khairul Kadir, Survey Superintendent, Survey of Bangladesh, and (iv) Mr. Munir Siddiquee, Head GIS unit, LGED. Then the draft report on Compatibility of GIS Data and Development of Guidelines for Metadata, Data Sharing Protocol and National GIS Data Policy was finalized and submitted to CDMP.



## Chapter 3

### GIS data compatibility status assessment

#### 3.1 Review of GIS data in Bangladesh

GIS is playing active and vital roles through analyzing different spatial problems (e.g. disaster management, environmental etc.) and providing different solutions. The developed world has been successfully using GIS for natural, physical and human resources development, management and planning activities since the beginning of 1970s. The utilities of GIS for national and local level development plans in developing countries are being felt increasingly. Over the years GIS technology has shifted towards desktop computer with ever-increasing processing power and ever-decreasing costs. Alongside the advanced countries, some of the developing countries have developed comprehensive GIS database and resources. From the present trend of technology advancement, it is expected that within a few years GIS usages will become ever popular and cover all types of spatial analyses around the world. Presently many organizations of Bangladesh have been using GIS for planning and decision-making process starting from local to regional to national to global levels.

Many government projects started to use of GIS with financial and technical support from donor agencies. One major player and introducer of GIS in Bangladesh was FAP 19. They introduced ArcInfo GIS for flood analysis. Since then, use of GIS spread among the technical projects at higher pace. On the other hand, LGED installed a GIS lab for mapping of different level of administrative units (such as Thana maps). Eventually many other government and Non-Government Organizations (NGOs) started using GIS for spatial data presentation and analysis, mainly for mapping. A project was initiated named EGIS (Environmental and GIS Support Project for Water Sector Planning) as the successor of FAP 19 to hold the GIS expertise, and it continued for Phase I and Phase II. Later on, under the Ministry of Water Resources, it turned into Center for Environmental and Geographic Information Services (CEGIS) as a public trust in 2002. By this time, many other organizations adopted the GIS technology for their analysis and spatial data management where they started using different GIS software with different projection systems and parameters, which created inconsistencies and duplication of GIS data. In the mean time, since 1990s, the Department of Geography and Environment of Jahangirnagar University has started to develop skilled manpower to fulfill the national demand. Hundreds GIS capability students are now working all around Bangladesh. Behind them, highly skilled faculties having foreign PhDs/Masters working for them. Undergraduate, Postgraduate and MPhil/PhD programs have been offering over the decades in the department. Moreover, one month long GIS short courses as providing excellent opportunities for profession bodies working in the field of GIS and Remote Sensing.

#### ***3.1.1 GIS data holding organizations and GIS activities in Bangladesh***

There are many public and private organizations in Bangladesh who produce spatial data or maps for different types of uses by the planners and analysts. Some of them are currently equipped with modern GIS facilities. A list of such organization with their most prominent spatial data is presented in Table 3.1.1.

**Table 3.1.1: Organizations with prominent spatial data in Bangladesh**

Organization	Name of Map	Scale
Bangladesh Water Development Board (BWDB)	Contour maps with spot elevation	1:15,840 (4 inch = 1 mile)
Department of Public Health Engineering (DPHE)	Arsenic concentration map	
Center for Environmental and Geographic Information Services (CEGIS)	Flood extent maps from 100 meter resolution RADAR SAT image	1:1000,000
Local Government Engineering Department (LGED)	Thana base maps	1:50,000
Department of Land Records and Survey (DLRS)	Thana maps Mouza Maps (General and Special)	1 inch = 1 mile 16 inch = 1 mile (1:3,960) 32 Inch = 1 mile (1:1,980)
Soil Resources Development Institute (SRDI)	Soil Resources maps Agricultural Landuse Maps	1:50,000
Bangladesh Agricultural Research Council (BARC)	AEZ Maps Soil & land Resources maps	1:250,000 1: 50000
Survey of Bangladesh (SoB)	Topographic maps Aerial Photograph	1:50,000
Geological Survey of Bangladesh (GSB)	Geological Maps Earthquake maps	1: 1000,000
Bangladesh Inland Water Transport Authority (BIWTA)	Navigation route map	1:1,000,000

**Major GIS applications by different organizations:** Different organizations in Bangladesh are using GIS as planning tool in different sectors including agriculture, disaster management, environmental management, landuse planning, infrastructure planning, water resources planning, socio-economics and rural development etc. The efficient application of GIS depends on the availability of quality data, technical manpower, hardware/software, and precise goals and objectives. Although the availability of GIS software is increasing under government and donor supported projects but the availability of consistent and quality data are still in question.

Examples of major field of GIS applications in several organizations are presented in Table 3.1.2 below.

**Table 3.1.2: Example of major field of GIS applications in several organizations in Bangladesh**

<b>Organization</b>	<b>Major Field of GIS Applications</b>	<b>GIS related broad activities</b>
Bangladesh Bureau of Statistics (BBS)	Population and Demographics maps and database	To develop census based population and demographic data in GIS database format
Bangladesh Centre for Advanced Studies (BCAS)	Resources management	To assess the vulnerability of coastal areas to climatic change, To apply GIS in environmental, resources management etc.
Rajdhani Unnayan Kartripakkha (RAJUK) Chittagong Development Authority (CDA) Khulna Development Authority (KDA) Rajshahi Development Authority (RDA)	Urban Planning	To prepare thematic maps for urban land use planning at scales ranging from strategic (1:50 000) to detailed (1:3960) using spatial and attribute data.
Local Government Engineering Department (LGED)	Rural Development	To develop GIS based thana base maps & rural infrastructures database and for the rural development
Forest Department (FD)	Forest Maps	To prepare forest maps for site specific matching resources
Department of Geography and Environment University of Dhaka (DU)	Education and training	To develop degree oriented academic curricula at graduate and postgraduate level; To create training opportunities for government and NGOs. To accomplish collaborative research works with Course, local and foreign organizations and institutions /universities Research
Department of Geography and Environment Jahangirnagar University (JU)	Education and training, higher research, projects, old maps, toposheets, map projections, Google Earth formats, UNCLoS etc.	To develop degree oriented academic curricula at graduate and postgraduate level; To create training opportunities for government and NGOs. To accomplish collaborative research works with To provide short Course for the local and foreign organizations and institutions /universities, Research bodies, defense etc.
Center for Environmental and Geographic Information Services (CEGIS)	Natural Resources	To apply GIS in environmental, impact assessment, socio-economic

Organization	Major Field of GIS Applications	GIS related broad activities
	Management and Environmental Analysis	analysis and natural, agricultural, water resources management for sustainable development. To assess the vulnerability of coastal areas to climatic change, GIS application in disaster management and community risk assessment.
Bangladesh Agricultural Research Council (BARC)	Crop suitability and land resources management	To assess crop potential under different agro-eco system

### 3.1.2 Available GIS resources and data in Bangladesh

During last couple of decades considerable volume of GIS data have been generated in Bangladesh by different organizations, particularly under different projects. Later on several initiatives were taken to make spatial data inventory under several projects. CEGIS prepared five GIS data and resource inventory so far, these are:

- GIS Installation Summary of Bangladesh 1994; under ISPAN project;
- GIS Installation Summary of Bangladesh 1994; under EGIS-I project;
- GIS related Data Inventory under National Water Resources Development Project (NWRD), Phase I;
- GIS related Data Inventory under National Water Resources Development Project (NWRD), Phase II; and
- Inventory under Integrated Coastal Resources Database (ICRD) project.

**Bangladesh GIS Installation Summary 1994:** Irrigation Support Project for Asia and Nearest (ISPAN) executed this survey for Flood Plan Coordination Organization (FPCO), Ministry of Water Resources, in October 1994. The survey (ISPAN, 1994) reveals that during 1990s, GIS application in different sectors grown very fast especially for water and environmental sectors. The main purpose of survey was to identify user linkages, information exchange and data sharing. It was also observed that there were about 20 installations in country and about a dozen of them were operational; and most of the operational GIS in Bangladesh included government, donor and commercially sponsored GIS facilities. The summary of this survey outputs is presented in Appendix 3.1.1.

**Summary of GIS Resources in Bangladesh 1996:** A report named “Summary of GIS Resources in Bangladesh” was prepared by Environment and GIS Support project for Water Sector Planning (EGIS) as an output of a survey during 1996. Questionnaires were sent to 25 organizations and responses from 20 were received. The summary information of this report (EGIS, 1996) has been presented in Appendix 3.1.2. This report shows the summary status of GIS installations in the Bangladesh including hardware, software and input data in different organizations. From the survey it has been found that majority of the organizations (15) were using PC ArcInfo software and several organizations (6) were using ArcView GIS software and as well as other software. The survey also revealed the variety of applications and GIS projects. In addition, it gave a picture of their capability,

training background, personnel and facilities. The survey information will be helpful in preparing data standard and sharing protocols.

**GIS related data inventory under NWRD Phase-I, 1999:** During first phase of NWRD detail data inventory survey was carried out (NWRD/WARPO, 1999) to collect the information from different organizations to prepare a National Water Resource Database for Water Resources Planning Organization (WARPO). Through questionnaire survey information were collected from 25 organizations. Under this survey mainly three categories of data were collected: spatial data, attribute data and time series data. The inventory was prepared aiming:

- to enhance the data requirement and collection process;
- to facilitate data exchange or sharing within different organizations; and
- to prepare a data documentation from the inventory results

List of agencies and summary information of the inventory are presented in Table 3.1.3 and Appendix 3.1.3

**Table 3.1.3: List of agencies inventoried under NWRD Phase - I**

SL No	Organization	Type of Organization
1	Bangladesh Agricultural Development Corporation (BADC)	Government
2	Bangladesh Agricultural Research Center (BARC)	Do
3	Bangladesh Bureau of Statistics (BBS)	Do
4	Bangladesh Inland Water Transport Authority (BIWTA)	Do
5	Bangladesh Water Development Board (BWDB)	Do
6	Chittagong Water and Sewerage Authority (CWASA)	Do
7	Department of Environment (DoE)	Do
8	Department of Fisheries (DoF)	Do
9	Forest Department (FD)	Do
10	Department of Livestock Services (DPHE)	Do
11	Dhaka Water and Sewerage Authority (DWASA)	Do
12	Environmental and Geographic Information Services (EGIS)	Government Project
13	Geological Survey of Bangladesh (GSB)	Government
14	Local Government Engineering Department (LGED)	Do
15	National Minor Irrigation Development Project (NMIDP)	Government Project
16	Roads and Highway (R&H)	Government
17	River Research Institute (RRI)	Do
18	Survey of Bangladesh (SoB)	Do
19	Space Research and Remote Sensing Organization (SPARRSO)	Government
20	Soil Resources Development Institute (SRDI)	Government
21	Surface Water Modelling Centre (SWMC)	Institute
22	United Nations Children's Fund (UNICEF)	UN agency
23	Water Resources Planning Organization (WARPO)	Government

**GIS related data inventory under NWRD Phase-II:** During second phase of NWRD detail data inventory survey was carried out again to collect and update the information. The questionnaires were updated from the previous one and information were collected from 35 organizations (NWRD/WARPO, 2003).

The objective of this inventory was to prepare the base information on the data source, resolution, its future plan for updating and redundancy of the data set. Further, assessment of the data quality and metadata status of different organization was also part of the objectives. The major objectives of the inventory were:

- Enhance the data requirement and collection process;
- Facilitate data collection, exchange or sharing within different organizations;
- Data documentation status or metadata information; and
- Prepare the documentation of data inventory.

List of inventoried agencies under Phase-II of NWRD is presented in Table 3.1.4. The summary information of the inventory has been presented Appendix 3.1.4.

**Table 3.1.4: List of agencies inventoried under NWRD Phase –II, 2004**

Sl No.	Name of Organization	Type of organization
1	Association of Development Agencies in Bangladesh	Government
2	Bangladesh Agricultural Development Corporation	Government
3	Bangladesh Agricultural Research Council	Do
4	Bangladesh Bureau of Statistics	Do
5	Bangladesh Inland Water Transport Authority	Do
6	Bangladesh Inland Water Transport Corporation	Do
7	Bangladesh Meteorological Department	Do
8	Bangladesh Petroleum Corporation	Do
9	Bangladesh Road Transport Authority	Do
10	Bangladesh Small Cottage Industries Corporation	Do
11	Bangladesh Textile Mills Corporation	Do
12	Bangladesh Water Development Board	Do
13	Center for Environmental and Geographic Information Services	Public Trust
14	Coastal Embankment Rehabilitation Project	Do
15	Coastal Fisher-folk Community Network	NGO
16	Department of Agriculture Extension	Government
17	Department of Land Record Survey	Do
18	Disaster Management Bureau	Do
19	Department of Fisheries	Do
20	Forest Department	Do
21	Department of Livestock	Do
22	Department of Public Health Engineering	Do
23	Dhaka Water Supply and Sewerage Authority	Do
24	Economic Relation Department, Finance Ministry	Do

25	Geological Survey of Bangladesh	Do
26	International Union for Conservation of Nature	International Agency
27	Institute of Water and Flood Management	Do
28	Local Government Engineering Department	Government
29	Power Development Board	Do
30	Roads & Highways Department	Do
31	Rural Electrification Board	Do
32	River Research Institute	Do
33	Soil Resources Development Institute	Do
34	Bangladesh Telephone & Telegraph Board	Do
35	Department of Water Resources Engineering, BUET	Educational Institutes

**GIS related data inventory under ICRD, 2005:** Under ICRD project, data inventory survey was carried out in different organizations who are directly and indirectly involved in coastal zone management related activities (ICRD/WARPO, 2005). The overall objectives of the inventory survey was to prepare the base information on the data (GIS/spatial and attribute/non spatial) holdings of different organizations related to coastal zone management activities. The objectives of this inventory were as below:

- To realize the status of available datasets.
- To assess the requirement of the coastal zone data.
- To ensure proper collection of the existing information on coastal zone.
- To define the usability, accessibility and quality of data.
- To identify different organizations involved in coastal zone activities.
- To identify the completed and ongoing projects of different organizations related to coastal zone.
- To assist the collection, exchange or sharing of data among different organizations.
- To prepare the documentation of data inventory.
- To evaluate its implications in formulation of coastal policy and coastal development strategy.

The report of this survey included overview of the organizational functions in relation to coastal zone, analytical study, availability of data (GIS and attribute), quality of available data, status, usability, accessibility etc. List of inventoried agencies under ICRD survey is presented in Table 3.1.5 and the summary information has been presented in Appendix 3.1.5.

**Table 3.1.5: List of agencies visited for ICRD data inventory**

Sl. No.	Name of Organization/Projects	Types of organization
1	Bangladesh Agricultural Development Corporation (BADC)	Government
2	Bangladesh Agricultural Research Council (BARC)	Do
3	Bangladesh Bureau of Statistics (BBS)	Do
4	Bangladesh Haor and Wetland Development Board (BHWDB)	Do
5	Bangladesh Institute of Development Studies (BIDS)	Do

Sl. No.	Name of Organization/Projects	Types of organization
6	Bangladesh Inland Water Transport Authority (BIWTA)	Do
7	Bangladesh Inland Water Transport Corporation (BIWTC)	Do
8	Bangladesh Meteorological Department (BMD)	Do
10	Bangladesh Parjatan Corporation	Do
11	Bangladesh Petroleum Corporation	Do
12	Bangladesh Power Development Board (BPDB)	Do
13	Bangladesh Railway (BR)	Do
14	Bangladesh Rice Research Institute (BRI)	Do
15	Bangladesh Small and Cottage Industries Corporation (BSCIC)	Do
16	Bangladesh Water Development Board (BWDB)	Do
17	Cooperative of Assistance and Relief Everywhere (CARE)	Donor Agency
18	Chittagong City Corporation (CCC)	Do
19	Chittagong Development Authority (CDA)	Do
20	Char Development and Settlement Project (CDSP)	Govt. Project
21	Coastal Embankment Rehabilitation Project (CERP)	Do
22	Chittagong Port Authority (CPA)	Do
23	Chittagong Water Supply and Sewerage Authority (CWASA)	Do
24	Department of Agricultural Extension (DAE)	Do
25	Department of Environment (DoE)	Do
26	Department of Fisheries (DoF)	Do
27	Forest Department (FD)	Do
28	Department of Livestock Services (DLS)	Do
29	Department of Public Health Engineering (DPHE)	Do
30	Department of Water Resources Engineering (WRE), BUET	Do
31	Directorate of Health	Do
32	Directorate of Land Record and Survey (DLRS)	Do
33	Directorate of Secondary and Higher Education	Do
34	Disaster Management Bureau (DMB)	Do
35	Geological Survey of Bangladesh (GSB)	Do
36	International Union for Nature Conservation (IUCN)	Research
37	Institute of Water and Flood Management (IWFM), BUET	Educational Institute
38	Khulna Development Authority (KDA)	Do
39	Local Government Engineering Department (LGED)	Do
40	Marine Institute	Institute
41	Meghna Estuary Study (MES)	Govt. Project
42	Mongla Port Authority	Government
43	PETROBANGLA	Do
44	Rural Electrification Board (REB)	Autonomous
45	Roads and Highway Department (RHD)	Government
46	River Research Institute (RRI)	Do
47	Survey of Bangladesh (SoB)	Do
48	Space Research and Remote Sensing Organization (SPARRSO)	Do
49	Soil Resources Development Institute (SRDI)	Do
50	United Nations Children's Fund (UNICEF)	Donor Agency
51	World Fish Center (WFC)	Research

### 3.2 Assessment of current GIS data status in Bangladesh

The above 5 surveys give an idea of state of GIS data and holding organizations in Bangladesh evolved through 1994 to 2005. The GIS technology and its uses growing very fast, so another survey was felt required to assess the most recent situation on the state of GIS information for development of metadata, metadata standard, data sharing protocol and national GIS data policy. For this assessment, a questionnaire survey was carried out under this project to gather relevant GIS related information. The description and outputs of this survey is presented in following sub sections.

#### 3.2.1 Questionnaire Survey

Before the questionnaire survey, relevant GIS related major organizations were identified in consultation with CDMP (see Table 3.2.1). After that, a well-defined GIS data assessment questionnaire was developed and discussed with CDMP to gather information on GIS data format, projection system, projection parameters, data layers, data extent, metadata, software-hardware platforms, existing and probable future data communication protocols etc. The developed questionnaire has been presented in Appendix 3.2.1. The questionnaire was sent to different organizations along with a request letter from CDMP and finally the information were collected through physical visits. The process is shown in Figure 3.2.1.

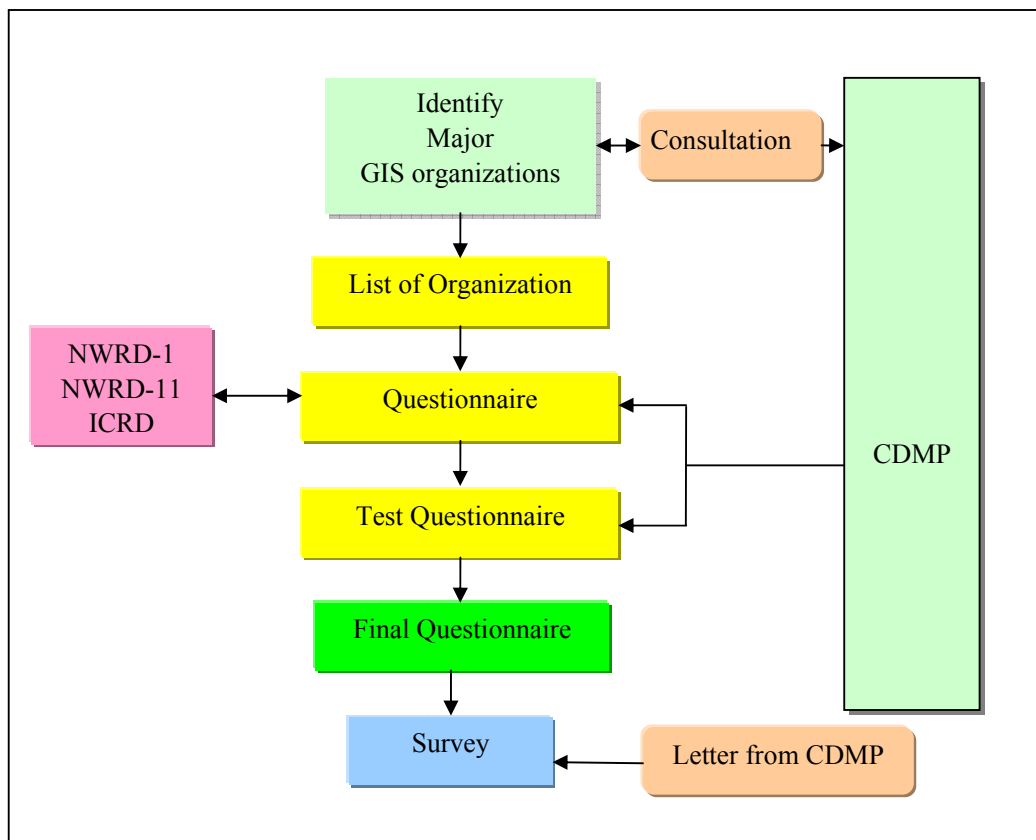


Figure 3.2.1: Process of questionnaire survey

**Table 3.2.1: Identified major GIS user organizations**

SL. No.	Name of organization	Type	SL. No.	Name of organization	Type
1	BBS	Government	21.	BUET	Educational Institute
2.	BARC	Government	22.	CNRS	Non-government Organization
3.	BWDB	Government	23.	CWASA	Government
4.	CEGIS	Public Trust	24.	DoE	Government
5.	DLRS	Government	25.	DPHE	Government
6.	FD	Government	26.	DWASA	Government
7.	IWM	Institute	27.	IUCN	International Agency
8.	LGED	Government	28.	RAJUK	Government
9.	SoB	Government	29.	RRI	Government
10.	SPARRSO	Government	30.	RU	Educational Institute
11.	SRDI	Government	31.	UNICEF	UN agency
12.	WARPO	Government	32.	RAB	Law enforcement agencies
13.	GSB	Government	33.	Grameen Phone	Cellular Mobile Phone Company
14.	RHD	Government	34.	KU	Educational Institute
15.	BADC	Government			
16.	DU	Educational Institute			
17.	Jahangirnagar University	Educational and Research Institute			
18.	BCAS	Non-government Organization			
19.	BIWTA	Government			
20.	BMD	Government			

During the survey, institutional capacity, policy, mandate regarding data generation, processing, sharing and dissemination were also collected. Short consultation meetings were also conducted with GIS managers, Database managers, IT experts and other relevant persons.

After this assessment survey, a matrix of available data and metadata has been furnished to map the GIS data compatibility issues among the organizations.

The survey revealed that different organizations have been using different projection systems and parameters to develop their GIS data layers for their own purposes. Many organizations even creating same data layers such as administrative boundary, which leads to data duplication at different level of accuracies and wastage of resources. Moreover, different organizations used different mode of data capture at different level of accuracies. The GIS platforms were also different.

Other GIS data compatibility issues are related to data format and data conversion process. All these factors contributed to inconsistencies and incompatibilities among the GIS data and users of different organizations.

### 3.2.2 Present status of geo-hazard related GIS data and data holding organizations

The survey conducted under this project covers 41 GO-NGO organizations through a questionnaire. A sample questionnaire is presented in Appendix 3.2.1. About 31 numbers of organization responded with their information. A summary showing organization, trained professional, GIS software and data collection process is presented in Table 3.2.2 below.

**Table 3.2.2: Present of GIS Resources in terms of GIS software and GIS personnel**

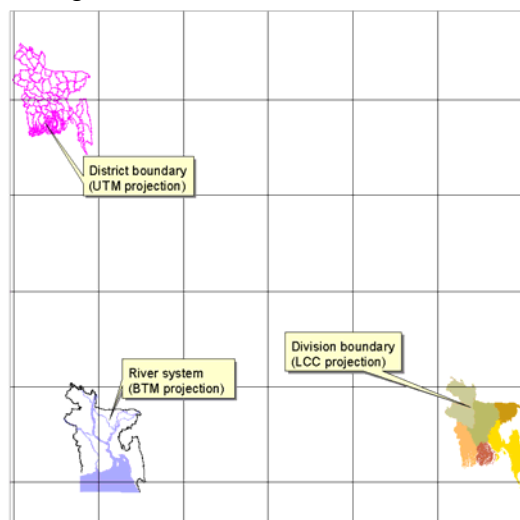
SL.	Name of Organization	No. of GIS Trained Professional	Name of GIS Software Available	Data Collection Procedures
1	BADC	Post Graduate-10, Graduate-14	ArcView-3.2 & 3.3, ERDAS-8.4	Primary, secondary collector and Collator
2	BARC	Post Graduate-3	ArcGIS-1, ArcInfo-1, ArcView-3	Primary, secondary collector and Collator
3	BBS		ArcInfo 3.3, 3.4D, 3.5.1, ArcView 3.0A, Erdas Imagine Professional Edition 8.5.	Primary and secondary collector
4	BIWTA	Under Graduate-02		
5	BMD	Post Graduate-5 (Trained), 2 (Non-trained), Graduate-1, Under Graduate-3	ArcGIS-9.2 ArcView-3.3	Secondary collector
6	BCAS	Post Graduate-3	ArcInfo ArcView	Primary, secondary collector and Collator
7	BNUS	PhD-1(Trained), Graduate-2(Trained), PhD-1(Non-trained)	ArcInfo MapInfo	
8	CARE – Bangladesh	Post Graduate-1	ArcGIS-9.0 ArcInfo ArcView-3.2 ERDAS	Primary, secondary collector and Collator
9	CEGIS	Post Graduate-10 (Trained) Graduate-10 (Trained), Under Graduate-10 (Trained)	pc ArcInfo 3.4, 3.4D, NT ArcInfo 7.0, ArcView 3.3, Erdas Imagine 8.6, ArcGIS 8.3, Pathfinder Office 2.8, MapInfo 9.02	Primary, secondary collector and Collator
10	CNRS	Post Graduate-3, Graduate-2	ArcInfo, ArcView	Primary, secondary

SL.	Name of Organization	No. of GIS Trained Professional	Name of GIS Software Available	Data Collection Procedures
				collector and Collator
11	CWASA	Data not received		
12	DOE	Data not received		
13	DoF	Post Graduate-3+2 (Trained)	ArcView-3.3, DBMS, dB IV-1.5	Secondary source as a collator
14	WRE, BUET	PhD-3, Post Graduate-2, Graduate-1		For educational purposes primary data are collected
15	DCC	Post Graduate-3 (Trained)		
16	Dhaka WASA	Post Graduate-1 (Trained) Graduate-4 (Trained) Under Graduate-1 (Trained)	ArcView-3.2, Mike Urban-11	Primary and secondary collector and collator
17	DLRS	Graduate-10 Under Graduate-3	ArcInfo-14	Secondary Collector
18	DPHE	Data not received		
19	DU-Geology	Data not received		
20	FFWC, BWDB	Graduate-4	ArcGIS, ArcInfo, ArcView	Field
21	Forest Department	PhD-1 (Trained) PostGraduate-2 (Trained) Under Graduate-2 (trained)	ArcInfo-3.5.1 (1) ArcView-3.2 (3) ERDAS-8.6 (3)	Primary, secondary collector and Collator
22	GSB	PhD-2 (Trained), Post Graduate-24 (Trained), Post Graduate-6 (Non-trained)	ArcGIS, ILWIS	Primary, secondary collector and Collator
23	IWFM, BUET	Trained-10 (PhD) Non-trained-15	ILWIS- version 3.4(Shareware)	Mostly secondary data collection. In some cases primary data also collected.
24	IUCN	Data not received		
25	IWM	Post Graduate-6 (Trained) Graduate-3 (Trained) Under Graduate-1 (Trained) Under Graduate-1 (Non-Trained)	ArcGIS, ArcView, ArcInfo, ERDAS	Primary, secondary collector and Collator
26	Dept. of Geography and Environment, JU	PhD-6 (Trained in England) Post Graduate-4 (Trained Abroad) PhD-5 (Non-Trained) Post Graduate-6 (Non-Trained) Masters at JU: 600 Honors at JU: 650 Short Course: 100	ArcGIS – Site ArcView – Site ArcInfo-Site ERDAS-Site ILWIS-Open Source	Primary, secondary collector and Collator mainly for research, project and degree purposes.
27	KDA	Post Graduate-2 (Trained) Graduate-2 (Trained)	ArcInfo, ArcView	Primary and secondary collector

SL.	Name of Organization	No. of GIS Trained Professional	Name of GIS Software Available	Data Collection Procedures
28	LGED	Post Graduate-15 (Trained) Graduate- 5(Trained) Under Graduate-5 (Trained) Graduate-3 (Non-trained)	ArcGIS-8&9 ArcInfo-3.5.1 ArcView-3.2 ERDAS-8	Primary, secondary collector and Collator
29	RDA	Post Graduate-1 (Non trained) Graduate-1 (Trained), Under Graduate-2 (Non trained)	ArcInfo, ArcView	Primary and secondary collector
30	RAJUK	Data not received		
31	RHD	Post Graduate-1+2 (Consultant) Graduate-2 (Part-time) UnderGraduate-2 (Part-time)	ArcGIS-8.2 ArcInfo-8.2 ArcView-3.1 Engine-Runtime	Primary, secondary collector and Collator
32	RRI	Data not received		
33	Dept. of Geography & Environmental Studies, RU	Not Described	ArcGIS, ArcInfo, ArcView	
34	RU-Geology	Data not received		
35	SRDI	Post Graduate-2 (Trained) Graduate-4 (Trained) Post Graduate-2 (Non-trained)	ArcGIS-V. -9.1;01 ArcInfo-V. -9.1;01 ArcView-V.3.0;06	Primary, secondary collector and Collator
36	SPARRSO	PhD-4 (Trained) Post Graduate-30 (Trained) Graduate-6 (Trained) Under Graduate-6 (Trained)	ArcInfo, ERDAS	Primary, secondary collector and collator
37	SoB	Data not received		
38	UNICEF	Data not received		
39	WARPO	10 Officers of Different Section (Trained), 15 Officers of Different Section (Non- trained)	ArcView, ArcGIS, ArcInfo	Secondary Collector
40	Dept. of Geography and Environment, DU	Ph.D 5 (Post Graduate Training in GIS from USA, UK, Australia, Japan and India). M.GIS 1 MS 2	ArcGIS - 9.2 ArcInfo - 3.4.1 ArcView - 3.3 ERDAS 9.2 ENVI	Primary, secondary collector and Collator
41	Dept. Urban and Rural Planning, KU	PhD-4 (Trained) & 5 (Non- Trained), Post Graduate-2 (Trained) & 4 (Non-Trained), Graduate-4 (Trained) & 3 (Non-Trained)	ArcGIS- 9.1 ArcView- 3.0 ERDAS- 8.4	Not Described

### 3.2.3 Projection System

It has been seen from the study that the main reasons of data incompatibility is different method of geo-referencing using different projection systems and parameters. This causes data overlay problems. An example is presented in Figure 3.2.2 and in Table 3.2.3. The Figure 3.2.2 shows that with LCC, BTM and UTM projection systems, the map of Bangladesh spatially falls in three different locations when overlaid. The area and length also differs as shown in Table 3.2.3.



**Figure 3.2.2: Variation of location of different data layers of Bangladesh due to different projection systems**

**Table 3.2.3: Variation of areas and lengths in different projection systems**

Projection	Area of Bangladesh (sq.km)	Road Length (km) of Teknaf- Tentulia
Lambert Conformal Conic (LCC)	139,798.00	954.78
Universal Transverse Mercator (UTM 46)	140,073.21	955.58
Bangladesh Transverse Mercator (BTM)	139,813.28	955.22
Bangladesh Universal Transverse Mercator (BUTM WGS84)	139,845.65	955.95
Bangladesh Universal Transverse Mercator (BUTM Everest)	139,813.28	955.84
Indian Zone Grid (IIB)	139793.00	954.85

The survey under this project also included the information on projection systems used by different organizations and a summary is presented in Table 3.2.4 below. The Table shows that more than 75% of the surveyed organizations are using BTM Projection system, around 25% of the organizations are using LCC and as well as UTM projection system. Some organizations, mainly universities, are using multiple projection systems for their GIS data preparation and database development.

**Table 3.2.4: Projection systems used by different organizations**

SL. No.	Organization	Projection System Used
1	BADC	BTM = Bangladesh Transverse Mercator
2	BARC	BTM = Bangladesh Transverse Mercator LCC = Lambert Conformal Conic
3	BBS	BTM = Bangladesh Transverse Mercator
4	BIWTA	UTM = Universal Transverse Mercator
5	BMD	BTM = Bangladesh Transverse Mercator
6	BCAS	BTM = Bangladesh Transverse Mercator
7	BNUS	Not described
8	CARE - Bangladesh	BTM = Bangladesh Transverse Mercator
9	CEGIS	BTM = Bangladesh Transverse Mercator
10	CNRS	BTM = Bangladesh Transverse Mercator
11	CWASA	Data not received
12	DoE	Not received
13	DoF	BTM = Bangladesh Transverse Mercator
14	WRE, BUET	UTM = Universal Transverse Mercator BTM = Bangladesh Transverse Mercator
15	DCC	BTM = Bangladesh Transverse Mercator
16	Dhaka WASA	BTM = Bangladesh Transverse Mercator
17	DLRS	Cassini
18	DPHE	Data not received
19	DU-Geology	Data not received
20	FFWC, BWDB	BTM = Bangladesh Transverse Mercator
21	Forest Department	BTM = Bangladesh Transverse Mercator
22	GSB	BTM = Bangladesh Transverse Mercator
23	IWFM, BUET	UTM = Universal Transverse Mercator BTM = Bangladesh Transverse Mercator LCC = Lambert Conformal Conic
24	IUCN	Data not received
25	IWM	BTM = Bangladesh Transverse Mercator
26	Dept. of Geography and Environment, JU	UTM = Universal Transverse Mercator BTM = Bangladesh Transverse Mercator LCC = Lambert Conformal Conic
27	KDA	BTM = Bangladesh Transverse Mercator
28	LGED	LCC = Lambert Conformal Conic
29	RDA	BTM = Bangladesh Transverse Mercator
30	RAJUK	Data not received
31	RHD	LCC = Lambert Conformal Conic
32	RRI	Data not received
33	RU-Geography	BTM = Bangladesh Transverse Mercator
34	RU-Geology	Data not received
35	SRDI	LCC = Lambert Conformal Conic
36	SPARRSO	BTM = Bangladesh Transverse Mercator

SL. No.	Organization	Projection System Used
37	SoB	Data not received
38	UNICEF	Data not received
39	WARPO	UTM = Universal Transverse Mercator BTM = Bangladesh Transverse Mercator LCC = Lambert Conformal Conic
40	Dept. of Geography and Environment, DU	UTM = Universal Transverse Mercator BTM = Bangladesh Transverse Mercator IIB = Indian Zone Grid
41	Dept. of Urban and Rural Planning, KU	UTM = Universal Transverse Mercator

The advantage of the BTM projection system is that it minimizes the amount of distortion over the area of interest while preserving certain relationships such as direction or area consistency. On the other hand BUTM, being used by SoB is similar to BTM except its false northing is zero instead of (-2000000). This includes the trans boundary on south of Bangladesh.

The other two common map projections systems used in Bangladesh are (i) Universal Transverse Mercator (UTM) and (ii) Lambert Conformal Conic (LCC). The spatial distortions under UTM projection increase from the central meridian in east-west directions. This projection system is suitable for maps of tropical latitudes and result in increasing spatial exaggerations where the great circles of longitude converge near the poles. The UTM system divides the world into sixty north-south zones, each 6° wide. Unfortunately, Bangladesh is divided almost equally between two UTM zones (45 & 46), one east of 90° E longitude and other one is the west of that meridian. Therefore, the UTM projection requires use of two different transformations for dealing with spatial data from the two zones of Bangladesh (ISPAN/FAP-19).

The Cassini-Soldner projection is the ellipsoidal version of the cassini projection for the sphere. It is not conformal but as it is relatively simple to construct it was extensively used in the last century and is still useful for mapping areas with limited longitudinal extent. It has now largely been replaced by the Conformal Transverse Mercator which it resembles. Like this, it has a straight central meridian along which the scale is true, all other meridians and parallels are curved, and the scale distortion increases rapidly with increasing distance from the central meridian. This projection maintains scale along the central meridian and all lines parallel to it and is neither equal area nor conformal. It is most suited for large-scale mapping of areas predominantly north-south in extent.

The parameters of different map projection systems used by various organizations mentioned in Tables 3.2.4 and 3.2.5.

**Table 3.2.5: Parameters of different projection systems**

Projection	Projection name	Spheroid	Central Meridian	Latitude of Origin	False Northing	False Easting	Scale Factor	Units	Common Users
TM	Transverse Mercator	Everest (probable 1830)	90° E of Greenwich	-	-	500,000 meters	0.9998	Meter	ISPAN
BUTM	Bangladesh Universal Transverse Mercator	Gulshan 1937	90° E of Greenwich	0°	0	500,000 meters	0.9996	Meter	SOB
BTM	Bangladesh Transverse Mercator	Everest 1830	90° E of Greenwich	0°	-2000000	500,000 meters	0.9996	Meter	CEGIS, IWM, WARPO, JU, BCAS etc.
UTM for zone 45	Universal Transverse Mercator	WGS 1984	87° E	0°	0	500,000 meters	0.9996 0r 0.9998	Meter	RS images provider
UTM for zone 46	Universal Transverse Mercator	WGS 1984	93° E	0°	0	500,000 meters	0.9996	Meter	RS images provider
LCC	Lambert Conformal Conic	Everest 1830	90° E of Greenwich	26° N	914,395 meters	2,743,186	0.9988	Meter	LGED, SRDI, R&H
LCC	Lambert Conformal Conic	Everest 1830	90° E of Greenwich	26° N	100,000 yards	3000,000 yards	0.9996	Yards	SoB until late1990s
IIB	Indian Zone Grid II B	Everest 1830	90° E of Greenwich	26° N	1000000 Indian yards	3000000 Indian yards	0.998786408	Yards	
IIIB	Indian Zone Grid III B	Everest 1830	100° E of Greenwich	19° N	1,000,000 Indian yards	3,000,000 Indian yards	0.998786408	Yards	
Cassini	Cassini, Cassini-Soldner	Everest 1830	90°					Meter	DLRS

### 3.2.4 GIS data formats and conversion

The major data sources for GIS maps are old hardcopy maps available in Survey of Bangladesh (SoB), BWDB, DLRS, LGED, BADC, BARC etc. SoB maintains detail topographic maps covering the whole Bangladesh. DLRS has the hard copy thana maps with mouza boundaries and mouza maps with plot boundaries, BWDB has the hardcopy contour maps and irrigation maps and LGED has the upazila base maps. All of these organizations holds some other maps also. Almost all of them have GIS setup and already converted a significant coverage of maps into digital format under different projects. The digital maps are in different formats based on the mapping software used. Most of the organizations used ArcInfo and ArcGIS as their mapping software. They produced ESRI ArcInfo Coverage and ESRI Shape files. Some organizations used different software like TNT Mips, MapInfo etc., for preparing GIS maps. BIWTA prepared Finnmaps for coastal area during last decade. They used TNT mips. Among the non-government organizations Grameen Phone uses MapInfo for their radio planning maps. The problem is data format and export/import such as, TNT mips can read/import/export ArcInfo and Shape format files but ArcInfo, ArcView can not read/import the TNT mip files directly. The satellite images, scanned maps and other generated spatial data like Digital Elevation Model are stored in raster or grid format. Most of the organizations, such as SPARRSO, CEGIS, LGED use ERDAS IMAGINE to process and store satellite image data. Some organizations store images and scanned maps in GeoTiff and JPEG format.

During the format conversion by export/import some data might be lost or distorted. The differences between the GIS software creates incompatibilities and inconsistencies in GIS data. It generates problems in data sharing across the organizations and projects. Such problems were felt when the DEM prepared by WARPO was imported into TNT Mips.

For exchanging the data from one format to another, it is essential to convert the data following the standard process and standard file format. The two important issues concerned to data format are (i) Data Conversion, and (ii) Data Standardization.

**Data Conversion:** Data conversion is defined as the translation of data from one format to another. When data is moved from one system to another, some form of data conversion is required. The following are the usual data conversion format used among the GIS users.

- Vector-to-Vector & Raster-to-Raster
- Vector-to-Raster & Raster-to-Vector

A standard GIS file format is important in data exchange from one platform to another. Different types of standards are available in GIS world. One prominent Vector GIS data format is ESRI Shapefile.

**Data Exchange Standards:** To ensure distortion free exchange of data among the user organizations a standard for data exchange is highly essential. So far, in Bangladesh, no such standard is developed or adopted. Some data exchange standards in international arena are as follows:

- Government Standards, SDTS
- Industry Standards
- Open GIS Consortium, GML

In USA and Europe, most of the countries usages the Government Standard e.g. SDTS as data exchange standard. The brief description of SDTS is given below:

**Spatial Data Transfer Standard (SDTS):** The Spatial Data Transfer Standard (SDTS), is a robust way of transferring geo-referenced spatial data between dissimilar computer systems with the

potential for no information loss. The purpose of the SDTS is to promote and facilitate the transfer of digital spatial data between dissimilar computer systems, while preserving information meaning and minimizing the need for information external to the transfer. SDTS implementation will significantly ensure the interest of the users and producers of digital spatial data, which increased the potential access and sharing of spatial data. The SDTS also reduces the information loss in data exchange, eliminate the duplication of data acquisition, and the increases the quality and integrity of spatial data.

STDS is a transfer standard that embraces the philosophy of self-contained transfers, i.e. spatial data, attribute, georeferencing, data quality report, data dictionary, and other supporting metadata all included in the transfer. SDTS transfer format was developed and designed to handle all types of geographic data. SDTS can be either binary or ASCII but is generally binary. Virtually all geographic concepts can be encoded in SDTS, including coordinate information, complex attribute information, and display information. This versatility causes a corresponding increase in complexity. To simplify things, several standard subsets of SDTS have been adopted. The first of these, the Topological Vector Profile (TVP), is used to store certain types of vector maps. SDTS can also be used for raster information. Unfortunately, many software systems still do not support it. However, National Spatial Data Infrastructure (NSDI) of USA is trying to establish this standard at national level and promoting at international level.

### 3.2.5 Quality and data management

During the survey under this project, two sets of information regarding the data quality were collected: (i) whether quality control was considered; (ii) was there any quality guideline. The summarized survey findings are presented in Table 3.2.6. It is found that only 12 organization responded with positive answers and most of them were following their own process of quality control monitoring. CEGIS developed a “*Spatial Data Quality Standards and Guideline for NWRD Spatial Data Quality*” in 2001 for WARPO under NWRD project (NWRD/WARPO, 2001). Otherwise, no other organization found to have any quality control guideline document on GIS data.

**Table 3.2.6: Data quality status from 2008 survey**

SL.	Organization	Description of Data Quality	Data Documentation/ Report
1	BADC		1. Irrigation Area & Equipment Survey Report. 2. Water Quality Testing & Monitoring Report 3. Irrigation Cost Report (yearly).
2	BARC		1. GIS at BARC 2. Documentation of methodologies used in preparing various technical outputs
3	BBS		Yes
4	BIWTA		1. Tide table 2. Water level data. 3. Hydrographic survey maps
5	BMD		No
6	BCAS	Standard format - As per requirement	Technical report
7	BNUS		Seismic Hazard In Bangladesh
8	CARE - Bangladesh		No
9	CEGIS	Data quality guideline	All projects report

SL.	Organization	Description of Data Quality	Data Documentation/ Report
10	CNRS		All projects report
11	CWASA	Data not received	
12	DoE	Data not received	
13	DoF		Yes, Fishery Statistical Yearbook of Bangladesh (2005-2006)
14	WRE, BUET		No
15	DCC		GIS based Ward Map preparation
16	Dhaka WASA	No	No, Tracing map
17	DLRS		No
18	DPHE	Data not received	
19	DU-Geology	Data not received	
20	FFWC, BWDB		1.Monthly flood report 2.Annual flood report 3.Daily flood report
21	Forest Department	Standard format -Own standard	Yes, Data processing has been reported in the methodology chapter of Project Consultant report.
22	GSB	Not described	Geology of Barguna district, Bangladesh
23	IWFM, BUET	Standard format- Manual check through visualization and usual statistics	List of publications for all the reports. Detailed description of collected data tools and techniques use also documented in the study report
24	IUCN	Data not received	
25	IWM	Yes	All projects report
26	Dept. of Geography and Environment, JU		Yes, Need to be collected from Individual Researcher, Teacher or Students.
27	KDA	Standard format- As Per Terms of Project and Technical Project Proforma	Yes
28	LGED	Standard format -Own standard	No
29	RDA	Not described	Yes
30	RAJUK	Data not received	
31	RHD	Standard format- As usual	No
32	RRI	Data not received	
33	RU-Geography	Not described	Thesis and other publications
34	RU-Geology	Data not received	
35	SRDI	Primary data is generated by trained officials with supervision of professional supervisor. Quality of the data is satisfactory. However, there is no quality control authority in the digital data generation process.	Data register, Technical reports [Reconnaissance Soil Survey Report, Thana Guide, Salinity Monitoring Report, Fertility Monitoring Report]

SL.	Organization	Description of Data Quality	Data Documentation/ Report
36	SPARRSO	Quality control being done according to the relevant policy of SPARRSO.	Yes, but it is not in final form.
37	SoB	Data not received	
38	UNICEF	Data not received	
39	WARPO	Yes, NWRD has upgraded the quality of the collected data by: Checking the obvious errors, updating the shapefiles using recent satellite images, digitizing, converting the hardcopy into digital form, field verification etc.	Yes
40	Dept. of Geography and Environment, DU	Data are generated for individual student or faculty research requirements.	Individual Reports, Thesis and Dossertations.
41	Dept. Urban and Rural Planning, KU	Yes	Yes

### 3.2.6 Data documentation

The data documentation information was also collected during the questionnaire survey under this project. The summarized status of GIS data documentation by different organizations is presented in Table 3.2.7 below. It shows that 15 organizations have the data documents/reports and 13 organizations have no specific data documents. Those who have the data documents are yet to be standardized. The available data documents are part of the technical reports describing the data processing and their quality.

**Table 3.2.7: Data documentation status in different organization**

SL.	Organization	Data Documentation
1	BADC	Yes
2	BARC	Yes
3	BBS	Yes
4	BIWTA	Yes
5	BMD	No
6	BCAS	Yes
7	BNUS	Yes
8	CARE - Bangladesh	No
9	CEGIS	Yes
10	CNRS	No
11	CWASA	Data not received
12	DoE	Data not received
13	DoF	Yes
14	WRE, BUET	No

SL.	Organization	Data Documentation
15	DCC	Yes
16	Dhaka WASA	No
17	DLRS	No
18	DPHE	Data not received
19	DU-Geology	Data not received
20	FFWC, BWDB	Yes
21	Forest Department	Yes
22	GSB	Yes
23	IWFM, BUET	Yes
24	IUCN	Data not received
25	IWM	Yes
26	Dept. of Geography and Environment, JU	Yes
27	KDA	Yes
28	LGED	Yes
29	RDA	Yes
30	RAJUK	Data not received
31	RHD	No
32	RRI	Data not received
33	RU-Geography	Yes
34	RU-Geology	Data not received
35	SRDI	Yes
36	SPARRSO	Yes
37	SoB	Data not received
38	UNICEF	Data not received
39	WARPO	Yes
40	Dept. of Geography and Environment, DU	Yes
41	Dept. of Urban and Rural Planning, KU	Yes

### 3.3 Findings on GIS Data Compatibility

The study of previous surveys and current survey show that, regarding the data compatibility the major problems are concerned with the different projection systems, lack of metadata standard, quality guideline and common or national data sharing/dissemination protocols. All these are causing data duplication, accessibility problems and incompatibilities. The findings regarding the data compatibilities in brief are:

- The survey shows that majority of the organizations are using ESRI Software e.g. ArcGIS, ArcInfo, ArcView etc. for preparation of GIS data.
- Majority of the surveyed organizations are using BTM projection with WGS 1984 datum and some frontline organizations such as BARC, LGED, RHD and SRDI are using LCC projection system.
- Majority of the organizations do not have standard rules or regulations to disseminate and share the GIS data. Some organization disseminate/share data following their own process, such as:

- Letter to the head of the organization is required.
  - Some organizations have data requisition forms.
  - Some organizations provide data to the researchers/ students at free of costs.
  - Some organizations provide data on payment.
  - Some organizations provide/share data through memorandum of understanding between the organizations etc.
- A few organizations have the metadata system and they are not even using commonly used metadata system and standard.
  - Only two organizations (CEGIS, WARPO) have draft spatial data quality documents for capturing, processing and quality control of GIS data.
  - Data documentation lies in tiny chapters of the relevant project technical report.
  - All the organizations urge that there should be common metadata standard, national GIS data policy and well-defined data sharing protocols.

Based on above findings the study suggests:

- A national common metadata standard, a national GIS data policy and a well-defined data sharing protocol are required.
- All the organizations should have the common projection systems and parameters to make the data compatible among the GIS user organizations in Bangladesh. BUTM projection system could be taken a standard for Bangladesh, since most of the organizations are using BTM and BTM projection is similar to BUTM except one parameter. Further, BUTM gives better accuracy and produce minimum distortion. Further investigation could be done on this issue with participation from major GIS user organizations.
- There should be a common and standard data capturing, processing and development system of GIS data.
- A set of guidelines for national GIS data sharing protocols with data security and royalty among the organizations are required.
- A broad base national GIS and atlas committee should also be formed where GIS could also be included to overview project data standards.



# Chapter 4

## Metadata and metadata standard

### 4.1 Introduction

Metadata is information about data, describing the "what", "when", "who" and "how" of data. Metadata is structured data, which describes the characteristics of a resource. It shares many similar characteristics to the cataloguing that take place in libraries, museums and archives. A metadata record consists of a number of pre-defined elements representing specific attributes of a resource, and each element can have one or more values. Spatial metadata incorporates additional information about the "where" component of data. It also provides information about geospatial dataset to facilitate searching, extracting and sharing. In the context of digital spatial data, metadata is the background information, which describes the content, quality, condition, and other appropriate characteristics of the data. Metadata serves many important purposes, including data browsing, data transfer, and data documentation.

### 4.2 Metadata Standard

A metadata standard is simply a common set of terms and definitions that are presented in a structured format. Use of geospatial data has been growing tremendously in all over the world in recent years. For the compatibility and standardization of describing geospatial data, a standard system needs to be used. Many national, regional and special-user groups have developed standards and methods for transferring and handling this type of data. Among these, the most well circulated standard is the Federal Geographic Data Committee (FGDC) standard that contents standards for digital geospatial metadata. Australia New Zealand Information Council (ANZLIC) developed a metadata standard for Australia and New Zealand. The European Committee for Standardization (CEN) has developed a European metadata standard. The International Standard Organization (ISO) has also developed metadata standard known as Geospatial metadata standard ISO 19115:2003. Brief descriptions of these standards are given below.

#### 4.2.1 FGDC Metadata Standard

The Content Standard for Digital Geospatial Metadata (CSDGM), Version 2 (FGDC-STD-001-1998) is the US Federal Metadata standard. The Federal Geographic Data Committee originally adopted the CSDGM in 1994 and revised it in 1998. FGDC provided worldwide leadership in the development of the CSDGM, which became a base for many other national standards including ISO 19115. The objectives of the standard are to provide a common set of terminology and definitions for the documentation of digital geospatial data. This standard is intended to support the collection and processing of geospatial metadata (FGDC, 1998).

The Content Standard for Digital Geospatial Metadata (CSDGM) was developed to identify and define the metadata elements used to document digital geospatial data sets for many purposes. These include metadata to: 1) preserve the meaning and value of a data set; 2) contribute to a catalog or clearinghouse and; 3) aid in data transfer. The standard is organized in a hierarchy of data elements and compound elements that define the information content for metadata to document a set of digital geospatial data. The starting point is "metadata", which is a compound element composed of other compound elements representing different concepts about the data set. Each of these compound

elements has a numbered section in the standard. In each numbered section, these compound elements are defined by other compound elements and data elements. For example, the section "contact information" is a special section that specifies the data elements for contacting individuals and organizations. This section is used by other sections, and is defined once for convenience. Brief descriptions of the compound sections in the CSDGM are given below.

**Metadata:** data about the content, quality, condition, and other characteristics of data.

**Identification Information:** basic information about the data set.

**Data Quality Information:** a general assessment of the quality of the data set.

**Spatial Data Organization Information:** the mechanism used to represent spatial information in the data set.

**Spatial Reference Information:** the description of the reference frame for, and the means to encode, coordinates in the data set.

**Entity and Attribute Information:** details about the information content of the data set, including the entity types, their attributes, and the domains from which attribute values may be assigned.

**Distribution Information:** information about the distributor of and options for obtaining the data set.

**Metadata Reference Information:** information on the currentness of the metadata information, and the responsible party.

**Time Period Information:** information about the date and time of an event.

**Citation Information:** the recommended reference to be used for the data set.

#### **4.2.2 ANZLIC Metadata Standard**

In the absence of an international metadata standard, Australia New Zealand Information Council (ANZLIC) developed a metadata standard in 2001 for Australia and New Zealand defining minimum requirements for metadata to be included in Australian Spatial Data Directory (ASDD). The ANZLIC Metadata Guidelines version two is designed for use by data custodians to assist them to create store and distribute core metadata elements. The document includes introductory information on metadata, its use and its management. References include sources of more detailed information that users may require as they become more experienced with metadata and its use as an aid to data management within their own agencies. There was extensive input by Australia during development of International Standard for Metadata (ISO 19115:2003) by Technical Committee for Geographic information/Geomatics (ISO/TC 211), and as a result, ISO 19115 incorporates several ANZLIC core metadata elements. ANZLIC is currently developing a metadata profile as part of the ANZLIC Metadata Project (ANZLIC, 2008).

The ANZLIC Metadata Guidelines specify a set of core metadata elements consist 41 elements. They were originally based on the United States Federal Geographic Data Committee (FGDC)'s *Content Standard for Digital Geospatial Metadata* and have been made consistent with the *Australian New Zealand Standard on Spatial Data Transfer AS/NZS 4270*. To assist in describing and referencing core elements, those relate to similar information have been grouped into ten different categories – dataset, custodian, description, data currency, dataset status, access, data quality, contact information, metadata date and additional metadata.

**Dataset, Custodian** and **Description** categories provide essential information about the content of the data, the agency responsible for its collection and maintenance, and the geographic area it covers.

**Data Currency** and **Dataset Status** categories establish the time frame of the data described.

**Access** category is intended to provide potential users of datasets with sufficient information to determine if the data is in a suitable format or able to be transformed for their purpose.

**Data Quality** information is critical to determining the usefulness of a dataset for a particular application. While lineage, positional accuracy, attribute accuracy, logical consistency and completeness have not always been well documented in the past, the national directory system must provide relevant information about data quality at the highest level – at least a summary or overview.

**Contact Information** provides address details for the contact person in the contact organization that is responsible for delivery of the dataset to other users.

**Metadata Date** establishes the currency of the directory entry.

**Additional Metadata** provides additional information that supports documentation of the dataset. This additional information may include a link to the source of more detailed information about a dataset through specific theme directory systems.

A summary of core metadata elements of ANZLIC is presented in Table 4.2.1. For each of the core metadata elements, basic characteristics, such as, Category, Element Name, Definition of Element, Obligation (Obln), Maximum Occurrence (Max Occ) and Type, (both Field Type and Length of Field) is also provided. Graphical representation of ANZALIC metadata elements is also shown in Figure 4.2.1.

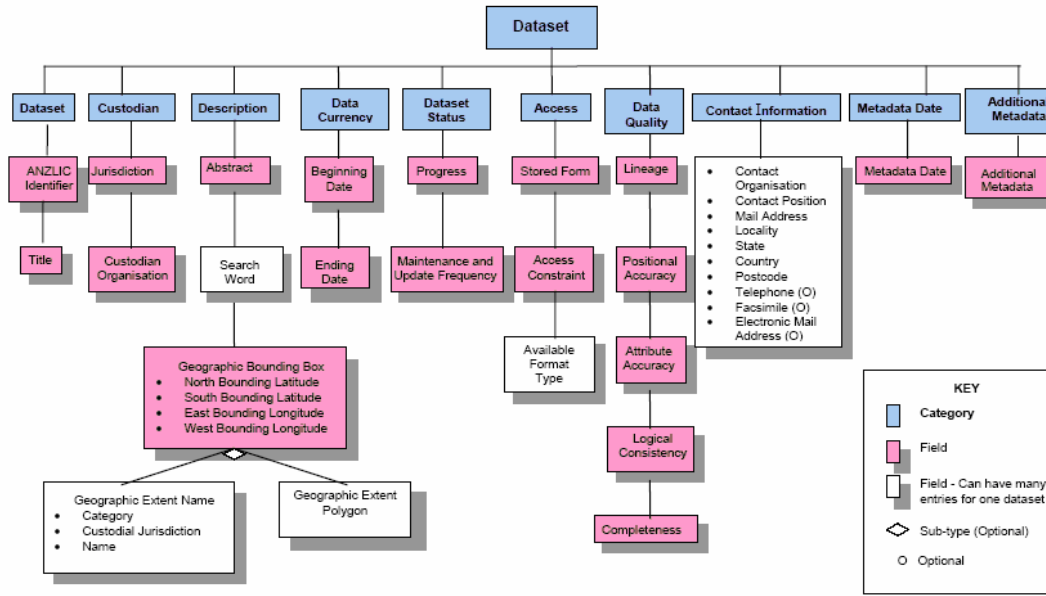
**Table 4.2.1: A summary of the ANZLIC Core Metadata Elements**

Category	Element	Definition of Element	ObIn	Max Occ	Field
<b>Dataset</b>	ANZLIC Identifier	The unique identifier given to the dataset by ANZLIC.	M	1	Text(15)
	Title	The ordinary name of the dataset.	M	1	Text(160)
<b>Custodian</b>	Custodian	The business name of the custodial organisation or responsible party associated with the dataset.	M	1	Text(120)
	Jurisdiction	The state or country in which the Custodian of the dataset is domiciled.	M	1	Text(30)
<b>Description</b>	Abstract	A brief narrative summary of the content of the dataset.	M	1	Text(2000)
	Search Word	Words likely to be used by a non-expert to find the dataset.	M	N	Text(60)
	Geographic Extent Name	The ordinary name of one or more pre-defined, known geographic objects that reasonably show the extent of geographic coverage of the dataset. This element is usually implemented as three discrete elements as listed below	O	N	
	GEN Category	Category to which the Geographic Extent Name belongs including map series, local government area, and drainage divisions and major river basins.	C	1 <sup>1</sup>	Text(80)
	GEN Custodial Jurisdiction	Country, state or territory that is responsible for maintaining the detail of the geographic object	C	1 <sup>1</sup>	Text(30)
	GEN Name	Name of the geographic object.	C	1 <sup>1</sup>	Text(80)
	Geographic Extent Polygon	Boundary enclosing the dataset expressed as a closed set of geographic coordinates (latitude, longitude) of the polygon referenced to GDA94. This is an alternate way of describing geographic extent of the dataset if no pre-defined area is satisfactory.	O	N	Text(1000)
	Geographic Bounding Box	A rectangle defining the minimum and maximum coordinates of the entire data. This element is implemented as four discrete elements as listed below.	M	1	
	North Bounding Latitude	Northern-most coordinate of the limit of the dataset expressed in latitude, in decimal degrees.	M	1	Signed Real Number
	South Bounding Latitude	Southern-most coordinate of the limit of the dataset expressed in latitude, in decimal degrees.	M	1	Signed Real Number
	East Bounding Longitude	Eastern-most coordinate of the limit of the dataset expressed in longitude, in decimal degrees	M	1	Signed Real Number
West Bounding Longitude	Western-most coordinate of the limit of the dataset expressed in longitude, in decimal degrees.	M	1	Signed Real Number	
<b>Data Currency</b>	Beginning date	Earliest date at which the phenomena in the dataset actually occurred.	M	1	Text(10)
	Ending date	Latest date at which the phenomena in the dataset actually occurred.	M	1	Text(10)
<b>Dataset Status</b>	Progress	The status of the process of creation of the dataset.	M	1	Text(20)

	Maintenance and Update Frequency	Frequency of changes or additions that are made to the dataset after its initial completion.	M	1	Text(20)
<b>Access</b>	Stored Data Format	The format in which the dataset is stored by the custodian.	M	1	Text(500)
	Available Format Type	The format in which the dataset is available.	O	N	Text(240)
	Access Constraint	Any restrictions or legal prerequisites that may apply to the access and use of the dataset including licensing, liability and copyright.	M	1	Text(500)
<b>Data Quality</b>	Lineage	A brief history of the source and processing steps used to produce the dataset.	M	1	Text(4000)
	Positional Accuracy	A brief assessment of the closeness of the location of spatial objects in the dataset in relation to their true position on the Earth.	M	1	Text(4000)
	Attribute Accuracy	A brief assessment of the reliability assigned to features in the dataset in relation to their real world values.	M	1	Text(4000)
	Logical Consistency	A brief assessment of the degree of adherence of logical rules of data structure, attribution and relationships. Data structure can be conceptual, logical or physical.	M	1	Text(4000)
	Completeness	A brief assessment of the extent and range in regard to completeness of coverage, completeness of classification and completeness of verification.	M	1	Text(4000)
<b>Contact Information</b>	Contact Organisation	Name of the organisation from which the dataset may be obtained.	M	1 <sup>2</sup>	Text(120)
	Contact Position	The position in the Contact Organisation that will answer questions about the dataset.	M	1 <sup>2</sup>	Text(40)
	Mail Address	Postal address or delivery point of the Contact Position.	M	2 <sup>2</sup>	Text(40)
	Locality	Locality associated with the Mail Address.	M	1 <sup>2</sup>	Text(60)
	State	Aust: State associated with the Mail Address NZ: Optional extension for Locality.	M	1 <sup>2</sup>	Text(40)
	Country	Country associated with the Mail Address.	M	1 <sup>2</sup>	Text(40)
	Postcode	Aust: Postcode associated the Mail Address. NZ: Optional postcode for mail sorting.	M	1 <sup>2</sup>	Text(10)
	Telephone	Telephone number of the Contact Position.	O	1 <sup>2</sup>	Text(25)
	Facsimile	Facsimile number of the Contact Position.	O	1 <sup>2</sup>	Text(25)
	Electronic Mail Address	Electronic Mail Address of the Contact Position.	O	1 <sup>2</sup>	Text(80)
<b>Metadata Date</b>	Metadata Date	Date on which the metadata record was created or modified.	M	1	Text(10)
<b>Additional Metadata</b>	Additional Metadata	Any additional metadata the supports documentation of the dataset including a reference to another directory or report.	O	1	Text(4000)

<sup>1</sup> Dependent upon the repeatability of the parent element.

<sup>2</sup> Number of occurrences associated with each contact – a dataset may have many contacts



**Figure 4.2.1: Graphical Representation of the ANZLIC Core Metadata Elements: Version 2**

Recently, ANZLIC has adopted ISO metadata standards by Standards Australia/Standards New Zealand (AS/NZS ISO 19115:2005). A community profile of ISO 19115:2003 was also created.

**4.2.3 European Metadata Standard**

This European model is an official standard that is maintained by a standardization board known as European Committee for Standardization (CEN, 2008). The European CEN/TC287 standard has been chosen as the national standard for some European nations such as the Netherlands. The generic CEN model has been further specified in the Dutch preliminary standard NVN-ENV 12657. This model contains about 290 metadata elements. The Dutch version of the CEN/TC287 standard has been accepted as the metadata standard for the Netherlands and is used in the National Clearinghouse for Geo Information (NCGI) pilot project. However, the CEN standard and the official Dutch version of the CEN standard are not practical from a user perspective because both have too many variables. The ministries of Traffic, Water Management, and Public Works decided to define a simpler version of CEN containing a subset of 80 metadata elements. This model, known as CEN-RWS, WHICH has been implemented in the ministries' metadata management system and is being adopted by many other organizations.

In general, the description of a dataset in European Metadata Standard covers the following topics.

**Identification:** This is basic information about the dataset title, geographic extent, and rules for using the data.

**Spatial Data Organization:** This provides the representation of spatial information in a dataset. This representation can be either raster or vector based and it can have direct or indirect spatial reference.

**Spatial Reference:** This is a description of the reference frame and means of encoding coordinates in the dataset. This includes the map projection, coordinate system, and datum—both horizontal and vertical.

**Data Quality:** Metadata items, such as, positional and attribute accuracy, completeness, consistency, and methods used to produce the data, provide criteria for assessing the quality of the dataset.

**Content:** It describes the information about the objects in the dataset including the names and definitions of features and attributes.

**Distribution:** It describes the contact information and other items needed for obtaining the dataset.

**Metadata Reference:** This describes the currency of the metadata and the organization responsible for the metadata.

CEN is now streamlined with the ISO standard for geospatial metadata ISO 19115:2003. At this moment, ISO standard is considered as European Standard for metadata.

#### 4.2.4 ISO Metadata Standard

The International Organization for Standardization (ISO) has published the geographic information metadata standard, ISO 19115:2003 (ISO, 2003), to provide a structure for describing digital geographic data. Although this standard is primarily developed for digital datasets, its applicability can be extended to many other forms of geographic data such as maps, charts, textual documents, and general purpose data. The standard is published using an abstract object model that is implemented via the Unified Modeling Language (UML) for conceptualizing the underlying structure of the norm (Appendix 4.2.1). As a continuation for further enhancement ISO is currently working on a geographic information metadata implementation specification norm, ISO 19139.3 that seeks to find a new implementation for the UML-based abstract model for the ISO 19115:2003. The current implementation approach favors the use of a XML Schema to represent the 19115 norm in machine readable format.

ISO defines an extensive set of metadata elements (about 300) but typically only a subset (albeit carefully selected) of them is used. Metadata elements are also classified as: (1) mandatory (M), (2) conditional (C), and (3) optional (O), which determine their prominence. Mandatory elements must be documented whereas optional elements may be added or not. Conditional elements are tested through the associated conditions and if the answers are positive they must be documented. ISO recommends about twenty-one metadata elements to be used as a core element set of metadata for any dataset description, which are listed in Table 4.2.2. Of those only seven elements are defined as mandatory and four of them are conditional. Detail list of all the elements in the ISO standards and their characteristics are presented in Appendix 4.2.2.

ISO also published three examples of metadata instances in the standards. An example set of mineral metadata license using ISO metadata standard has been presented in Appendix 4.2.3. In this example, core and extensive metadata elements were used to describe the datasets. Similar metadata sets can be developed for any geospatial datasets in Bangladesh.

**Table 4.2.2: Metadata core elements as defined in ISO 19115:2003**

Mandatory Elements	Conditional Elements	
1. Dataset title	1. Dataset responsible party	7. Reference system
2. Dataset reference date	2. Geographic location by coordinates	8. Lineage statement
3. Dataset language	3. Dataset character set	9. On-line Resource
4. Dataset topic category	4. Spatial resolution	10. Metadata file identifier
5. Abstract	5. Distribution format	11. Metadata standard name
6. Metadata point of contact	6. Spatial representation type	12. Metadata standard version
7. Metadata date stamp		13. Metadata language
		14. Metadata character set

#### 4.2.5 Comparison of Metadata Standards

A comparison has been made among three metadata standards: CEN, FGDC and ISO. The detail of this comparison has been presented in Appendix 4.2.4. The comparison was done based on the equivalent element name and their obligations (Mandatory, Conditional and Optional). It will help to provide an idea about various core elements of the metadata and their development process. It is worth to mention that ISO metadata standard was developed after the development of FGDC and CEN standards. Therefore, many metadata elements of FGDC and CEN were directly used as metadata elements of ISO.

#### 4.3 Metadata status in Bangladesh

During data inventory preparation under NWRD Project Phase-II in 2003, metadata status in Bangladesh was assessed. From that assessment it was found that only two organizations have the metadata system and 11 organizations have the plan for development of the metadata system (see Table 4.3.1).

**Table 4.3.1: Metadata status during 2003**

Update plan	Yes	No
Metadata maintained	2	29
Future plan for development of metadata	11	20

Under the current project, the survey shows that only five (5) organizations have the metadata system as shown in Table 4.3.2. But data of 10 out of 41 organizations yet to be received. According to the survey, LGED is following ICIMOD metadata system (ISO standard) and BNUS, BUET are using USGS metadata system. It can be noted that USGS metadata is following the FGDC metadata standard. WARPO has developed their metadata following the ISO standards and this metadata was developed by CEGIS.

**Table 4.3.2: Metadata status during 2008 as surveyed by CEGIS**

SL.	Organization	Metadata System
1	BADC	No
2	BARC	No (However required information of data is stored in word file)
3	BBS	No
4	BIWTA	No
5	BMD	No
6	BCAS	No
7	BNUS	Yes, USGS/ IAEE metadata standard.
8	CARE – Bangladesh	No
9	CEGIS	Yes, ISO standard metadata
10	CNRS	No
11	CWASA	Data not received
12	DoE	Data not received
13	DoF	No
14	WRE, BUET	No
15	DCC	No
16	Dhaka WASA	No

SL.	Organization	Metadata System
17	DLRS	No
18	DPHE	Data not received
19	DU-Geology	Data not received
20	FFWC, BWDB	No
21	Forest Department	No
22	GSB	No
23	IWFM, BUET	No
24	IUCN	Data not received
25	IWM	No
26	Dept. of Geography and Environment, JU	No
27	KDA	No
28	LGED	Yes, ICIMOD
29	RDA	Not described
30	RAJUK	Data not received
31	RHD	No
32	RRI	Data not received
33	RU-Geography	Data not received
34	RU-Geology	Data not received
35	SRDI	Yes
36	SPARRSO	Yes, But still under preparation
37	SoB	Data not received
38	UNICEF	Data not received
39	WARPO	Yes, ISO standard
40	Dept. of Geography and Environment, DU	No
41	Dept. of Urban and Rural Planning, KU	No

#### 4.4 Development of Guidelines for Geospatial Metadata of Bangladesh

Three key components should be included in the guidelines of geospatial metadata applications in Bangladesh.

- Firstly, the selection of metadata standards is essential. In the Section 4.2, four metadata standards were discussed in details and core elements of those standards were compared. Metadata standard should be selected based on the use of geospatial dataset and it should be consistent.
- Secondly, based on certain standards, a community profile should be created. This profile can be helpful for that particular community since it reduce the complexity by extracting essential sections from the comprehensive profile. Community profile also includes or develops additional elements which are not available in the comprehensive metadata profile.
- Finally, it is also essential to provide a guideline for selecting best available tools to create metadata for a particular metadata community. This tool can be open source or commercial and can have single user or multi-user interface.

In the following subsections, the details about the selection of metadata, development of metadata community profile and the selection of metadata creating tools will be described.

#### **4.4.1 Selection of Standards**

Although there are several metadata standards have been developed for geospatial data, only a few choices of metadata standards is now available to consider as a metadata standard for geospatial community of Bangladesh. CEN metadata standard is completely submerged with ISO metadata standards. ANLIC is also creating profiles based on ISO metadata standard. Similar situation can be found for FGDC, they also have taken a project to harmonize with ISO metadata standards. After its publication in 2005, ISO 19115:2003 metadata standards become widely acceptable to the geospatial community. ISO/TC 211 has 32 participating members and 10 observing members who are involved in developing and testing the metadata standard. It is claimed that ISO 19115 development was based on a solid foundation of national, regional, and information community standards, it has broad global participation and it has gone through formal development cycles.

In brief the ISO 19115:2003 is:

- Based on a harmonized object model
- Designed to support geographic information
- Designed to fill a broad range of requirements
- Designed to serve the global community
- Recommending core with a full comprehensive profile

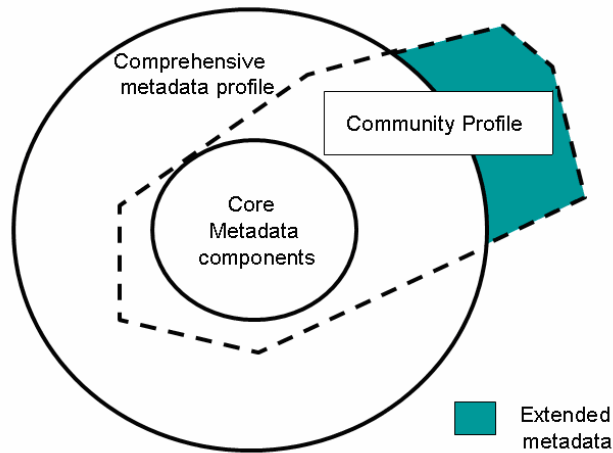
Some other additional advantages, which give supremacy to use ISO metadata standard are:

- i) Controlled vocabularies and Code Lists: More than 300 hundred control vocabularies or keywords are found in this standard.
- ii) Multi-lingual: This standard has been published in most of the widely used languages in the world.
- iii) Granularity: The model of this standard is created in Unified Modeling Language (UML), which provides both granularity and compactness.
- iv) Implementation: This standard is normalized in both human and machine understandable data format, e.g. XML.

In this context, this study proposes to use **ISO 19115:2003** metadata as standards of geospatial community for Bangladesh.

#### **4.4.2 Metadata Community profile**

Although a large extent of standard metadata for digital geographic data has been documented in the ISO 19115:2003, the standard does not contain all metadata descriptions that are needed to describe a specific geospatial community and their associated data sets. As a result, the ISO standard needs to be extended which can be done by creating a community profile for that specific user group. Based on the extension guideline of ISO, a community profile need to be developed for a specific geospatial community as schematically shown in Figure 4.4.1. This profile should be composed of three parts: core metadata components (as required by ISO and shown in Table 4.2.2), some elements of the comprehensive metadata set (these are pick-and-choose from the existing definitions), and the extended metadata components (to be defined by the community). The selection of optional metadata in addition to the core metadata is left to the community metadata creators, however a balance must be found between excessive description of data (“more-is-better-approach”) and a sufficient but small enough description set. In other words, although more metadata elements are better to fully capture all description aspects of a specific data set, the inclusion of too many optional metadata elements could become an overwhelming burden to the users reducing the acceptance threshold.



**Figure 4.4.1: Community profile for a specific geospatial community**

Many organizations have developed metadata profile for their community. In Bangladesh, Water Resources Planning Organization (WARPO) and Center for Environmental and Geographic Information Services (CEGIS) has jointly developed a metadata community profile using ISO metadata standards. In the following sub section, details of this metadata profile will be discussed.

**NWRD Metadata Community Profile:** WARPO-CEGIS has developed a metadata community profile for National Water Resources Database (NWRD). This is national level database contains more than 300 data layers including national boundary, district boundary, thana boundary, thana headquarters, roads, railway, river (major), river (detail), soil association boundary, digital elevation model, water level and discharge station locations, rainfall stations, flood inundation and more. It was essential to select a metadata standard as first task by considering the use of metadata within the framework of the organizations. Considering the use and worldwide acceptability, ISO metadata standard was selected to create this community profile. In the Appendix 4.4.1, details of the community profile created for NWRD has been presented. Finally, metadata was created based on this community profile using software tools. The selection process of software tools to create metadata has to consider some aspects such as the database or discrete documents to hold the metadata, metadata standards, GIS and operating system, other functionalities as viewed within the limit of available metadata tools. Considering all the fact, GeoKey was used for creating metadata sets in that study. Later on CEGIS developed a metadata editor using Visual Basic keeping the metadata in Access database.

Community profile for geospatial community of Bangladesh: Like NWRD, it is also possible to take similar approaches for any of the geospatial community of Bangladesh to develop their metadata community profiles. In order to develop a community profile, it is essential to follow a set of rules defined by ISO. Some of the major rules for creating ISO standard metadata profile are:

- i. Before creating a profile, the user shall check existing profiles.
- ii. A profile must adhere to the rules for defining an extension.
- iii. A profile shall not change the name, definition, or data type of a metadata element.
- iv. A profile shall include:
  - a. The basic, minimum set of metadata collected for a digital geospatial dataset
  - b. All mandatory metadata elements in all mandatory sections.

- c. All conditional metadata elements in all mandatory sections, if the dataset meets the condition required by the metadata element.
- d. All mandatory metadata elements in all conditional sections, if the dataset meets the condition required by the section.
- e. All conditional metadata elements in all conditional sections, if the dataset meets the condition required by the metadata element and the section.
- v. Relationships shall be defined so a structure and schema can be determined.
- vi. A profile shall be made available to anyone receiving metadata that was created according to that profile.

This study suggests to create community profile for any specific geospatial user community in Bangladesh using the above stated rules of ISO. This profile includes all mandatory and core elements of ISO metadata standard. In addition to core elements, geo-hazard related optional elements are also included in this profile. However, any extended metadata elements are not proposed in this profile. As part of future works, users of these data community can propose additional (extended) elements, which can be included in future. The code number column of the Table 4.4.1 is similar to the serial number presented in the data directory of ISO as shown in Appendix 4.2.2

**Table 4.4.1: Metadata Community Profile for Geo-hazard community of Bangladesh using ISO 19115:2003**

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
1	MD_Metadata	root entity which defines metadata about a resource or resources	M	1	Class	Lines 2-22
2	FileIdentifier	unique identifier for this metadata file	O	1	CharacterString	Free text
3	Language	language used for documenting metadata	C	1	CharacterString	ISO 639-2
4	CharacterSet	full name of the character coding standard used for the metadata set	C	1	Class	MD_CharacterSetCode <<CodeList>> (B.5.10)
6	HierarchyLevel	scope to which the metadata applies	C	N	Class	MD_ScopeCode <<CodeList>> (B.5.25)
7	HierarchyLevelName	name of the hierarchy levels for which the metadata is provided	O	N	CharacterString	Free text
8	Contact	party responsible for the metadata information	O	N	CharacterString	Free text
9	DateStamp	date that the metadata was created	M	1	Class	Date (B.4.2)
10	metadataStandardName	name of the metadata standard (including profile name) used	O	1	CharacterString	Free text
11	MetadataStandardVersion	version (profile) of the metadata standard used	O	1	CharacterString	Free text
23	MD_Identification	basic information required to uniquely identify a resource or resources	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	Lines 24-35
24	Citation	citation data for the resource(s)	M	1	Class	CI_Citation (B.3.2) <<DataType>>
25	Abstract	brief narrative summary of the content of the resource(s)	M	1	CharacterString	Free text

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
30	resourceMaintenance	provides information about the frequency of resource updates, and the scope of those updates	O	N	Association	MD_MaintenanceInformation (B 2.5)
33	DescriptiveKeywords	provides category keywords, their type, and reference source	O	N	Association	MD_Keywords (B 2.2.2)
35	ResourceConstraints	provides information about constraints which apply to the resource(s)	O	N	Association	MD_Constraints (B 2.3)
36	MD_DataIdentification	information required to identify a dataset	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	Lines 37-46 and 24-35
37	SpatialRepresentationType	method used to spatially represent geographic information	O	N	Class	MD_SpatialRepresentationTypeCode <<CodeList>> (B.5.26)
38	spatialResolution	factor which provides a general understanding of the density of spatial data in the dataset	O	N	Class	MD_Resolution <<Union>> (B.2.2.4)
39	language	language(s) used within the dataset	M	N	CharacterString	ISO 639-2
41	topicCategory	main theme(s) of the dataset	M	N	Class	MD_TopicCategoryCode <<CodeList>> (B.5.27)
44	environmentDescription	description of the dataset in the producer's processing environment, including items such as the software, the computer operating system, file name, and the dataset size	O	1	CharacterString	Free text
45	extent	additional extent information including the bounding polygon, vertical, and temporal extent of the dataset	O	N	Class	EX_Extent <<DataType>> (B.3.1)

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
52	MD_Keywords	keywords, their type and reference source	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 53-55
53	keyword	commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject	M	N	CharacterString	Free text
54	type	subject matter used to group similar keywords	O	1	Class	MD_KeywordTypeCode <<CodeList>> (B.5.17)
55	thesaurusName	name of the formally registered thesaurus or a similar authoritative source of keywords	O	1	Class	CI_Citation (B.3.2) <<DataType>>
56	MD_RepresentativeFraction	derived from Scale where MD_RepresentativeFraction.denominator = 1 / Scale.measure And Scale.targetUnits = Scale.sourceUnits	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 57-58
57	denominator	the number below the line in a vulgar fraction	M	1	Integer	Integer > 0
58	scale	role indicating that MD_RepresentativeFraction is derived from Scale	(Not applicable)	(Not	Derived Association	Scale (B.4.3)
67	MD_Constraints	restrictions on the access and use of a resource or metadata	Use obligation from referencing object	Use maximum occurrence from referencing	Aggregated Class (MD_Metadata and MD_Identification)	Line 68

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
				object		
68	Use Limitation	limitation affecting the fitness for use of the resource. Example, “not to be used for navigation	O	N	CharacterString	Free text
69	MD_LegalConstraints	restrictions and legal prerequisites for accessing and using the resource	Use obligation from referencing object	N	Specified Class (MD_Constraints)	Lines 70-72 and 68
70	Access Constraints	access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
71	Use Constraints	constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations or warnings on using the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
72	Other Constraints	other restrictions and legal prerequisites for accessing and using the resource	C	N	CharacterString	Free text
73	Md_Security Constraints	handling restrictions imposed on the resource for national security or similar security concerns	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Constraints)	Lines 74-77 and 68
74	classification	name of the handling restrictions on the resource	M	1	Class	MD_ClassificationCode <<CodeList>> (B.5.11)
78	DQ_DataQuality	quality information for the data specified by a data quality scope	Use obligation from referencing object	Use maximum occurrence from	Aggregated Class (MD_Metadata)	Lines 79-81

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
				referencing object		
79	Scope	the specific data to which the data quality information applies	M	1	Class	DQ_Scope <<DataType>> (B.2.4.4)
81	Lineage	non-quantitative quality information about the lineage of the data specified by the scope	C	1	Association	LI_Lineage (B 2.4.1)
82	LI_Lineage	information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_Data Quality)	Lines 83-85
83	Statement	general explanation of the data producer's knowledge about the lineage of a dataset	C	1	Character String	Free text
138	DQ_Scope	description of the data specified by the scope	Use obligation from referencing object	Use maximum occurrence	Class <<DataType>>	Lines 139-141
139	level	Hierarchical level of the data specified by the scope	M	1	Class	MD_ScopeCode <<CodeList>> (B.5.25)
142	MD_Maintenance Information	information about the scope and frequency of updating	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)	Lines 143-148
143	Maintenance and Update Frequency	frequency with which changes and additions are made to the resource after	M	1	Class	MD_MaintenanceFrequencyCode <<CodeList>> (B.5.18)

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
		the initial resource is completed				
156	MD_Spatial Representation	digital mechanism used to represent spatial information	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	
176	MD_Vector Spatial Representation	information about the vector spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	Lines 177-178
177	Topology Level	code which identifies the degree of complexity of the spatial relationships	O	1	Class	MD_TopologyLevelCode <<CodeList>> (B.5.28)
178	Geometric Objects	information about the geometric objects used in the dataset	O	N	Class	MD_GeometricObjects <<DataType>> (B.2.6.2)
183	MD_Geometric Objects	number of objects, listed by geometric object type, used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 184-185
184	Geometric Object Type	name of point and vector spatial objects used to locate zero-, one-, and twodimensional spatial locations in the dataset	M	1	Class	MD_GeometricObjectTypeCode <<CodeList>> (B.5.15)
185	Geometric Object Count	total number of the point or vector object type occurring in the dataset	O	1	Integer	> 0

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
186	MD_Reference System	information about the reference system.	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 187-188
187	referenceSystemIdentifier	name of reference system	C	1	Class	RS_Identifier (B.2.7.2)
205	MD_Identifier	value uniquely identifying an object within a namespace	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	Lines 206-207
207	code	alphanumeric value identifying an instance in the namespace	M	1	CharacterString	Free text
208	RS_Identifier	identifier used for reference systems	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identifier)	Lines 206-207
270	MD_Distribution	information about the distributor of and options for obtaining the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 271-273
272	distributor	provides information about the distributor	O	N	Association	MD_Distributor (B.2.10.2)

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
273	Transfer Options	provides information about technical means and media by which a resource is obtained from the distributor	O	N	Association	MD_DigitalTransferOptions (B.2.10.1)
274	MD_Digital Transfer Options	technical means and media by which a resource is obtained from the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Distributor)	Lines 275-278
276	Transfer Size	estimated size of a unit in the specified transfer format, expressed in megabytes. The transfer size is > 0.0	O	1	Real	> 0,0
277	Online	information about online sources from which the resource can be obtained	O	N	Class	CI_OnLineResource <<DataType>> (B.3.2.4)
278	MD_Medium	information about offline media on which the resource can be obtained	O	1	Class	MD_Medium <<DataType>> (B.2.10.4)
279	Md_Distributor	information about the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution)	Lines 280-283
280	contact	party from whom the resource may be obtained. This list need not be exhaustive	M	1	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
281	Distribution Order Process	provides information about how the resource may be obtained, and related instructions and fee information	O	N	Association	MD_StandardOrderProcess (B.2.10.5)
282	Distributor Format	provides information about the format used by the distributor	C	N	Association	MD_Format (B.2.10.3)

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
284	MD_Format	description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Identification)	Lines 285-290
285	name	name of the data transfer format(s)	M	1	CharacterString	Free text
286	version	version of the format (date, number, etc.)	M	1	CharacterString	Free text
291	MD_Medium	information about the media on which the resource can be distributed	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 292-297
292	name	name of the medium on which the resource can be received	O	1	Class	MD_MediumNameCode <<CodeList>> (B.5.20)
298	MD_Standard Order Processes	common ways in which the resource may be obtained or received, and related instructions and fee information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distributor)	Lines 299-302
301	Ordering Instructions	general instructions, terms and services provided by the distributor	O	1	CharacterString	Free text
334	EX_Extent	information about spatial, vertical, and temporal extent	Use obligation/condition from referencing object	Use maximum occurrence from referencing	Class <<DataType>>	Lines 335-338

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
				object		
336	Geographic Element	provides geographic component of the extent of the referring object	C	N	Association	EX_GeographicExtent <<Abstract>> (B.3.1.1)
337	Temporal Element	provides temporal component of the extent of the referring object	C	N	Association	EX_TemporalExtent (B.3.1.2)
339	Ex_Geographic Extent	geographic area of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent and EX_Spatial Temporal Extent)	Line 340
340	Extent Type Code	indication of whether the bounding polygon encompasses an area covered by the data or an area where data is not present	O	1	Boolean	0 – exclusion 1 – inclusion
343	EX_Geographic Bounding Box	geographic position of the dataset NOTE This is only an approximate geographic position of the dataset NOTE This is only an approximate	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Lines 344-347 and 340
344	West Bound Longitude	western-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east) reference so specifying the co-ordinate system is unnecessary	M	1	Angle (B.4.3)	-180,0 <= West Bounding Longitude Value <= 180,0
345	East Bound Longitude	eastern-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Angle (B.4.3)	-180,0 <= East Bounding Longitude Value <= 180,0

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
346	North Bound Latitude	northern-most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90,0 <= North Bounding Latitude Value <= 90,0; North Bounding Latitude Value >= South Bounding Latitude Valu
347	South Bound Latitude	southern-most, coordinate of the limit of the dataset extent expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90,0 <= South Bounding Latitude Value <= 90,0; South Bounding Latitude Value <= North bounding Latitude Value
350	Ex_Temporal Extent	time period covered by the content of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	Line 351
351	extent	date and time for the content of the dataset	M	1	Class	TM_Primitive (B.4.5)
359	CI_Citation	standardized resource reference	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 360-373
360	title	name by which the cited resource is known	M	1	CharacterString	Free text
362	date	reference date for the cited resource	M	N	Class	CI_Date (B.3.2.3) <<DataType>>
363	edition	version of the cited resource	O	1	CharacterString	Free text
364	Edition Date	date of the edition	O	1	Class	Date (B.4.2)
368	Presentation Form	name by which the cited resource is	O	N	Class	CI_PresentationFormCode

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
		known				<<CodeList>> (B.5.4)
374	CI_Responsible Party	identification of, and means of communication with, person(s) and organizations associated with the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 375-379
375	Individual Name	name of the responsible person- surname, given name, title separated by a delimiter	C	1	Character String	Free text
376	Organization Name	name of the responsible organization	C	1	Character String	Free text
377	Position Name	role or position of the responsible person	C	1	Character String	Free text
378	Contact Info	address of the responsible party	O	1	Class	CI_Contact <<DataType>> (B.3.2.2)
379	Role	function performed by the responsible party	M	1	Class	CI_RoleCode <<CodeList>> (B.5.5)
380	Address	location of the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 381-386
381	Delivery Point	address line for the location	O	N	Character String	Free text
382	city	city of the location	O	1	Character String	Free text
383	Administrative Area	state, province of the location	O	1	Character String	Free text
384	Postal Code	ZIP or other postal code	O	1	Character String	Free text
385	country	country of the physical address	O	1	Character String	ISO 3166-3

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
386	Electronic Mail Address	address of the electronic mailbox of the responsible organization or individual	O	N	Character String	Free text
387	CI_Contact	information required to enable contact with the responsible person and/or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 388-392
388	phone	telephone numbers at which the organization or individual may be contacted	O	1	Class	CI_Telephone <<DataType>> (B.3.2.6)
393	CI_Date	reference date and event used to describe it	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 394-395
394	date	reference date for the cited resource	M	1	Class	Date (B.4.2)
395	dateType	event used for reference date	M	1	Class	CI_DateTypeCode <<CodeList>> (B.5.2)
396	CI_On Line Resource	information about on-line sources from which the dataset, specification, or community profile name and extended metadata elements can be obtained	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 397-402
397	linkage	location (address) for on-line access using a Uniform Resource Locator address or similar addressing scheme	M	1	Class	URL

Code	Name / Role name	Definition	Cond.	Max Occur	Data type	Domain
		such as <a href="http://www.statkart.no/isotc211">http://www.statkart.no/isotc211</a>				
398	protocol	connection protocol to be used	O	1	CharacterString	Free text
401	description	detailed text description of what the online resource is/does	O	1	CharacterString	Free text
402	function	code for function performed by the online resource	O	1	CharacterString	Free text
407	CI_Telephone	telephone numbers for contacting the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 408-409
408	voice	telephone number by which individuals can speak to the responsible organization or individual	O	N	CharacterString	Free text
409	facsimile	telephone number of a facsimile machine for the responsible organization or individual	O	N	CharacterString	Free text

**4.4.3 Example of Geo-hazard metadata sets using ISO 19115**

Common geo-hazards occur in Bangladesh are mainly flood, cyclone, storm surge and riverbank erosion. Earthquake is an important and alarming geo-hazard, which is drawing attention day by day. Information related to these natural hazards are essential for both planning and management of disaster caused by these hazards. Metadata can play a key role to represent the content of geo-hazard related information. Therefore, it is essential to prepare metadata set for geo-hazard datasets and publish it as metadata catalogue for public use. An example of metadata set for earthquake using ISO metadata standards is presented in Table 4.4.1. Earthquake is one severe type of geo-hazard, which instantaneously takes lives of many people and destroys infrastructures. Therefore, it will be helpful to identify earthquake intensity zones in the country. The intensity describes exclusively the effects of an earthquake on the surface of the earth and integrates numerous parameters (such as ground acceleration, duration of an earthquake, subsoil effects). Table 4.4.2 resents metadata set describing information of a dataset of earthquake intensity map. The first column of this table shows the number of ISO metadata element as shown in Appendix 4.2.2, the second column is metadata element names and third column is value of the metadata.

It is recommended to create such metadata sets using ISO metadata standards for each geo-hazard related data sets for the respective data collecting organizations. The metadata element presented in Table 4.4.2 contains both mandatory and optional metadata elements of ISO. Different data collecting originations can include and exclude some of the optional elements while creating their metadata set. Details of all the ISO metadata elements are presented in Appendix 4.2.2 of this report, which will be helpful for developing metadata sets for any organization.

**Table 4.4.2: Metadata set of Earthquake Intensity Map using ISO 19115**

Code	Metadata	Value
1	Metadata Entity Set Information	
2	Metadata identifier	{ENVIRON\NaturalDisaster\Shape\earthquak.shp}
3	Metadata language	English
4	Metadata character set	utf8 - 8 bit UCS Transfer Format
6	Scope of the data described by the metadata	dataset
7	Scope name	dataset
8	Metadata contact	
375	Individual's name	Director General
376	Organization's name	Water Resources Planning Organization
377	Contact's position	Director General
378	Contact information	
380	Address	
381	Delivery point	House no.103, Road no.1
382	City	Dhaka
383	Administrative area	Banani
384	Postal code	1213
386	<a href="#">e-mail address</a>	dg_warpo@bangla.net
385	Country	Bangladesh
388	Phone	

Code	Metadata	Value
408	Voice	88-02-8814217
409	Fax	88-02-9883456
379	Contact's role	publisher
9	Last update	20060101
10	Name of the metadata standard used	ISO 19115 Geographic Information - Metadata
11	Version of the metadata standard	DIS_2003
279	Distribution Information	
272	Distributor	
273	Transfer options	
277	Online source	
397	<a href="http://www.warpo.org/">Online location (URL)</a>	http://www.warpo.org/
398	Connection protocol	Hypertext Transfer
402	Function performed	Offline access
401	Description	Offline Data
276	Transfer size	1.749
278	Medium of distribution	
292	Medium name	CD-ROM
282	Available format	
285	Format name	Shapefile
286	Format version	Standard ESRI shapefile format
280	Contact information	
375	Individual's name	Director General
376	Organization's name	Water Resources Planning Organization
377	Contact's position	Director General
378	Contact information	
380	Address	
381	Delivery point	House no.103, Road no.1
382	City	Dhaka
383	Administrative area	Banani
384	Postal code	1213
386	<a href="mailto:dg_warpo@bangla.net">e-mail address</a>	dg_warpo@bangla.net
385	Country	Bangladesh
388	Phone	
408	Voice	88-02-8814217
409	Fax	88-02-9883456
379	Contact's role	Distributor
281	Ordering process	
301	Instructions	Forward requests to WARPO
23	Identification Information	
44	Processing environment	Microsoft Windows XP; ESRI ArcGIS 9.0
39	Dataset language	English
24	Citation	

Code	Metadata	Value
368	Presentation format	Digital map
374	Party responsible for the resource	
375	Individual's name	Director General
376	Organization's name	Water Resources Planning Organization
377	Contact's position	Director General
379	Contact's role	Publisher
280	Contact information	
380	Address	
381	Delivery point	House no.103, Road no.1
382	City	Dhaka
383	Administrative area	Banani
384	Postal code	1213
386	<a href="#">e-mail address</a>	dg_warpo@bangla.net
385	Country	Bangladesh
388	Phone	
408	Voice	88-02-8814217
409	Fax	88-02-9883456
360	Title	Seismic Zone of Bangladesh
363	Edition	earthquak.shp
364	Edition date	20060101
393	Reference date	
394	Date	19920101
395	Type of date	Creation
374	Party responsible for the resource	
375	Individual's name	Director General
376	Organization's name	Water Resources Planning Organization
377	Contact's position	Director General
280	Contact information	
380	Address	
381	Delivery point	House no.103, Road no.1
382	City	Dhaka
383	Administrative area	Banani
386	<a href="#">e-mail address</a>	dg_warpo@bangla.net
385	Country	Bangladesh
388	Phone	
408	Voice	88-02-8814217
409	Fax	88-02-9883456
379	Contact's role	
362	Reference date	Originator
394	Date	20060101
395	Type of date	Publication
37	Spatial representation type	Vector

Code	Metadata	Value
33	Keyword Information	
54	Keyword Type	Place keywords
55	Thesaurus name	
360	Title	WARPO Metadata Server
53	Keywords	Bangladesh
35	Resource constraints	
73	Security constraints	
74	Classification	Unclassified
67	Constraints	
68	Limitations of use	Restricted use under the guidelines of data dissemination protocol of WARPO
69	Legal constraints	
72	Other constraints	
70	Access constraints	Outside users are not allowed to get direct access to this data layer. With due permission of DG, WARPO, one can have access to it.
71	Use constraints	The data layer can be used for any purpose by maintaining the data dissemination protocol of WARPO with nominal price.
339	Resource's bounding rectangle	
344	West longitude	87.5000
345	East longitude	93.5000
346	North latitude	27.0000
347	South latitude	20.5000
45	Extent contains the resource	Yes
25	Abstract	A spatial data layer showing the earthquake potentials of the country dividing it into different zones with respect to basic seismic co-efficient.
41	Themes or categories of the resource	geo-scientific information
38	Spatial resolution	
58	Dataset's scale	
57	Scale denominator	10,00,000
30	Resource maintenance	
143	Update frequency	Unknown
45	Other extent information	
337	Temporal Component	
350	Temporal extent	
351	Temporal extent	
B.4.5	Temporal extent	
B.4.5	Single Date/Time	
B.4.5	Time	
B.4.5	Calendar date	
B.4.5	Calendar date	19920101
336	Geographic extent	

Code	Metadata	Value
339	Geographic extent	
344	West longitude	87.5000
345	East longitude	93.5000
346	North latitude	27.0000
347	South latitude	20.5000
340	Extent contains the resource	yes
78	Data Quality Information	
81	Lineage	
83	Lineage statement	As the source was in 1:10,00,000 scale it is recommended that the data layer should be used in this scale or smaller than this. While the data layer has been updated using different data layers therefore it encounters same level of error and precision that inherits in those layers.
79	Scope of quality information	
139	Level of the data	Dataset
156	Spatial Representation Information	
176	Spatial Representation - Vector	
177	Level of topology for this dataset	Geometry only
178	Geometric objects	
184	Object type	complexel
185	Object count	142
186	Reference System Information	
187	Reference system identifier	
208	Reference system identifier	
207	Identity code	Bangladesh_Transverse_Mercator

#### 4.5 Metadata tools

Tools is an option depends on the hardware and operating systems should be used whenever huge numbers of metadata sets need to be created. Hence, it has to be investigated whether the metadata tool can read the file produced with the existing geospatial data. The tool must be user friendly along with desired functionality. Aspects that are included in the evaluation of different tools are:

Form Based: These tools provide a user interface that helps to guide the user throughout the documentation process. Typically, a series of forms with fill in boxes or pick lists is central to the tool. Some of these tools indicate which are the optional and mandatory elements and have on-line help. Several of these are built on the framework of a database that makes it easy to recycle portions of metadata that may repeat between data sets.

User friendliness: Some metadata tools provide user-friendly environment while the other do not. The following points are considered for user friendliness.

- Conventional window like interface: Some tools provide the common windows like interface and users may be very quickly acquainted with these tools.
- Help facilities: There may be help facilities in the software that might guide user during the production of metadata.

- Import export: Support for importing existing metadata and export metadata to standard formats.

A list of available tools to create geospatial metadata is presented in the Table 4.5.1. Some of them are freely available and some are commercial software. In the following sub sections, two most widely used metadata tools: open source GeoNetwork and commercial tool ArcCatalog have been discussed.

**Table 4.5.1: List of available geospatial metadata creation tools**

SI No.	Tool Name / Source Vendor, Agency or Author	Function	Platform/OS/GIS
1	tkme / Peter Schweitzer (USGS)	Multi-lingual CSDGM (1998) metadata creation tool	MS-Windows. Linux and Solaris 7 SPARC require Tcl/Tk library installation. C source code available.
2	ArcCatalog / ESRI	Intelligent CSDGM (1998) and ISO metadata creation tool for Arc/Info and ArcView	MS-Windows NT/2000/XP with ArcGIS 8+ or with ArcView 8.1+
3	Spatial Metadata Management System (SMMS) / Intergraph	Intelligent CSDGM (1998) metadata creation tool	MS-Windows NT, 2000, XP. Version for GeoMedia requires GeoMedia.
6	Corpsmet95 / U.S. Army Corps of Engineers	CSDGM metadata creation tool	MS-Windows 95, NT
7	CatMDEdit / TeIDE consortium	Intelligent metadata editor for ISO19115 and NEM and SDIGER profiles of ISO19115	Platform independent Java or 32-bit MS Windows
8	DataLogr / IMAGIN	CSDGM metadata creation tool	MS-Windows (32 bit versions)
9	Data Tracker GIS, Data Tracker FGDC/ AXON Systems, Inc.	Intelligent CSDGM metadata creation tool with automated data inventory capabilities	MS-Windows 95-XP
10	GEOSCOPE / Intelec Geomatics Inc.	Metadata Creation Tool (Canada)	MS-Windows NT
11	ISO Metadata Editor (IME) / INTA	Metadata editor / validator following ISO19115/19139	JRE 5.0+ and MS Windows or Linux
13	MetaStar Data Entry / Blue Angel Technologies	CSDGM, DIF, GILS, Dublin Core metadata tool	MS-Windows 95, NT
14	MMS MetaData System / Michiel Boelhouwer	Metadata tool for ArcView	ArcView 3.x
16	GeoKey	Metadata Tool	
17	GeoNetwork		

**4.5.1 GeoNetwork Metadata Tool**


GeoNetwork opensource prototype was started by FAO during 2000-2001 and started collaboration on Spatial Data Management between with World Food Programme (WFP) in 2002 to develop GeoNetwork & InterMap Web Map Viewer. It started the collaboration with UNEP to develop

GeoNetwork version 2. In 2005 a GeoNetwork consortium was formed between FAO, WFP, UNEP, WHO, OCHA and CGIAR.

The opensource Geonetwork is a web based catalogue application and a component in the Global Spatial Data Infrastructure. It integrates search functions, administrative functions, data distribution and publication, interactive access to maps from distributed servers through InterMap and optionally an embedded Web Map Server.

The metadata profile used by GeoNetwork opensource describes the geographic data and services is based on the ISO standard 19115:2003 that provides information related to the identification, the spatial and temporal extent, spatial reference, the quality, and distribution of a geographic dataset. GeoNetwork open source provides a set of simplified metadata templates that hide the complexity of the ISO 19115 standard. These can be used as a basis for describing geographic metadata and they are extendable with new elements to fit specialized needs through the Advanced View. The main metadata sections used are: Identification Section, Distribution Section, Reference System Section and Data Quality Section. An example of metadata set using GeoNetwork metadata tool is presented in Figure 4.5.1. It also supports both ASCII plain text and XML file format to export metadata sets. Figure 4.5.2 shows a XML representation of the example sets of metadata created in this metadata tool.

::Identification info



<b><u>Title</u></b>	Park Boundary, SNP
<b><u>Date</u></b>	2004-04-29 (creation)
<b><u>Identifier</u></b>	SNPB01
<b><u>Presentation form</u></b>	Map Digital
<b><u>Language</u></b>	en
<b><u>Character set</u></b>	Utf8
<b><u>Abstract</u></b>	Park Boundary Data of Sagarmatha National Park (SNP)
<b><u>Supplemental Information</u></b>	Data prepared for DSS Project
<b><u>Purpose</u></b>	
<b><u>Status</u></b>	On Going
<b><u>Topic category</u></b>	Boundaries
<b><u>Descriptive keywords</u></b>	Administrative Boundary (theme).
<b><u>Descriptive keywords</u></b>	Sagarmatha National Park (place).
<b><u>Spatial representation type</u></b>	Vector

Figure 4.5.1: An example metadata set created by GeoNetwork metadata tool based on ISO metadata standard

```

<?xml version="1.0" encoding="UTF-8"?>
<Metadata>
  <mdFileID>7e8df290-17df-11dc-973e-0008028b39bd</mdFileID>
  <mdLang>
    <languageCode value="en"/>
  </mdLang>
  <mdChar>
    <CharSetCd value="utf8"/>
  </mdChar>
  <mdContact>
    <rpIndName>Birendra Bajracharya</rpIndName>
    <rpOrgName>MENRIS, ICIMOD</rpOrgName>
    <rpPosName>GIS Specialist</rpPosName>
    <rpCntInfo>
      <cntPhone>
        <voiceNum>977-1-5003222</voiceNum>
        <faxNum>977-1-5003299</faxNum>
      </cntPhone>
      <cntAddress>
        <delPoint>Khumaltar, Lalitpur</delPoint>
        <city>Patan</city>
        <adminArea>Kathmandu</adminArea>
        <postCode>GPO Box 3226</postCode>
        <country>Nepal</country>
        <eMailAdd>menris@icimod.org</eMailAdd>
      </cntAddress>
    </rpCntInfo>
    <role>
      <RoleCd value="author"/>
    </role>
  </mdContact>
  <mdDateSt>2007-06-11T14:37:41</mdDateSt>
  <mdStanName>ISO 19115</mdStanName>

```

Figure 4.5.2: XML representation of metadata created in GeoNetwork metadata tool

#### 4.5.2 ArcCatalog Metadata Editor of ESRI

ArcCatalog comes as a component of ESRI's ArcGIS standard package. ArcCatalog provides easy user interface to create metadata is just by clicking the item in the Catalog tree and click the Metadata tab. Properties, such as the extent of a shapefile's features, are automatically derived from the item by ArcCatalog and added to the metadata. Any item in ArcCatalog, including folders and file types, such as Word documents, can have metadata. Once created, metadata is copied, moved, and deleted along with the item when it is managed with ArcCatalog. Metadata created with ArcCatalog is stored in XML format either in a file alongside the item or within its geodatabase. The style sheets whose names begin with "FGDC" present metadata elements that are defined in the FGDC's Content Standard for Digital Geospatial Metadata, which will be referred to as the FGDC standard (Figure 4.5.3). Style sheets beginning with "ISO" present metadata elements defined in the ISO standard 19115, Geographic Information – Metadata, which will be referred to as the ISO standard (Figure 4.5.4). Some style sheets show ESRI-defined content in addition to the content defined by the appropriate standard. For better describing the resources such as geometric networks and topologies ESRI has created the ESRI Profile of the Content Standard for Digital Geospatial Metadata, which will be referred to as the ESRI Profile. The ESRI profile is documented at [www.support.esri.com](http://www.support.esri.com). ESRI has not created a profile of the ISO standard. ArcCatalog uses map to import and export metadata in its supported formats. XML format can be used to import metadata created with ArcCatalog. It is not possible to import metadata in HTML format.

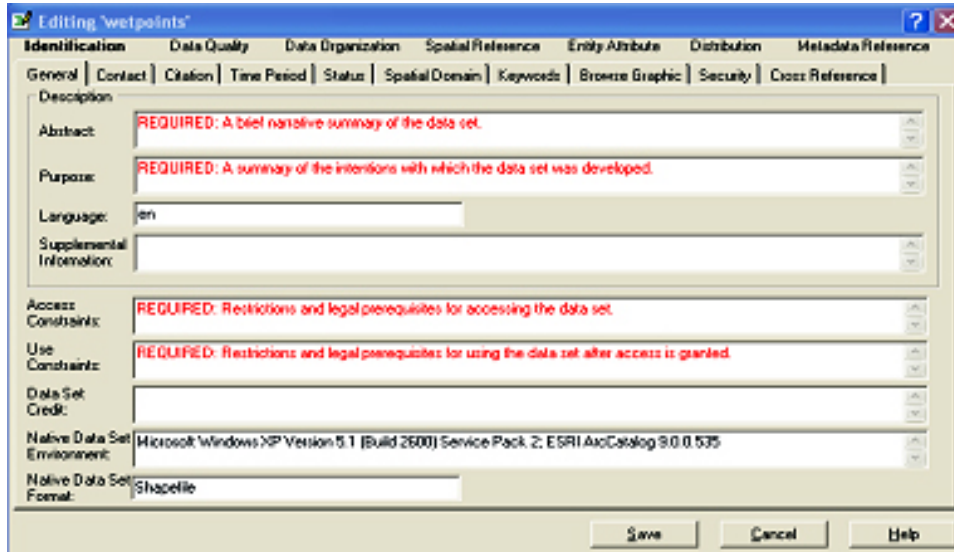


Figure 4.5.3: ArcCatalogue Metadata Editor for FGDC metadata standards (CSDGM)

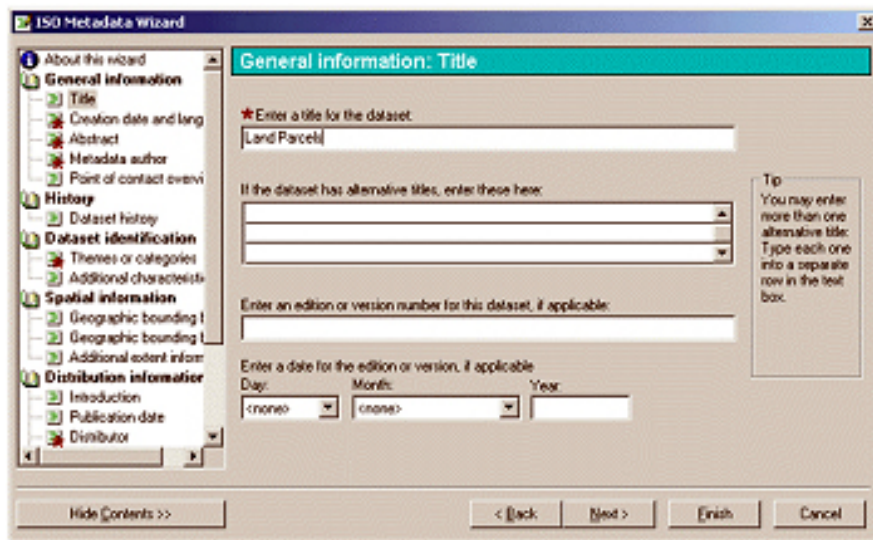


Figure 4.5.4: ArcCatalogue Metadata Editor for ISO 19115:2003 metadata standards

### 4.5.3 Selection of metadata tools to create geospatial metadata for Bangladesh

The Metadata describes GIS resources in the same way a card in a library’s card catalog describes a book. It consists of properties and documentation. Documentation is descriptive information supplied by a person using a metadata editor. The metadata is critical for sharing tools, data, and maps, and for searching. Keeping these purposes in mind, it is hard to select one single tool for metadata creation and reuse. Any one of the metadata tools described in the above section can be considered to develop metadata for geospatial community of Bangladesh.

The advantage of the GeoNetwork opensource software is the accessibility of a wide variety of data, together with the associated information, at different scale and from multidisciplinary sources, which are organized and documented in a standard and consistent way. Moreover, it is developed following ISO and OGC (Open Geospatial Consortium). Another major advantage is that it is open source, that is, it involves no purchase cost. Two big regional scientific organizations in South Asia International Water Management Institute (IWMI) and International Center for Integrated Mountain Development

(ICIMOD) have already adopted GeoNetwork for their Metadata management and data sharing. Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan are the member countries of ICIMOD. Considering the regional data sharing, its standards (ISO and OGC) and costs (free because it is opensource) GeoNetwork could be a good choice for Bangladesh.

#### **4.6 Conclusion and Recommendations on Metadata**

Metadata provides essential information about the geo-spatial data sets to facilitate searching, extracting and sharing. A metadata standard is simply a common set of terms and definitions that are presented in a structured format. For comparability and standardization of description of geo-spatial dataset, a standard metadata system needs to be initiated.

Many metadata elements from ANZLIC, FGDC and CEN Metadata Standards were directly used as metadata elements of ISO as it has been developed after them. ISO Metadata standards become widely acceptable to the geospatial community. More than 300 hundred control vocabularies or keywords are found in this standard. To implement ISO 19115:2003 community profile needs to be prepared to scale down or extend metadata elements. ISO community profile is composed of three parts: core metadata components (as required by ISO), some elements of the comprehensive metadata set (these are pick-and-choose from the existing definitions), and the extended metadata components (to be defined by the community).

ISO is created in Unified Modeling Language (UML) and normalized in both human and machine understandable data format, e.g. XML.

GeoNetwork open source provides a set of simplified metadata templates that hide the complexity of the ISO 19115 standard. It supports both ASCII plain text and XML file format to export metadata.

ArcCatalog provides easy user interface to create metadata from both ISO and FGDC Metadata Standards. Metadata created in ArcCatalog can be exported in both HTML and XML format.

This study proposes to use ISO Metadata Standard—ISO 19115:2003 to create metadata for any geospatial as well as geo-hazard related data sets.

ISO Metadata should be created using standard software tools. It has been found that both open source “GeoNetwork” and commercial tool “ArcCatalog” can efficiently create metadata using ISO standards.

Considering the pricing, openness, regional development, and internationalization “GeoNetwork” could be selected as the metadata tool for Bangladesh.

# Chapter 5

## GIS Data Sharing Protocol

### 5.1 Introduction

The data sharing protocol can be defined as the formal agreement among the data holding organizations that are sharing the data. It describes why data is being shared and sets out the principles and commitments the organizations will adopt when they collect, store and disclose spatial information. Sharing protocols also explain when and under what condition information can be shared. Usually public organizations do not exchange their data without such formal agreements.

The protocol is the basic framework for setting the principles for using and sharing information among the partner organizations. For assessment of geo-hazards (such as earthquake, tsunami and landslides), the GIS data sharing through a standard protocol among the organizations will be highly useful. In Bangladesh there is no national level GIS data sharing protocol to exchange / retrieve the data.

This chapter has been focused on reviewing the existing data sharing protocols used at home and abroad. A data sharing guidelines for Bangladesh has been proposed at the end of this chapter.

### 5.2 Purpose of the Data Sharing Protocols

The main purpose of the proposed data sharing protocol is to prepare well-defined guidelines of data sharing among different government and non-government organizations to share the geo-information for disaster management and planning activities in Bangladesh. This data sharing protocol will help the GIS user organizations to facilitate the information in efficient geo-hazard and disaster management in Bangladesh.

### 5.3 Elements of the Data Sharing Protocols

For developing a data sharing protocols elements / factors to be considered are (i) purpose of data sharing, (ii) role and responsibilities of the partners, (iii) legislation, (v) data security, (vi) complaints procedures, (vii) building awareness etc. These elements are briefly described below.

**The purpose of data sharing:** The purpose of the data sharing is one of the important parameters of data sharing protocol. This element clearly explains the reasons for sharing the information among the partners. It should also state whether partners are obliged to, or are merely enabled to, share data. The purpose of the data sharing arrangement must be approved, understood and formally agreed by those entering into a data sharing agreement.

**Roles and responsibilities of partner's organizations:** Roles and responsibilities of the sharing organizations should be clearly mentioned under this element. The examples of the roles and responsibilities within the formally established protocols could be: who will collect, store and disclose information. A steering group with senior individuals from each of the sharing organizations should be formed to negotiate and to define individuals' responsibilities.

**Legislation:** The involved organizations should have to satisfy themselves that the sharing protocol is lawful. In addition to this, the protocol should mention that partners would have to comply with all relevant acts of the country.

**Data Security:** The partner organizations should be concerned that their information is safe and secure. Every partner organization should be able to describe and apply its own security measures to protect, store and transmit the information it processes. Each organization or partner will take all reasonable care and safeguard to protect both the physical security of information technology and the data contained within it.

**Complaints procedures:** Complaint is an expression of pain or dissatisfaction, or resentment between the partner organizations. There should have a commitment to establishing a system to deal with complaints about the way that organizations handle information. The partner organizations would have to appreciate that there will be differences in the complaints procedures of other partners. It would be useful for partners to have examples of standards and these should be included within the protocol.

**Building awareness:** The success of any data sharing protocol depends upon visible high-level support from senior managers within each organization. Awareness of the protocol should be raised through training and publicities. Each organization should ensure that appropriate officers/professionals are sufficiently trained to make lawful decisions about data sharing. It may be useful to arrange joint-training sessions to allow people from the different organizations to meet each other, to build co-operation between partners, and to promote a better understanding of the objectives of the data sharing arrangement. A staff booklet and a checklist for disclosing data and obtaining consent, should help maintain a level of consistency and confidence that the correct procedures are being followed.

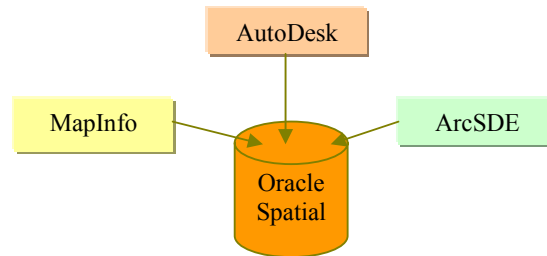
#### **5.4 Review of Existing Sharing System and technology**

There are two different aspects of data sharing and interoperability. One is the technology of the sharing and interoperability and the other is the policy or intent of sharing. The following provides a very brief review of the status of spatial sharing technology and then discusses the policy statements of FGDC and ANZLIC.

**Review of Data Sharing Technology:** Spatial data sharing and interoperability depends on use of appropriate software tool and technique to exchange and transform spatial data so that the users can make full advantage of the function of Geographic Information System (GIS) software. At present, the technical implementation of spatial data sharing and interoperability include three methods, namely (1) data format exchange method, (2) direct data access method and (3) the Open Geo-data Interoperability Specification (OGIS) -based method. These three technical methods are applied in different fields of application respectively and are being improved constantly.

**Data Format Exchange Method:** Data format exchange method is to turn certain data format into internal data format through transform action. The method is mainly based on external data exchange file or the Spatial Data Transform Standard (SDTS). Data transform function is implemented by the commercial GIS software. In the recent years, the special software tools are developed to solve spatial data transform, for example, Feature Manipulation Engine (FME), the software product of Safe Company. It supports transform among nearly one hundred kinds of data format, including geometry data and attribute data. The users can define new data format to exchange with other data format. FME can batch the data transform, thus improve the work efficiency. Data format exchange method is very useful in the field of data processing before importing data into spatial database and providing digital map products according to the requirement of the users. This method is considered as one kind of data sharing from the viewpoint of data transformation. But it is only file-based sharing and cannot implement real-time data sharing at the feature level. So it can not be considered as true data interoperability.

**Direct Data Access Method:** Direct data access method is directly accessing to the data of other platform. Direct data access method avoids the complicated data transformation and provides one kind of applied multi-sources data integration pattern. One example is the research and application of spatial data sharing based on Oracle Spatial. Most GIS software can store spatial data and attribute data into Oracle database. Oracle Spatial is gradually accepted as the spatial data management pattern. But Oracle Spatial provides open data structure and only describes the structure of spatial data field. It does not limit spatial data type codes and coordinate sequence. Thus, different GIS software has different methods to describe the spatial object, for example, MapInfo, AutoDesk Map and ArcSDE as shown in Figure 5.4.1. Though these software store spatial data into the Oracle Spatial, the storage rules are different and data can not be accessed by other GIS software.



**Figure 5.4.1: Different spatial data storing on Oracle Spatial**

To implement mutual access to the heterogeneous data in the Oracle Spatial, data storage rule, namely spatial data structure established by different GIS software, must be transformed. It is mainly processed and transformed on the spatial data tables according to the corresponding GIS software. Thus spatial data tables can be read and written by different software and the aim of heterogeneous database is achieved. Direct data access method also has inevitable problems. Spatial data sharing based on Oracle Spatial is not exception. One problem is that the upgrade of any platform will influence other platforms concerned and make them lose the function of access to the spatial data. Another problem is some data management characteristics owned by every GIS platform will be lost in the processing of data sharing, for example, topology structure and version management in the ArcGIS, heterogeneous geometry collections in the MapInfo and etc. Direct data access method is considered to implement spatial data sharing and interoperability through a local intranet.

Furthermore, different data sharing system exist in abroad and home has been reviewed and briefly described in subsequent section below:

#### **5.4.1 Data sharing in other countries**

Some of the data sharing protocol exist in different countries have been reviewed and described below:

**The Australia New Zealand Information Councils (ANZLIC) Data Sharing Protocol:** The Australia New Zealand Land Information Council (ANZLIC) has the understanding to support in the national interests of both the countries through information sharing. ANZLIC believes that Australia and New Zealand should have the spatial data infrastructure needed to support their economic growth, and their social and environmental interests, backed by national standards, guidelines, and policies on community access to that data. Principles for data sharing in ANZLIC. The major principles of ANZLIC are:

- All sectors of the community should have easy, efficient and equitable access to fundamental spatial data where technology, data formats, institutional arrangements, location, costs and conditions do not inhibit its use.

- The fundamental spatial data needed by all sectors of the community should be available to support economic, environmental and social needs.
- Governments should seek to maximize the net benefits to the community when developing their spatial data access policies and pricing regimes.
- Fundamental spatial data should be made available online through customer-focused portals, as one of a number of ways to meet community needs for equity of access.
- Access arrangements should be geared to maximize the use of spatial data resources in both public and private sectors and to encourage the development of an innovative and competitive value-adding industry.
- Access arrangements should recognize confidentiality, privacy, security and intellectual property rights.

**FGDC Data Sharing Protocol:** In 1992 the FGDC Steering Committee endorsed Geographic Data Sharing. The overall purpose of this data sharing protocol is to facilitate full and open access to Federal geographic data by Federal users and the general public. They were prepared in consonance with the goals of the Federal. The major principles of this data sharing are as below:

- Geographic data that are created, collected, processed, disseminated, and stored by the Federal Government are a valuable national resource. The Federal Government serves as a steward of this resource, shall exercise information resource management with special emphasis on the information life cycle, and shall ensure the effective and economical development of the Nation's spatial data infrastructure.
- Agencies shall commit to the maintenance, validation, description, accessibility, and distribution of geographic data.
- Agencies shall manage geographic data in a way that facilitates data sharing and use by other agencies and the general public. Geographic data shall be maintained consistently among agencies. Data sharing maximizes the net return on the investment of public resources.
- Federal program managers are data managers and have a responsibility to plan for information resource management as an integral part of overall mission planning. Agencies need to plan from the outset for the steps in the information life cycle.
- Federal, national, and international standards shall be used to the greatest extent possible for data content, processing, and dissemination of geographic data sets.
- Federal agencies shall maintain an information dissemination management system for geographic data that shall include easily accessible information and the data holdings, including quality assessments, supporting information, and guidance and aids for locating and obtaining the data.
- Agencies shall disseminate geographic data in a manner that achieves the best balance among the goals of maximizing the usefulness of the data and minimizing the cost to the government and the public. Data products should be disseminated equitably and on timely and equal terms.

#### **5.4.2 The Data Sharing in Bangladesh**

Data sharing is one of the major problems in Bangladesh. For developing the national level data sharing protocol it is essential to know the present status of data sharing / dissemination status among

the organizations. In Bangladesh there is no well-established data sharing protocols to disseminate the data. Different organizations disseminate/ share the data following their organizational rules regulations. Data are also disseminated based on the national requirements and request from the data receiving organizations.

**Data Sharing status of Bangladesh:** Data sharing status were assessed using the information inventoried under NWRD project and GIS data assessment survey under this study. From the NWRD Project Phase-II data inventory (2003), data accessibility information of different agencies were assessed and presented in Table 5.4.1. It shows that data accessibility varies from agency to agency and users to users. It shows that the 28 organizations have the provision of data accessibility of which six (6) organizations have given opinion for data access with cost and 22 organizations has given opinion for data access without cost. Data accessibility is driven by the organizational status and in most of the cases it is free for the government agencies. Some data and information are free to access by the citizens as those are not sensitive parameters. Furthermore, Table 5.4.1 also shows that only one out of 30 (97%) agencies have given opinion in favor of open and wide accessibility to different level of users; and only one agency reported to continue to have restriction in accessing their data.

**Table 5.4.1: Summary of data accessibility from NWRD Phase-II data inventory, 2003**

Index	Accessibility		With Cost	Without cost
	Yes	No		
Within government organization	17	-	1	16
Accessible to all	11	1	5	6
Other (authorities decision)	2	-	-	-
Total	30	1	6	22

The GIS Data Status Inventory survey under the present study has also collected accessibility information and presented in Table 5.4.2. The Table 5.4.2 shows that 10 organizations have no data sharing/dissemination system, and only 9 organizations have their own data dissemination system. Data not yet received from 10 organizations.

Further the detail data accessibility statuses of different organizations were also assessed and presented in Table 5.4.3. That shows nine (9) organizations has given opinion on data accessibility to GoB only, seven (7) organizations has given opinion on open data accessibility to researcher and 13 organization have the opinion on data accessibility to all.

**Table 5.4.2: Status of data sharing protocol in Bangladesh.**

SL.	Organization	Data Sharing/Dissemination Policy /Protocol	SL.	Organization	Data Sharing/Dissemination Policy /Protocol
1	BADC	Yes, Data Providing Form, Pen Drive, Data Security	19	DU-Geology	Data not received
2	BARC	No	20	FFWC, BWDB	Yes
3	BBS	No	21	Forest Department	Yes. Pen Drive, Data security needed
4	BIWTA	Dissemination rule for data sale	22	GSB	No
5	BMD	Yes. Data Providing Form, Pen Drive, Data Cost, Data	23	IWFM, BUET	Data Providing Form - of Application

SL.	Organization	Data Sharing/Dissemination Policy /Protocol	SL.	Organization	Data Sharing/Dissemination Policy /Protocol
		Security			
6	BCAS	Yes, Pen drive, Data Security should be maintain BCAS's name	24	IUCN	Data not received
7	BNUS	No	25	IWM	Yes. CD/Tape/Pen Drive,Data Cost, Data Security
8	CARE - Bangladesh	No	26	Dept. of Geography and Environment, JU	Yes. Only for BSc, MSc, MPhil & Ph.D Students
9	CEGIS	Yes, by CD, Pen Drive	27	KDA	Data Cost (Through Khulna Development Authority Rules)
10	CNRS	Yes, By CD	28	LGED	Yes. Pendrive, DataCost, Data Security needed
11	CWASA	Data not received	29	RDA	No
12	DoE	Data not received	30	RAJUK	Data not received
13	DoF	Distribute published data	31	RHD	No
14	WRE, BUET	No	32	RRI	Data not received
15	DCC	Data Providing Form - Application	33	RU-Geography	Data not received
		CD/Tape/Pen Drive - CD, Pen Drive	34	RU-Geology	Data not received
		Data Cost - GIS Data (per ward) 100000 Tk. (For Government Institution), 200000 Tk. (For Non-government Institution), Data Security - Data source must be mentioned	35	SRDI	Yes, Data cost
			36	SPARRSO	Yes
			37	SoB	Data not received
38	UNICEF	Data not received			
16	Dhaka WASA	No	39	WARPO	Yes
17	DLRS	No	40	Dept. of Geography and Environment, DU	Not describe
18	DPHE	Data not received	41	Dept. of Urban and Rural Planning, KU	Not describe

**Table 5.4.3: Status of data accessibility in Bangladesh**

SL	Organization	Accessibility			SL	Organization	Accessibility		
		Only GoB	All	Researcher			Only GoB	All	Researcher
1	BADC	√		√	21	FD		√	
2	BARC	Not described			22	GSB	Not described		
3	BBS	Not yet decided			23	IWFM		√	
4	BIWTA		√	Free for University students	24	IUCN	Data not received		
5	BMD		√		25	IWM	√		√
6	BCAS			√	26	JU- Geography	Not applicable		
7	BNUS	Not described			27	KDA		√	
8	CARE - Bangladesh	Depends on management			28	LGED	√		
9	CEGIS	√		√	29	RDA	Not described		
10	CNRS	√		√	30	RAJUK	Data not received		
11	CWASA	Data not received			31	RHD			√ Partially
12	DoE		√		32	RRI	Data not received		
13	DoF		√		33	RU-Geography	Not described		
14	WRE, BUET	Not described			34	RU-Geology	Data not received		
15	DCC		√		35	SRDI	√	√	√
16	DWASA	Not yet decided			36	SPARRSO	GoB preferred	√	
17	DLRS	Not described			37	SoB	Data not received		
18	DPHE	Data not received			38	UNICEF	Data not received		
19	DU-Geology	Data not received			39	WARPO	Approval and price		
20	FFWC, BWDB		√	√	40	DU-Geography		√	
					41	KU		√	

However, a very few organizations have any data dissemination form. WARPO has been disseminating the data using the three types of forms are (i) data estimation form, (ii) data invoice form and (iii) data receipt form; those forms are presented in Appendix 5.4.1.

## **5.5 Guidelines of data sharing protocols in Bangladesh**

Different GIS user organizations are producing different GIS data layers in Bangladesh. Due to lack of data sharing protocols—data collection, generation, processing and dissemination activities are consuming lots duplication of works and thus making wastage of resources and times. During the survey and discussions, it was observed that most of the GIS users in different organizations feels the needs of a national level GIS data policy, data standard and data sharing protocols. Based on literatures of the other countries stands on these issues, relevant situation in Bangladesh and opinions of some advance data users, a draft guideline for data sharing protocols has been prepared and proposed in following sub section.

### **5.5.1 Preface**

This draft data sharing protocol guidelines have been developed under the guidance of CDMP to facilitate geo-hazard related data in disaster management and planning activities through sharing of information among GoB and other GIS user organizations of Bangladesh, so that member organizations can receive the available information according to the requirements.

Extensive consultation has been done amongst the agencies for developing the final version of this protocol guideline.

### **Introduction and Overviews**

- For geo-hazard assessment different geological and relevant information is required those are belongs to different GIS users and relevant organizations.
- This protocol sets out the principles for using and sharing geo-hazard information amongst the GIS user organizations.
- Organizations involved in providing services to the public have a legal responsibility to ensure that use of their geo-information is lawful, properly controlled and that an individual's (i.e. data holding organization and the users) rights are respected. This balance between the need to share information to provide quality services and protection of confidentiality can be a difficult one to achieve.
- Uncertainty and legal issues on geo-hazard related GIS data may lead to unavailability of information. These types of issues could cause suffering to the data requesters who have a genuine need of the information for doing their geo-hazard related activities/services properly.

### **5.5.2 Aim and objectives**

The overall aim of this protocol is to develop data-sharing guidelines for the GIS user organizations to establish and regulate working practices in order to ensure that the information is managed and shared on a lawful basis.

The major objectives are:

- a. To guide partner organizations on how to share the GIS data within the legal framework;
- b. To promote the development and use of geo-information sharing protocols;
- c. To encourage GIS users organizations for lawful flows of information; and

- d. To increase awareness and understanding of the relevant legislation regarding geo-information sharing in Bangladesh within the Data Protection Act of Bangladesh.

### **5.5.3 Scope of the proposed data sharing protocol**

This protocol sets out the principles that all partner organizations will follow when using and sharing GIS data / information among them.

- In this protocol the terms 'data' and 'information' are indicated as synonymous.
- The protocol applies to all geo-hazard related GIS data handled by the partner organizations including information held on manual records and information processed electronically by computer, and hard copy maps.
- According to the “The Data Protection Act” of Bangladesh some data are also defines, as confidential information or ‘sensitive data’ and additional conditions must have to be met where necessary to use and disclose these data within legal framework of the country. “The Data Protection Act” of Bangladesh could be relaxed to share and disseminate the GIS data for planning and research purposes.
- Confidential and sensitive data will not be shared unless the need is totally justified.

### **5.5.4 Key Principles**

The partner organizations will agree to the following key principle when they sign the sharing protocol among themselves:

- Geo-hazard related GIS information will be shared among the users/partners organization where it is lawful to do so;
- The user / partner organizations must be informed on data subjects, e.g. when and how information is recorded, and how their information may be used;
- To ensure that adequate security measures are applied to the sensitive/confidential data that they hold and transfer and commit to comply as far as possible;
- To develop local Information Sharing Agreements that govern the way transactions are undertaken between the partner organizations and with other organizations that are not parties to this protocol;
- To promote staff awareness of the protocol and to train staff in the principles of lawful information sharing; and
- To promote public awareness of the need for information sharing through the use of appropriate communications media including publishing the protocol on the websites of the respective agencies.

### **5.5.5 The Legal Framework**

- In general, people have a right to choose how their GIS data is used and who may have access to it. However the law allows for information to be shared where there is a legitimate purpose and a legal basis.
- Public bodies require administrative powers to administer the protocols to share information for specific purposes and these powers will often be provided by a statutory provision which sets out the lawful basis for disclosure.

### **5.5.6 Purposes for Sharing Information**

- The partner organizations will clearly identify the specific purposes for which they may need to share information. These will be recorded in Information Sharing Agreements.
- The partner organizations will ensure that the information holding organization has been notified of the purposes for which they share information.
- The partner organizations will ensure where appropriate that data subjects are provided with a 'Fair Collection Notice' at the time they provide spatial / GIS data. This will state the identity of the data controller, the purposes(s) for which the data are intended to be processed and the organizations with whom it may be shared. If the Data Controller has a nominated representative for the purposes of the Data Protection Act, the identity of that representative should be provided.
- The partner organizations will also ensure that this information for data subjects is made readily and easily available through websites and leaflets to those about whom personal data is already held.
- The partner organizations will ensure that information is requested and shared on the principle that it will be made available only on a justifiable 'need to know basis'.
- The partner organizations will follow a consistent metadata standard for Bangladesh. It could be ISO 19115:2003 as described in chapter 4.
- The partner organizations will preferably use a common metadata and data sharing tool. This study recommended the GeoNetwork for this purpose, which supports ISO 19115:2003. The detail is given in chapter 4.

### **5.5.7 Sharing information with and without the consent**

- Where possible partner organizations will seek consent before sharing their spatial data with other partner organizations.
- Where consent to disclose information is requested it will be made aware of the information it is proposed to share and the purposes for which it will be used.
- The partner organizations will ensure that whether the consent is given freely or not.
- The partner organizations will have the right to withdraw consent at any time and should be informed of this right.
- The partner organizations will agree on standards and procedures for ensuring that a written record is kept of consent given or withdrawn.
- There are circumstances when it is lawful to disclose spatial data without their consent, those should be identified by the partner organizations and should be clearly mentioned.
- Decisions to disclose or to decline to disclose information without consent will be made by an authorized officer and recorded for audit purposes. The partner organizations will keep an up to date list of authorizing officers and their contact details.

### **5.5.8 Access to information**

- The partner organizations will maintain accurate records and will inform data subjects of their procedures for seeking access to information held about them.

- The partner agencies will develop systems to record consent given or refused, the sharing or transfer of information and deletion of and/or amendment to data held.
- Where rectification or deletion of data held by one of the partner agencies occurs, whether at the request of the data subject or otherwise, any changes made as a result will be recorded and communicated to all organizations with whom the data had previously been shared.
- Data security and interoperability should be ensured through actions such as setting of encryption standards and agreements on interoperability.
- ICT Act of Bangladesh should be enacted immediately to protect against computer crimes such as computer fraud, hacking and damage to programs and data and introducing/spreading computer viruses.

#### **5.5.9 Organizational Responsibilities**

- Each partner organization is responsible for ensuring spatial data passed to them should be clearly marked and kept securely within a password computer system or otherwise physically secure with appropriate levels of staff access.
- Partner organizations will accept the access levels on supplied information and handle the information accordingly. Partner organizations accept responsibility for independently or jointly auditing compliance with the Information Sharing Agreements in which they are involved within reasonable time-scales.
- Partner organizations will take steps to ensure that their staffs are aware of their responsibilities under the Data Protection Act to ensure compliance with the Act. Relevant staff will be provided with copies of Information Sharing Agreements that cover services they provide.
- Every organization will make it a condition of employment that employees will abide by their rules and policies in relation to the protection and use of confidential information.
- Any failure by an individual to follow the policy will be dealt with in accordance with that organization's disciplinary procedures.
- Every partner organization will ensure that procedures are in place to ensure that disclosure of information without the consent of the data subject or secondary disclosure will only occur after authorization by an appropriate officer. An up to date list of authorizing officers and their contact details will be kept by each of the partner organizations.
- The partner organizations supplying information should be notified of any breach of confidentiality or incident involving a risk or breach of the security of information as soon as it has been identified. These breaches will be recorded and partner organizations will investigate and report back to the information manager/data protection officer.
- Partner organizations will have documented policies for retention, weeding and secure waste destruction and they will be available for inspection by all partner organizations.
- Each partner organization will ensure that a suitably senior officer is designated to represent the organization on a steering group, chaired by the Head of the Information Management Group of the respective partner organization, which will oversee the implementation, monitoring, and review of the protocol. This officer will ensure that their contact details are passed to all partner agencies.

#### **5.5.10 Individual Responsibilities**

- Every individual working for the organizations listed in this protocol will be responsible for the safekeeping of any information they obtain, handle, use and disclose.
- Every individual should know how to obtain, use and share information they legitimately need to do their job.
- Every individual will have obligation to request proof of identity, or take steps to validate the authorization of another before disclosing any information.
- Every individual should uphold the general principles of confidentiality, follow the rules laid down in this protocol and seek advice when necessary.
- Every individual should be aware that any violation of privacy or breach of confidentiality is unlawful and a disciplinary matter that could lead to their dismissal.

#### **5.5.11 Complaints**

- Complaints about the use of GIS data will be dealt with under the relevant complaints procedure of the partner organizations whose actions are the subject of complaint. The partner organizations agree to cooperate in any complaint investigation where they have information that is relevant to the investigation. If the complaint affects more than one partner organization it should be brought to the attention of the appropriate complaints officers who should liaise to investigate the complaint.
- The partner organizations will notify the Head of the Information Management Group of the data receiving and providing organization if any complaints and the outcome of any complaint investigated.

## Chapter 6

### Draft National GIS Data Policy Guideline

#### 6.1 Preamble

The introduction of GIS technology in this country dates back to the early 1990s when the Bangladesh Flood Action Plan (FAP) project set up a GIS facility under the Irrigation Support Project for Asia and the Near East (ISPAN) with funds from USAID. The GIS was to provide technical support to the country's flood disaster mitigation efforts. The success of ISPAN-GIS eventually helped the spread of the technology to the other government departments, national and international NGOs, the universities and also to the private sector. At present numerous organizations have developed their own GIS capability and are producing significant amount of digital spatial data covering areas like local government administration and management, natural resource management, natural disaster mitigation, utilities management, education and health care facility location, transport, communication and marketing.

A critical mass of highly skill GIS professionals have gradually emerged. The growing acceptance of GIS technology in different organizations has led to the availability of a substantial amount of spatial data on various themes produced in different GIS platforms. This proliferation of spatial data in Bangladesh, like in many other countries, has happened in a decentralized and uncoordinated manner. There is no central depository/clearing house for spatial data. Each agency or organization produced its own data, using their own platform, standards and formats being unaware of the existence of the same data with other agencies. The result was duplication of data, wastage of resources and difficulties in interoperability. It is under such a background that this review of spatial data policy is being carried out.

The pattern of GIS development in Bangladesh is characterized by sporadic project led growth. The GIS installations have been set up as part of various development projects. Lack of basic national digital data from secondary sources, lack of updated national population census information, lack of skilled GIS personnel and above all the lack of awareness of the project management on GIS's advantages are some of the reasons for the insignificant use of GIS in projects. The following sections report the status of GIS in the Projects visited by the study team.

It was found that the government sector is the most developed in terms of GIS infrastructure and personnel. Several government GIS organizations are rich in their software and hardware collection. There is a dominance of the ESRI format GIS in the country. ESRI software users also dominate GIS skills. The CEGIS, IWM, BARC, SRDI, LGED and SoB have significant GIS set-up (software, hardware) and trained personnel. All of these institutions are special purpose GIS organizations focused on particular types of spatial data. CEGIS and IWM are focused mainly on the environment and water sector database, the BARC and SRDI on agriculture and soil resources database, LGED on rural roads & growth center data. The SoB should have been the main producer and depository of the national spatial data. However, the organization has taken up several projects to create digital database. It has prepared a detailed digital database for the greater Dhaka metropolitan area in the year 2002. At present it has started a large scale digital database project for the whole country to be completed in the next six years.

The universities have good facilities with PhDs from Western Countries. However, most of these are for education and training and research. The universities have highly qualified GIS trained personnel

in advanced countries like the USA, UK and other countries in Europe. For example, only at JU Geography and Environment Department has at least five PhD holders working in the field of wide GIS world. The University's GIS efforts are handicapped by lack of funds to develop their spatial database production capability.

The private sector is only recently started in the GIS market. However, this has the most potentials for growth and retention of the skills and spatial databases that are produced. The dedicated GIS service companies can innovate to fill in the large gaps in the growth and the development of the countries GIS technology. The private sectors firms for their own interest collect and retain the database that is produced by the various agencies. They also have the flexibility to embark of the development of particular database demanded by the clients. Only some data-sets have been produced in the private sector. With proper patronization much more can be expected from the private sector.

There is absence of any national digital spatial database organization responsible for planning and implementing the GIS database development requirements. In the absence of that, organizations create their own GIS database. This leads to costly duplication of efforts. There is also the absence of guidelines for standardized spatial database creation. There is no information sharing guideline or protocol. Outdated laws related to national security considerations often restrict acquisition of important spatial information on 'sensitive' places within the country.

The different GIS database that exists with various organizations has already been discussed in the chapter 2. The database is available from the organizations. The usual procedure to collect data is to contact the chief executive of the organization and seek permission to acquire the data. The culture of selling or purchasing the GIS database has not yet developed on a firm footing. No pricing policy has been adopted by any of the organizations. The LGED has priced its Thana digital database at Taka 1000.00 for each thana. The NWRD database is priced and they have adopted a pricing policy. The BARC, SRDI and the data found in the university are not sold. These are, however, shared for research purposes.

## 6.2 Goal and Objectives

The goal of the GIS data policy is to reduce duplication of effort amongst agencies, improve quality and reduce costs related to geographic information, to make geographic data more accessible to the public, to increase the benefits of using available data, and to establish key partnerships with Ministries, departments, directorate, cities corporations, paurashavas and other local agencies, academia and the private sector to increase data availability.

With the above background in view the need for adoption a National GIS Data Policy has become urgent. The broad objectives of the GIS data policy are:

- The *first* is the development of **GIS Data Standards** including **Metadata**,
- The *second* is the facilitation of **access** and **sharing** of data,
- The *third* is the development of the **National Geographical Data Framework** and
- The *fourth* is the development of the Bangladesh National Geographical Data Infrastructure (BNGDI). All of these efforts were to be carried out through partnerships among government ministries, Departments, directorates, Local Government Agencies, the private and academic sectors, and non-profit organizations.

## 6.3 Review of GIS Database Production and Use in the Country

**The Survey of Bangladesh (SoB):** The Survey of Bangladesh (SoB) is the national surveying and mapping agency in Bangladesh under the Ministry of Defense. Major activities of SoB are:

preparation, revision and updating of topographic maps of the entire country at different scales, ground and aerial survey and the establishment of trigonometrically and geodetic control network. SoB carries out large-scale contour survey and produces various thematic maps. SoB is the custodian of all kind of aerial photographs and its negatives and also responsible for processing, development, printing and maintenance. Digital cartographic unit of SoB consists of geo-concept, ArcInfo and ArcView, and ArcGIS. SoB has in recent years established a new geodetic framework for the country based on Global Position Technology with JICA assistance. A countrywide network of geodetic benchmarks has been established to facilitate accurate survey and mapping. A new project for countrywide digital mapping is in progress. They are also creating 1: 25000 scale digital maps for the whole country.

**Space Research and Remote Sensing Organization (SPARRSO):** SPARRSO is an autonomous organization under the Ministry of Defense. Its prime mandate is to apply remote sensing technology for surveying and monitoring natural resources and monitoring of the environment and natural hazards in the country. It operates and maintains satellite ground receiving stations, conducts research and develops methodologies for both visual and digital interpretation of satellite and airborne images for various applications. It provides space related data and services to government and non-governmental organizations engaged in development, planning and policy making activities. Besides, the image processing system it also has a GIS set-up, which include ArcInfo and ERDAS Imagine.

**Directorate of Land Records and Surveys (DLRS):** DLRS is the authority to carry out periodical cadastral survey and settlement operations for preparing, updating and publishing cadastral information for the country. It is also preparing cadastral maps and ownership records. The entire set of land related database published into three categories: 1. Records and Rights, 2. Thana administrative Map, 3. Data on Agriculture and Livestock. In late nineties, it has initiated a number of pilot projects to perform digital cadastral surveys and mapping using survey grade dual frequency GPS receivers, Total Stations, Photogrammetry and GIS technology. DLRS is in the process of developing a comprehensive Land Information System (LIS) for Bangladesh, where information on every piece of land will be available digitally for public and departmental use. The pilot phase of this project produced digitized coverage of all the mauzas of two thanas in Gazipur district (Kaliakoir and Joydevpur) and one thana in Rajshahi district (Boalia). The database contains the individual plot numbers and other relevant information. These, however, are not geo-referenced. Besides, the DLRS's GIS Unit has digitized coverages of about 2500 mauza sheets spread over different district of the country. No pricing or sharing policy has been set up yet for this database.

**Bangladesh Bureau of Statistics (BBS):** BBS is the national statistical organization responsible for collecting, compiling and disseminating statistical data on various development sectors. BBS carries out population census every decade and it is also carrying out agricultural census every year and maintains and updates the national databases including sectoral information based on administrative units in digital form. In order to introduce and set-up a GIS unit in the cartographic wings of BBS a project "Development of Cartography and GIS Mapping in BBS" was undertaken with the financial support from GoB, UNDP and UNFPA. Under this project they have already procured hardware and software and arranged a number of training programs for the BBS staff. In order to prepare Enumeration Area maps, they have already acquired aerial photographs at a scale 1:25,000 for the entire country. The photographs were taken during 1999-2000. EA maps were prepared for some selected areas based on aerial photographs during the last census where the mapping scale of 1:10,000 for rural area and 1:5,000 for urban area. These maps contain information settlements, important structures, roads, rivers and canals.

**Center for Environmental and Geographic Information Services (CEGIS):** CEGIS is a public trust under the Ministry of Water Resources works in the fields of integrated Environmental Analysis using Geographic Information System (GIS), Remote Sensing, Information Technology and Databases. It is a think tank that provides solutions to stakeholders facing challenges in sectors such as, water

resources, agriculture, fisheries, engineering, transportation and environment, and recommends technical options based on local realities that are feasible from the socio-economic and institutional point of view. The services and products of CEGIS relate to advice and consulting, research and development, spatial analysis, information and database, and training. The clients of CEGIS are Water Resources Planning Organization (WARPO), the Bangladesh Water Development Board (BWDB), Ministry of Land (MoL), Department of Fisheries (DoF), Department of Environment (DoE), UNDP, UNICEF, The World Bank (WB), Asian Development Bank (ADB) and many other agencies of the Government of Bangladesh and private sector organizations. CEGIS is structured around its disciplines and services that include Environmental Analysis for integrated environmental studies, Spatial Analysis for Interpreting and processing satellite images and GIS. CEGIS has a substantial GIS set-up rich in hardware and software collection. Its personnel are highly experienced. It has a more than a dozen of GIS specialists. Among its significant spatial databases some are: the national and other administrative boundaries, river network and road network coverage, flood zones, digital elevation model, landuse, settlements etc. for the whole country. CEGIS prepared three large national level databases consisting huge GIS data layers, those are National Water Resources Database (NWRD) and Integrated Coastal Resources Database (ICRD) for WARPO, Climate Change Database (CCD) for DoE.

***Water Resources Planning Organization (WARPO):*** WARPO has the mandate to create, maintain and update a National Water Resources Database and Information Management System according to the National Water Policy. WARPO also maintains a GIS set-up at its premises even it depends upon CEGIS for most of its GIS needs. CEGIS personnel maintain the WARPO's GIS. WARPO GIS database possesses more than 300 data layers in several main groups. These are: Base data, surface water, ground water, soil and agriculture, fisheries, forest, socio-economic, meteorological, environment and images.

***Institute of Water Modeling (IWM):*** IWM a successor of SWMC (Surface Water Modeling Center) is an independent Trust formed by the Government of Bangladesh. The areas of activities of IWM include Salinity Mapping, Depth-Duration Analyses, Contour and DEM Preparation, Spatial Database Management, Flood Depth Inundation mapping, GIS based Application Development and Crop Damage Assessment due to Natural Calamities. GIS activities at IWM offer wide range of Mapping and Geo-referenced database services to both external and internal clients. The organization has several trained GIS personnel.

***Bangladesh Agricultural Research Council (BARC):*** BARC is a coordinating agency of all the national agricultural research under the Ministry of Agriculture. It aims to facilitate the formulation of agricultural policies, program planning and implementation of the government. It has completed a project on "Utilization of Agro-ecological Zones Database and Installation of GIS for Agricultural Development". It was initiated in 1996 with the support from UNDP and FAO. The main objective of the project was to create a National Agricultural Land Information System Database using GIS technologies to provide the guidance on agricultural planning and research needs. Under this project a number of geo-spatial and attribute data layers of national and thana level were created. A GIS based Decision Support system was developed in order to identify the suitable cropping pattern in the country. Besides this several GIS based applications have been developed using ArcView architecture for facilitating geo-spatial data handling and analyzing. BARC has a substantial GIS setup with various hardware and software i.e. ArcInfo, ArcView, ArcGIS and IDRISI. At present several agricultural scientists with expertise in GIS and database management are running this setup. The data sets are available from BARC's GIS unit.

***Soil Resources Development Institute (SRDI):*** SRDI has a formidable GIS set up to generate, store and provide data and information and maps related to soil and land qualities, their status, constraints and possibilities for overall development in agriculture sector. SRDI's GIS unit over the years

produced significant amount digital spatial data related to the soil resources of the country. Most of its data are in the ESRI format.

**Local Government Engineering Department (LGED):** LGED is providing technical support to various level of local government bodies for planning and implementation of development program. A GIS unit was established in its headquarter in early nineties in order to develop nationwide geo-spatial database for rural infrastructure and to strengthen institutional capabilities for planning and monitoring of rural development program in Bangladesh. LGED has completed the digital Thana Base Maps at 1:50,000 scale for the whole country. These digital thana databases comprises of various geo-spatial layers including administrative boundaries, different types of roads, educational institutions, settlement patterns and other socio-economic objects. These maps were based on the 1:50,000 topo-sheets from the Survey of Bangladesh (SoB), SPOT panchromatic satellite imagery of 1989 and mauza map from DLRS. The feature information came from mapping field surveys conducted by LGED engineers. This is the most complete thana level spatial database that covers the whole country. As individual thanas the database provides useful starting point for GIS work. However, due to flaws in the original database preparation plan the data have been found to be wanting in many respects. These maps are being used for developing a local level development plan.

**Roads & Highways Department:** The R & H department of the government of Bangladesh maintains a small GIS set-up at its main office in Dhaka. It has developed a nationwide GIS database for the road networks under its jurisdiction. The database has been prepared in ESRI format. The department is in the process to extend and update the database to include selected attribute information.

**Forest Department:** The Forest Department has developed GIS database for the country's forest areas. These are being constantly updated using satellite images. The format here is also ESRI format.

**Universities:** All the public universities have GIS setup under different departments. These have mainly been developed for education training and higher study purposes. Considerable research programme are also going on. The Geography & Environment of University of Dhaka, Jahangirnagar University, Urban & Regional Planning Department of BUET, the Geography and Environmental Studies Department of Rajshahi University and the Urban and Rural Planning Department of Khulna University have substantial GIS set up. These departments have highly educated foreign trained GIS faculties. The B.Sc. honors, M.Sc, M.Phil and PhD curriculum includes courses in GIS and Remote Sensing. The GIS Labs of the Department of Geography of the University of Dhaka offers evening certificate course in GIS open to outsiders. Department of Geography and Environment of the Jahangirnagar University also offers one-month interactive GIS certificate course approved by The Academic Council of the University and it is open for the outsiders.

**Private Sector:** Only a few private sector firms are there in Bangladesh that provides exclusive GIS services. Of these GSRC Ltd., Infoconsult Ltd. and Geoplan Ltd. are leading in terms of skilled personnel, equipment and software resources. GSRC Ltd. was set up in September 2000 to provide exclusive GIS services and training. It has some 15 skilled GIS personnel on its permanent payroll. It has also a collection of spatial data covering the whole country. It has data on the various boundary layers of the different administrative units of the country, the layers with information on the physical environment, the river and water way network, the roadway network, data of the four large city corporations and the data on 64 districts and the district head quarter paurashava. Large consulting firms like the Development Design Consultants (DDC), Sheltech Consultants, Bangladesh Engineering and Technological Services (BETS), Developing Planning Consultants (DPC), Bangladesh Consultants Limited (BCL) have their own GIS units and provides GIS services for their various projects.

## **6.4 Review of GIS Database Sharing and Interoperability in the Country**

Sharing of GIS data at the present is not encouraged by the data producer organizations. It is often very difficult to obtain data for use in projects other than one for which data were produced. The existing law of the land discourages free flow of spatial data due to lack of data sharing guidelines.

## **6.5 Elements of Data Standards in Bangladesh**

Digital spatial data standardization is an essential step towards greater access and interoperability. The responsibility of GIS data collection and production in almost all countries has fallen to multiple agencies both public and private. Due to this multiplicity of producers as well as the variability of the data requirements of different agencies data have been collected in different standards. The variability of data capture methods, the digitization, the coordinate systems, the projection system, the level of accuracy etc. all contribute to the variability of the resultant data. In order to standardize GIS data the following aspects must be coordinated.

### **6.5.1 Data Framework**

Data framework consists of the basic geographic/spatial elements of a database. The data to be standardized must follow common software platform, spatial coordinate system, projections and geodetic datum. The level of accuracy must also conform to common standards of accuracy both in its geographic position determination and its attributes. The metadata standards should also be a common one.

### **GIS data Management, Presentation, & Analytical Geographic Information Systems:**

Considering the overwhelming dominance of the ESRI software platform the GIS data produced in Bangladesh may continue to use ESRI base. The following may particularly be used:

- Workstation ArcInfo (version 9.0 and above) by ESRI
- ArcGIS for ArcInfo (version 9.0 and above) by ESRI
- ArcGIS for ArcView (version 9.0 and above) by ESRI
- ArcIMS (version 4.01 or above) by ESRI

An important feature of a GIS is the ability to input data from various sources and scales into a single, integrated database. This database, because it is geographic, can be manipulated to develop maps and tabular data that are an amalgamation of the original maps and databases.

### **6.5.2 Data Exchange**

**File Format:** The file format should be selected which is readable by most of the GIS application. Investigation shows that ESRI shapefile (.shp) format fulfills this criteria.

**Data Exchange Media:** The data producer organization supply ESRI's format GIS data in at least one of the following media types, using one of the relevant recording techniques noted:

- DVD/CD ROM
- Email
- File Transfer Protocol (FTP) if available from data recipient

**Recording techniques/standards by media type:** Since the GIS data is usually volumous, it requires bigger size capacity of media. For compression, very standard and widely used compression tools should be used. For media and compression followings can be used.

- DVD/CD ROM - ISO 9660 format
- WinZip data compression
- Coding:
  - 7 bit ASCII for text data
  - 8 bit binary for image data
- Coordinate Precision:
  - Double is preferable where applicable
  - As stored in the source documentation

**Co-ordinate System:** Adoption of a countrywide common coordinate system makes data produced by different sources readily integrated. The choice of the Geographic coordinate systems suitable for each country or region is dependent on the actual geographic location of the country over the globe. A number projected coordinate system is also in use internationally. Traditionally, many regions or countries have also adopted various local planer coordinate systems. Most government department data is referenced to the Bangladesh Transverse Mercator (BTM) Coordinate System with WGS 1984 datum. Based on the consultation meetings with major GIS users organizations and professionals, the recommended coordinate system for Bangladesh should be Bangladesh Universal Transverse Mercator (BUTM) Coordinate System with WGS 1984 datum.

**Projection:** The projection system suitable for each country or region is also dependent on the location of the country or region on the globe. However, in many countries with colonial history these systems were adopted as per the wishes of the colonial power. Conversion attempts of their accumulated spatial data into digital format open up the question of adoption of new projections or coordinate systems. Most used projection system in Bangladesh is BTM. The recommended standard projection system for Bangladesh should be Bangladesh Universal Transverse Mercator (BUTM) with WGS 1984 datum, according to the decision of consultation meetings with major GIS users organizations and professionals.

**Geodetic Datum:** The reference spheroids used in georeferencing larger scale spatial data should be common for all spatial data producers in the country or region. Presently the WGS 1984 datum is being adopted by an increasing number of countries for international interoperability. Everest 1830 spheroid is being used with False Easting (500000) and False Northing (-2000000). Measures should be taken so that the new data are prepared using WGS 1984 spheroid.

**Projection Parameters:** The parameters of BUTM-WGS 1984 projection system are:

Ellipsoid	WGS 1984
False easting	500000
False northing	0
Scale factor of central meridian	0.9996.
Latitude of origin of projection	0° N.
Longitude of central meridian	90° E.
Unit	meter

### 6.5.3 Data Accuracy

The level of accuracy of the spatial data being produced depends upon many factors including the purpose for which the data is being produced as well as the funds available for the data production

activity. However, to make data usable beyond the immediate requirements of the data producer some common levels of accuracy should be adhered to.

**Positional Accuracy:** Positional accuracy refers to the extent of the deviation of a map element from its actual geographic position. Compromises in accuracy often have to be made due to lack of proper instruments as well as properly skilled personnel. Countries have adopted various levels of accuracies for maps of various scales. Accuracy levels should be defined based on the scale of the maps being prepared.

**Attribute Accuracy:** Attribute accuracy is the correctness of the description of the geographic feature being mapped. Besides the quality of the field personnel, the integrity of the attribute data are often compromised due to the absence of common semantics. Nationally acceptable spelling of place names, commonly defined geological, geomorphological terms are steps to proper attribute data preparation.

Bangladesh needs to develop the standards in all the above aspects. However, since there are numerous such standards available, developed by different countries for their needs Bangladesh can adapt the rules developed in one country e.g. the United States. The following list provides the standards endorsed by the United States Federal Data Committee that can be adapted to the Bangladesh situation for the Bangladesh National GIS Data Policy:

- Content Standard for Digital Geospatial Metadata (version 2.0), FGDC-STD-001-1998
  - Spatial Data Transfer Standard (SDTS)
  - Parts 1-4, FGDC-STD-002.1
  - Part 5: Raster Profile with Basic Image Interchange Format (BIIF) Extension, FGDC-STD-002.5
  - Part 6: Point Profile, FGDC-STD-002.6
  - Part 7: Computer-Aided Design and Drafting (CADD) Profile, FGDC-STD-002.7-2000
  - Cadastral Data Content Standard, FGDC-STD-003
  - Geospatial Positioning Accuracy Standards
  - Part 1: Reporting Methodology, FGDC-STD-007.1-1998
  - Part 2: Standards for Geodetic Networks, FGDC-STD-007.2-1998
  - Part 3: National Standard for Spatial Data Accuracy, FGDC-STD-007.3-1998
  - Part 4: Architecture, Engineering, Construction, and Facilities Management, FGDC-STD-007.4-2002
  - Part 5: Standards for Nautical Charting Hydrographic Surveys, FGDC-STD-007.5-2005
  - Content Standard for Digital Orthoimagery, FGDC-STD-008-1999
  - Content Standard for Remote Sensing Swath Data, FGDC-STD-009-1999
  - Utilities Data Content Standard, FGDC-STD-010-2000
  - Standard for a U.S. National Grid, FGDC-STD-011-2001
  - Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing Metadata, FGDC-STD-012-2002
  - Digital Cartographic Standard for Geologic Map Symbolization, FGDC-STD-013-2006
- BBS geocode could be used as standard for attribute of administrative boundary.

## 6.6 Elements of Metadata Standards in Bangladesh

After its publication, ISO 19115:2003 Geographic Metadata Standard has been widely accepted to use as, metadata standards for geospatial data. In chapter 4, a overview of ISO metadata standard was provided. A community profile based on ISO metadata standard for geo-hazard related datasets was also developed based on ISO metadata standards. As an example, metadata sets for Seismic Zone of Bangladesh was created based on this community profile. At this point, we strongly recommend to use this community profile for geo-hazard related datasets and create metadata sets based on this profile.

## 6.7 Institutional Framework for Policy Implementation

### 6.7.1 Proposal for Establishment of Bangladesh National Geographical Data Infrastructure (BNGDI)

Consistent means to share geographic data among all users could produce significant savings for data collection and use and enhance decision making. Bangladesh Government may initiate the efforts for the establishment of the Bangladesh National Geographical Data Infrastructure (BNGDI) defined as the technologies, policies, and people necessary to promote sharing of GIS data throughout all levels of government, the private and non-profit sectors, and the academic community.

The BNGDI can be defined as the total ensemble of available geographic information that describes the arrangement and attributes of features and phenomena on the Earth within a nation's boundaries, as well as the materials, technology, and people necessary to acquire, process, store, and distribute such information to meet a wide variety of needs. The heart of a mature spatial data infrastructure is the basic spatial data: a network accessible multi-layer, multi-purpose cadastre covering topography, geology, hydrology, vegetation, wildlife habitat, wetlands, floodplains, zoning, utilities, roads, railways, canals, buildings, census data, titles, parcel structure, and geodetic network.

The BNGDI once it comes into existence will be seen as the technology, policies, criteria, standards and people necessary to promote geospatial data sharing throughout all levels of government, the private and non-profit sectors, and academia. It will provide a base or structure of practices and relationships among data producers and users that facilitates data sharing and use. It is a set of actions and new ways of accessing, sharing and using geographic data that enables far more comprehensive analysis of data to help decision-makers choose the best course(s) of action. Much has been accomplished in recent years in US and other developed and developing countries to further the implementation of their NSDI, but there is still much to be done to achieve the vision of current and accurate geographic data being readily available across the country.

The BNGDI may be defined as the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data for Bangladesh. The BNGDI will work for the:

**BNGDI Standard** defined and agreed to national agencies and defining content and schemas, design and process, network protocols, exchange and transfer. Standards are the crux of the NGDI and would be of relevance to database standardization - formats, exchange and interoperability; Networks-gateways and protocols; communication equipment, software standards, etc. Standards enable applications and technology to work together. Tools, applications, and data affect each other, and processes for developing standards must consider these interactions.

**BNGDI Metadata** of the NGDI content and depends on information availability. The NGDI Metadata would get evolved from the NGDI Standard and as GIS data is populated. As a part of NGDI, one of the critical steps would be the development of a metadata standard and development of metadata files.

**BNGDI Nodes** and GIS servers of the actual spatial information – in conformity of the NGDI Standard. The NGDI Nodes are mainly GIS databases and development oriented information systems servers - all integrated and linked to basic spatial/geographic units.

**BNGDI Search and Access Protocols** enable search and location of spatial information. The protocols provide the gateway for users to access NGDI. The basic issue in the operation of the NGDI is the backbone on which the information travels from one point to another. The backbone carriers are high-speed carriers capable of providing bandwidth on demand to intermediate levels of the NGDI and to users of the NGDI.

**BNGDI Electronic Clearinghouse.** The NGDI Clearinghouse is the mechanism to provide access to the metadata and finally to the actual data sets. The clearinghouse has systems to authenticate data requests and requests GIS data volumes that are usually large. In such cases, the system is able to generate media bearing the requested data for transmission by mail. The clearinghouse also stores information about the applications and availability of application specific modules that could be reused by other users. The clearinghouses use the BNGDI search and access protocols engines to look for and discover data and information.

### **6.7.2 The BNGDI Standard**

The BNGDI requires a major effort at standardizing content and schemas, design and process, network protocols, exchange and transfer. The standardization will enable “user transparency” to information access. The BNGDI standards will evolve and grow as more and more agencies commit and access the BNGDI Nodes.

The BNGDI Standard would have to be developed and should cover:

**Content standardization** – the layers, attributes and schemas that will populate a NGDI Node. Each BNGDI-Node agency will have to develop its own thematic content standard – SoB for topographic maps; GSB for geological maps; SPARRSO for satellite images and thematic maps; LGED for City maps and so on.

**Design and Process standardization** – the GIS database design encompassing issues of co-ordinate systems, projections, accuracies of databases, attribute schema forms etc. Further the database creation process standardization – the process and mechanics of actual database creation through manual digitization, scanning, keyboard entry of attributes and attribute file assimilation will also have to be developed.

**Network Protocols Standards** – for linking the BNGDI Node servers and their inter-server communications.

**Exchange and Transfer Standard** – file formats for the exchange of GIS data from and to BNGDI Nodes and defining output formats for user access.

**BNGDI Quality Standards** – the quality evaluation parameters and procedures for verification and quality certification of the BNGDI content BNGDI will work with different agencies, national and international, towards establishing systematic procedures that will enable each agency to undertake standard quality audits on their GIS data. Each committing agency must declare a “Quality Certification” of their GIS data and may adopt a self-certification and quality-audit process according to the BNGDI Quality Standards. It is only after certification and audit reports are made available that the GIS data form a part of BNGDI.

## **6.8 Conclusions**

The goal of the GIS data policy is to reduce duplication of effort among agencies, improve quality and reduce costs related to geographic information, to make geographic data more accessible to the public, to increase the benefits of using available data, and to establish key partnerships with Ministries,

departments, directorate, cities corporations, paurashavas and other local agencies, academia and the private sector to increase data availability.

GIS data standardization is an essential step towards greater access and interoperability. The responsibility of GIS data collection and production in almost all countries has fallen to multiple agencies both public and private. Due to this multiplicity of producers as well as the variability of the data requirements of different agencies data have been collected in different standards.

The variability of data capturing methods, the digitization, the coordinate systems, the projection system, the level of accuracy etc. contribute to the variability of the resultant data. In order to standardize GIS data, the data development activities must be coordinated. The adoption of a national data policy will help in attaining uniform coordinate system, projection system, geodetic datum, and accuracy standards. The GIS data will then be interoperable and the data sharing situation will improve tremendously.

The policy activity requires the development of GIS metadata standards so that data access and data sharing situation in the country improves. All the activities related to data policy will constitute the National Geographical Data Framework (NGDF). These activities together under one umbrella will constitute the Bangladesh National Geographical Data Infrastructure (BNGDI).



# Chapter 7

## Conclusion and Recommendations

The study has investigated the GIS data status in Bangladesh over the decades through existing survey reports and a intensive survey under this project. It has also focused the GIS data compatibility issues, metadata status, data sharing process and protocols. It is also highlighted that how these issues are being addressed in other advanced countries and worldwide famous companies. The key study findings and recommendations are highlighted below in brief.

### ***Key Findings:***

#### ***(a) Assessing GIS and Metadata Compatibilities:***

- Major problems concerning the data compatibility in Bangladesh are using different projection systems, lack of standard and lack of standard quality guidelines.
- Majority of the organizations are using ESRI Software e.g. ArcGIS, ArcInfo, ArcView etc. for preparation of GIS data.
- Most of the surveyed organizations are using BTM projection. Out of 31 surveyed organizations, 24 are using BTM, seven (7) are using UTM, and seven (7) are using LCC projection system. Only SoB is using BUTM, which is same as BTM but with exception of only one parameter which is false northing (-2000,000).
- More than 20 organizations have no metadata and only six (6) organizations have reported that they have metadata system, but they are not using common metadata system and metadata standard.
- Hardly any organization found to follow strict guideline for capturing, processing and quality control of GIS data. Data documentation lies only in tiny chapters or sections of the relevant project reports.

#### ***(b) Developing Metadata Standards:***

- Only two organizations (WARPO and CEGIS) are using ISO metadata as a common standard.
- LGED is using ICIMOD standard metadata, which is almost close to ISO and BNUS (BUET) using the IAEE/USGS standard, which is close to FGDC standard.
- No organization has any metadata document except CEGIS and WARPO.
- Substantial number of organizations has the plan to develop metadata system following common standard. However, there is no sufficient trained and well-experienced person inside the organization to prepare the metadata following a standard.

#### ***(c) Developing GIS Data Sharing Protocols:***

- Majority of the organizations do not have standard rules or regulations to disseminate and share the GIS data with others.
- Few organizations disseminate and share the data following their own rules/process.
- Only WARPO has the documented data dissemination process/system.
- There is no standard guideline to share the relevant data during emergency period for executing the disaster management planning activities.

**(d) Preparing National GIS Data Policy**

- i) There is no GIS data policy guideline to share the data during emergency for executing the disaster management planning activities
- ii) There is no central depository/data bank for GIS. Each agency or organization produced its own data, using their own platform, standards and formats, being unaware of the existence of the same data with other agencies.

**Recommendations and Strategies:**

**(a) General Recommendations:**

**Assessing GIS and Metadata Compatibilities:**

All the organizations in Bangladesh should follow a common projection system and parameters to make the GIS data compatible amongst the GIS user organizations.

BUTM projection system with WGS 1984 datum could be taken as the standard for Bangladesh. The parameters of the recommended projection system are as below:

Ellipsoid	WGS 84
False easting	500000
False northing	0
Scale factor of central meridian	0.9996.
Latitude of origin of projection	0 N.
Longitude of central meridian	90 E.
Unit:	meter

Though most of the organizations is using BTM projection but during the consultation meeting the majority of the organizations have given consent to use BUTM projection system with WGS 1984 datum as a common standard for better accuracy and as well as compatibility. Currently SoB is using the BUTM projection system.

**Developing Metadata Standards:**

All the organizations in Bangladesh should follow a common metadata standard and ISO 19115:2003 Geographic Metadata Standard has been recommended as national metadata standard.

Every GIS user organization should have web based metadata system, which will reduce data duplicacy.

**Developing Data Sharing Protocols:**

All the organizations in Bangladesh should follow a common GIS data sharing protocol.

The guideline for data sharing protocol will play important role in information collection, disaster response, disaster evaluation and relief administration and related infrastructure development forging greater synergy.

Ownership of GIS data should be acknowledged and source to be mentioned during data dissemination.

Procedures of data sharing should be simple and less time consuming and close co-ordination should be exercised between the GIS users' organizations to practice the data sharing process.

**Preparing National GIS Data Policy**

Bangladesh National Geographical Data Infrastructure (BNGDI) authority could be established. BNGDI will be the focal point of technology, policy, criteria and standards for GIS data.

A policy should be formed based on this guideline to share data within the GIS users' organizations (GO to GO, GO to NGO, NGO to NGO and academics).

**(b) Specific Recommendations:**

**CDMP:** This organization should take initiative to implement policy guideline for sharing geo-hazard information within the GIS users' organizations (GO to GO, GO to NGO, NGO to NGO and academics) for sustainable disaster management planning activities. The CDMP may take necessary initiative within its scopes to develop and integrate GIS data in Bangladesh for managing disasters and hazards efficiently.

**CEGIS:** CEGIS can play central role to provide technical assistance to the CDMP or other organizations to implement this policy guideline for sharing geo-hazard information within the GIS users' organizations (GO to GO, GO to NGO, NGO to NGO and academics) for sustainable disaster management planning activities.

**Expert Panel:** An expert panel can be created to overview the GIS interests in Bangladesh. The prospective members of the panel could be from GOs, NGOs, and from different universities having extensive knowledge/experiences of GIS and spatial data.

**(c) Implementation Strategies:****Short Term:**

- Projection Parameter Standard could be disseminated by CDMP with the help of CEGIS with close collaboration with SoB, SPARRSO, LGED, BARC and other frontline GIS user organizations.
- An organogram of Bangladesh National Geographical Data Infrastructure (BNGDI) including functionalities and GIS relevant personnel should be formed, which could be operational under the Science and Technology Ministerial Framework.

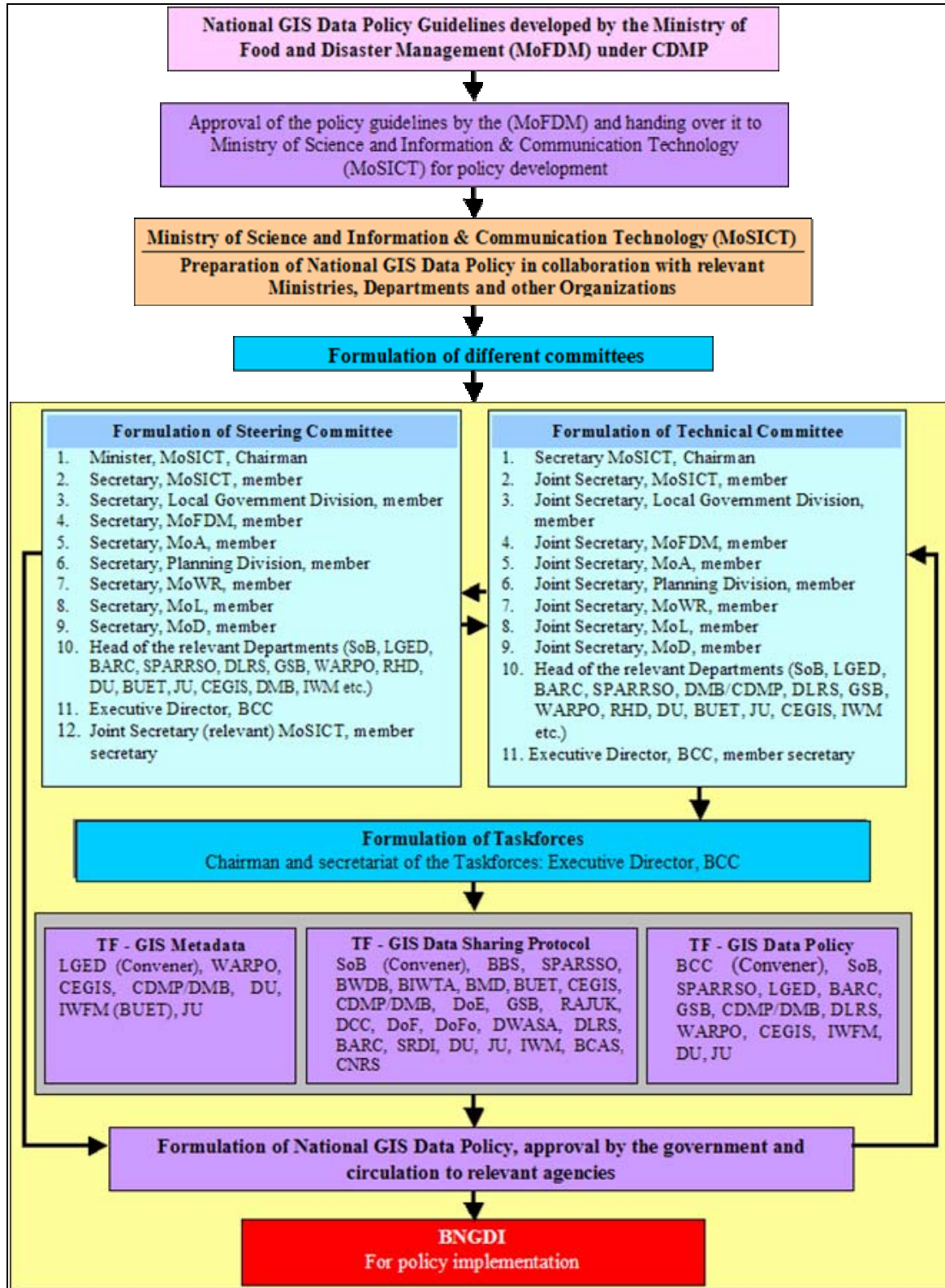
**Medium Term:**

- National Seminar, Symposium, Training Workshops and Manpower Development and Hardware/Software/Data support system should be developed and disseminated. In some cases, international link programs could be initiated.
- SoB should establish more ITRF station for better accuracy of GIS and GPS data.
- Professional who engaged in designing & planning as per clause 9(GA) of National Pay Scale '2005, the persons engaged in GIS activities would be entitled to get special increments as GIS professionals are also involved in designing & planning activities.

**Long Term:**

- There should be a common and standard data capturing, processing and development system of GIS data as mentioned in this report.
- A national common metadata standard, a national GIS data policy and well-defined data sharing protocols are required. Regarding metadata, ISO 19115:2003 standard should be used, as the wider communities in the USA, Australia and Europe have already accepted it.
- Community profile for each GIS data category and user group should be prepared following the ISO specifications. This should be done in harmony and cooperation with relevant frontline GIS user organizations and universities in Bangladesh.
- GeoNetwork should be used as metadata and data sharing tools to keep compatibilities with ISO and other regional scientific organizations (e.g., ICIMOD, IWMI).
- National GIS Data policy should be prepared which would guide and manage GIS data bank and user organizations in terms of data preparation, standard, data description, quality, management and sharing in order to promote GIS activities in Bangladesh.
- **Strategic plan for formulation of National GIS Data Policy:** CDMP could take the

initiative to develop a “National GIS Data Policy” using developed guidelines and following the well-defined steps presented in Figure 7.1 with brief descriptions of these steps below:



**Figure 7.1: Flow diagram of National GIS Data Policy Formulation and Implementation Strategies**

**Approval of policy guidelines by MoFDM and handing over to the Ministry concerned:** CDMP will submit the guidelines for “Metadata, Data Sharing Protocol and National GIS Data Policy” to the Ministry of Food and Disaster Management (MoFDM) for approval. Thereafter, the MoFDM will hand the guidelines over to the Ministry of Science and Information & Communication Technology (MoSICT) for development of a National GIS Data Policy. As lead agency, the MoSICT will take the following initiatives to develop a National GIS Data Policy in collaboration with relevant Ministries, Departments and other organizations:

**Formulation of different committees:** The MoSICT will form different committees such as (i) Steering Committee, (ii) Technical Committee and (iii) Taskforces for developing a National GIS Data Policy for Bangladesh.

**Formulation of Steering Committee:** The MoSICT will formulate a ‘Steering Committee’ headed by the Minister, MoSICT. Other members of this Committee will include Secretaries of relevant Ministries, heads of the relevant Departments and organizations. The Secretary, MoSICT will act as Member Secretary of this Committee. The Steering Committee will take inputs and feedback from the Technical Committee and taskforces regarding different aspects of the Policy such metadata standard, standardization of GIS data, data sharing protocol and GIS Data Policy etc. This Committee will finalize the rules and regulations of the National GIS Data Policy. After finalizing the draft of the Policy, it will be handed over to the Government.

**Formulation of Technical Committee:** The MoSICT will formulate a ‘Technical Committee’ headed by the Secretary, MoSICT. Other members of this committee will include Joint Secretaries of relevant Ministries, heads of relevant Departments and organizations. The Secretary, MoSICT will act as Member Secretary of this Committee. The Technical Committee will assist the Steering Committee in technical aspects of the National GIS Data Policy, such as projection systems, metadata and data sharing, dissemination, data security, and data duplication etc. The Committee will follow the recommended guidelines developed by the MoFDM under CDMP and will prepare policy Acts, rules and regulations. The Technical Committee will discuss technical inputs and suggestions from the taskforces with the Chairman of the taskforces for developing the National GIS Data Policy.

**Formulation of Taskforce:** The MoSICT will formulate three taskforces that will be headed by the Executive Director, Bangladesh Computer Council (BCC). The Executive Director will work as Chairman of the taskforces and assist the Technical Committee in providing necessary technical inputs. The three taskforces will be (i) Taskforce – Metadata, (ii) Taskforce – GIS Data Sharing Protocol, and (iii) Taskforce – GIS Data Policy. A Convener will head each taskforce. The Convener for the Metadata Taskforce will be from LGED, for the GIS Data Sharing Protocol Taskforce from SoB and for the GIS Data Policy Taskforce from BCC. These three taskforces will prepare the National GIS Data Policy document based on the developed guidelines and will submit it to the Technical Committee for necessary actions. The taskforces will recommend establishing a Bangladesh National Geographical Data Infrastructure (BNGDI) under the MoSICT.

**Formulation of National GIS Data Policy and circulation to relevant agencies:** The taskforces will prepare the National GIS Data Policy document based on the developed guidelines and the Chairman of the taskforces will hand over it to the Technical Committee. The Technical Committee will review the policy document and carry out necessary modifications and updates. The Technical Committee will then submit this updated policy document to the Steering Committee for approval and necessary actions. The Steering Committee will review and update the policy document and finalize the National GIS Data Policy. This Committee will also finalize the mandate and functions of the BNGDI to implement the Policy. After finalizing the National GIS Data Policy, it will be approved by the government and then it will be circulated to all parties through BCC under the MoSICT.

**The Bangladesh National Geographical Data Infrastructure (BNGDI):** The BNGDI under the MoSICT will work as the apex body for implementing the National GIS Data Policy. The BNGDI will maintain GIS data compatibility and standardization (projection system, metadata, data format etc.) among GIS data producers and users. The BNGDI will also facilitate the implementation of data sharing and dissemination among GIS data users. The BNGDI will be responsible for maintaining and ensuring implementation of the National GIS Data Policy in Bangladesh.

In line with the current Government's "**Digital Bangladesh**" policy, this report will hopefully be considered as a primary milestone in implementing their policies through the BNGDI.



## References

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# **APPENDICES**

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- Appendix 1.1.1: TOR provided by CDMP
- Appendix 2.2.1: Brief report of National Workshop on “Compatibility of GIS Data and Development of Guidelines for Metadata, Data Sharing Protocol and National GIS Policy”
- Appendix 2.2.2: Brief report of Consultation meeting on “Compatibility of GIS Data and Development of Guidelines for Metadata, Data Sharing Protocol and National GIS Policy”
- Appendix 2.2.3: Brief report of Consultation meeting on “Standardization of Projection Parameters for Bangladesh”
- Appendix 3.1.1: Bangladesh GIS installation summary, Year 1994
- Appendix 3.1.2: Bangladesh GIS installation summary, Year 1996
- Appendix 3.1.3: Summary of Data Inventory in NWRD Phase 1
- Appendix 3.1.4: Summary of NWRD Data Inventory Phase 2
- Appendix 3.1.5: Summary of ICRD Data Inventory
- Appendix 3.2.1: Final Questionnaire for GIS data assessment
- Appendix 4.2.1: ISO 191139 Metadata Implementation UML model
- Appendix 4.2.2: ISO 19115 Metadata Dictionary
- Appendix 4.2.3: Example Metadata Set using ISO 19115:2003
- Appendix 4.2.4: Comparison of Metadata Standards
- Appendix 4.4.1: CEGIS Metadata model for NWRD
- Appendix 5.4.1: Data dissemination form of WARPO

**CONTRACT FOR PROFESSIONAL CONSULTING SERVICES**

**BETWEEN**

**COMPREHENSIVE DISASTER MANAGEMENT PROGRAMME (CDMP)  
AND  
Center for Environment and Geographic Information Services (CEGIS)**

**Assignment: RFP II.1 Assess state of information systems and facilitate geo-hazard  
information sharing among GoB and NGO GIS platforms**

*(Handwritten marks)*



## Comprehensive Disaster Management Programme (CDMP)

Policy, Programme and Partnership Development Unit (PPPDU)

Disaster Management and Relief Bhaban, 92-93 Mohakhali C/A, Dhaka-1212, Bangladesh.  
Tel: +880 2 989 0937, 8821255, 8821459, Fax: +880 2 989 0854, Email: [info@cdmp.org.bd](mailto:info@cdmp.org.bd)

6 December 2007

To  
The Executive Director  
Center for Environment and Geographic Information Services (CEGIS)  
House 6, Road 23/C, Gulshan 1, Dhaka 1212

Dear Sir,

Ref.: BGD/01/004-CDMP/EC/4a/PC-II.1

The Comprehensive Disaster Management Programme (hereinafter referred to as "CDMP"), wishes to engage your organization (**Center for Environment and Geographic Information Services**), duly incorporated under the Laws of Bangladesh (hereinafter referred to as the "Contractor") in order to perform services in respect of **Assess state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms** (hereinafter referred to as the "Services"), in accordance with the following Contract:

### 1. Contract Documents

- 1.1 This Contract is subject to the UNDP General Conditions for Professional Services, **Rev. Oct 2000**, attached hereto as Annex I. The provisions of such Annex shall control the interpretation of this Contract and in no way shall be deemed to have been derogated by the contents of this letter and any other Annexes, unless otherwise expressly stated under section 4 of this letter, entitled "Special Conditions".
- 1.2 The Contractor and CDMP also agree to be bound by the provisions contained in the following documents, which shall take precedence over one another in case of conflict in the following order:
  - a) this letter;
  - b) the Statement of Work [as elaborated in the attached ToR (Annex II)];
  - c) the Contractor's technical proposal not attached hereto but known to and in the possession of both parties.
- 1.3 All the above shall form the Contract between the Contractor and CDMP, superseding the contents of any other negotiations and/or agreements, whether oral or in writing, pertaining to the subject of this Contract.

SIGNATURE:

NAME: Giasuddin Ahmed Choudhury  
TITLE: Executive Director  
FIRM/COMPANY: House 6, Road 23/C, Gulshan 1, Dhaka 1212  
DATE: 5/12/07

1

2. Obligations of the Contractor

- 2.1 The Contractor shall perform and complete the Services described in Annex II with due diligence and efficiency and in accordance with the Contract.
- 2.2 The Contractor shall provide the services of the following key personnel as stated in their proposal:
- | <u>Name</u>                | <u>Specialization</u>                       | <u>Nationality</u> |
|----------------------------|---|--------------------|
| Md. Motaleb Hossain Sarker | GIS Expert                                  | Bangladesh         |
| Mr. Ahmadul Hasan          | Disaster Management Expert                  | Bangladesh         |
| Mr. Sultan Ahmed           | Institutional and policy Development Expert | Bangladesh         |
- 2.3 Any changes in the above key personnel shall require prior written approval of Ian Stanford Rector, Chief Technical Adviser & Team Leader, CDMP.
- 2.4 The Contractor shall also provide all technical and administrative support needed in order to ensure the timely and satisfactory performance of the Services.
- 2.5 The Contractor shall submit to CDMP the deliverables specified in the attached ToR according to the schedule mentioned therein.
- 2.6 All reports shall be written in the English language along with some documents in Bangla as found necessary, and shall describe in detail the services rendered under the Contract during the period of time covered in such report. All reports shall be transmitted by the Contractor by Hand/Courier to the address specified in 9.1 below.
- 2.7 The Contractor shall represent and warrant the accuracy of any information or data provided to CDMP for the Purpose of entering into this Contract, as well as the quality of the deliverables and reports foreseen under this Contract in accordance with the highest industry and professional standards.

**OPTION 1 (FIXED PRICE)**

3. Price and Payment

- 3.1 In full consideration for the complete and satisfactory performance of the Services under this Contract, CDMP shall pay the Contractor a fixed contract price of **BDT 38.42.050 (Taka Thirty Eight Lac forty two thousand fifty ) only**.
- 3.2 The price of this Contract is not subject to any adjustment or revision because of price or currency fluctuations or the actual costs incurred by the Contractor in the performance of the Contract.
- 3.3 Payments effected by CDMP to the Contractor shall be deemed neither to relieve the Contractor of its obligations under this Contract nor as acceptance by CDMP of the Contractor's performance of the Services.
- 3.4 CDMP shall effect payments to the Contractor after acceptance by CDMP of the invoices submitted by the Contractor to the address specified in 9.1 below, upon achievement of the corresponding milestones and for the following amounts:

No.	Milestone	Target Date		% of Payment
		Deliverables	Payment	
1.	Submission of Bank Guarantee by the Consultant (Advance Payment)	14 Dec 2007	Within 7 days of receiving Bank Guarantee	20% of contracted amount
2.	Submission of Inception Report and acceptance of the same by the CDMP	5 January 2008	Within 30 days of receiving invoice	10% of contracted amount
3.	Compatibility of GIS data and metadata, as well as formation GIS data utilization regulations and data sharing protocol	5 April 2008	Within 30 days of receiving invoice	20% of contracted amount
4.	Validation and implementation exercises of GIS regulations and protocol	15 July 2008	Within 30 days of receiving invoice	20% of contracted amount
5.	Collection, reporting with application and submission of GIS and relevant data	15 August 2008	Within 30 days of receiving invoice	30% of contracted amount

Invoices shall indicate the milestones achieved and corresponding amount payable.

Special conditions

- 4.1 Duration of this Contract will be as per the time frame mentioned in the ToR.
- 4.2 The Contractor will open a separate Current Bank Account for each project with a local scheduled bank, which will solely be used for the transaction of funds through CDMP. The name of the account will be in the **name of Contractor along with –CDMP**. The account shall be operated jointly by the minimum two persons of the Contractor's Organization.
- 4.3 The contractor shall submit a bank guarantee equivalent to 20% of the fixed contract price issued by a Bank and in a form acceptable to CDMP.
- 4.4 The Contractor organization will incur the expenses in line with the ToR and budget line and the financial proposals submitted to the project authority. They will also maintain the separate Cashbook, General Ledger and preserve all the vouchers along with sufficient supporting documents in their office to satisfy the query of the CDMP monitoring and finance control mechanism.
- 4.5 The Contractor organization are to maintain full accounts of expenditure and is responsible to meet the internal audit or audit by UNDP authority (if required).
- 4.6 Any irregular and excess expenditure will not be reimbursed by the CDMP authority.
- 4.7 The Contractor will work in close co-operation with the consultants/experts of the CDMP. Besides this, they will maintain regular contracts with the project authority of the project of CDMP through meetings, progress reporting, assessment and/or evaluation of the activities as and when required.
- 4.8 The contractor shall ensure the necessary inputs, such as services and training materials, facilities required for the successful implementation of the project with a view to achieve the project goals.
- 4.9 The Contractor will implement the contract by itself and under no circumstances allow to sub-contract the activities wholly or partly to any other organization whatsoever.
- 4.10 In the event of cancellation of agreement, for whatever reason, no payment shall be due except for those services actually rendered before the date of cancellation. Payment so due may be made on receipt of justifiable document.
- 4.11 The Contractor will make all correspondence in English so that the papers are understandable to the government and to the UNDP authorities.
- 4.12 Any balance fund after execution of the project activities must be returned to CDMP.
- 4.13 The project authority will monitor the progress implemented by the Contractor as per the approved work plan.
- 4.14 The issue of IT and VAT deduction (if applicable) at source from the Contractor's fund will be settled as per Govt. rule. No additional payment shall be made by CDMP to the Contractor for this purpose since the amount that will be due from the Contractor to the Government as IT/VAT has already been included in the contractible amount.
- 4.15 The datasets, reports and other outputs resulting from the exercise pertaining to this contract shall be considered as the sole property of CDMP and the contractor not divulge, share or supply of these to any other agency without prior written approval of CDMP.
- 4.16 CDMP hold the full right to the legal measures in case of any defalcation/defaults/irregularities/charged against the contractor.
- 4.17 The Contractor shall follow all the conditions and provisions stated in this document and in case of any confusion regarding any of those, explanation provided by CDMP will be deemed as final.

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i. **Submission of invoices**

- i.1 An original invoice shall be submitted by person or by postal mail by the Contractor for each payment under the Contract to the following address:

**International Technical Manager  
EC-funded Components  
Comprehensive Disaster Management Programme (CDMP)  
Disaster Management and Relief Bhaban (6<sup>th</sup> Floor)  
92-93 Mohakhali C/A  
Dhaka-1212**

- 5.2 Invoices submitted by fax shall not be accepted by CDMP.

3. **Time and manner of payment**

- 6.1 Invoices shall be paid within thirty (30) days of the date of their acceptance by CDMP. CDMP shall make every effort to accept an invoice or so advise the Contractor of its non-acceptance within a reasonable time from receipt.

- 6.2 All payments shall be made by CDMP to the following Bank account of the Contractor:

\_\_\_CEGIS-CDMP-PC II.1-4A\_\_\_ [NAME OF THE ACCOUNT]

\_\_\_THE HONGKONG AND SHANGHAI BANKING CORPORATION LIMITED\_\_\_ [NAME OF THE BANK]

\_\_\_Current Account No. 001-214881-014\_\_\_ [ACCOUNT NUMBER]

\_\_\_Dhaka Main Office: Anchor Tower, 1/1-B, Sonargaon Road, Dhaka-1205\_\_\_ [ADDRESS OF THE BANK]

7. **Entry into force. Time limits**

- 7.1 The Contract shall enter into force upon its signature by both parties.

- 7.2 The Contractor shall commence the performance of the Services not later 6 December 2007 and shall complete the Services within 8 and half months of such commencement (i.e. 15 August 2008).

- 7.3 All time limits contained in this Contract shall be deemed to be of the essence in respect of the performance of the Services.

8. **Modifications**

- 8.1 Any modification to this Contract shall require an amendment in writing between both parties duly signed by the authorized representative of the Contractor and Ian Stanford Rector, Chief Technical Advisor and Team Leader, CDMP.

9. **Notifications**

- 9.1 For the purpose of notifications under the Contract, the addresses of CDMP and the Contractor are as follows:

For the CDMP:

Ian Stanford Rector, Chief Technical Advisor and Team Leader  
Comprehensive Disaster Management Programme (CDMP)  
Disaster Management and Relief Bhaban (6<sup>th</sup> Floor)  
92-93 Mohakhali C/A  
Dhaka-1212  
Tel: 88 02 9890 937, Fax:88 02 9890 854, E-mail: ian.rector@cdmp.org.bd

*R. @*

For the Contractor:

Giasuddin Ahmed Choudhury  
Executive Director  
Center for Environment and Geographic Information Services (CEGIS)  
House 6, Road 23/C, Gulshan 1, Dhaka-1212

If the above terms and conditions meet with your agreement as they are typed in this letter and in the Contract Documents, please initial every page of this letter and its attachments and return to this office one original of this Contract, duly signed and dated.

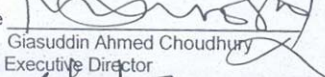
Yours sincerely,



Ian Stanford Rector  
Chief Technical Advisor and  
Team Leader, CDMP

For Center for Environment and Geographic Information Services (CEGIS)

Agreed and Accepted:

Signature   
Name Giasuddin Ahmed Choudhury  
Title Executive Director  
Date 4/1/07



**UNDP GENERAL CONDITIONS OF CONTRACT  
FOR PROFESSIONAL SERVICES  
(Rev. Oct. 2007)**

**1. LEGAL STATUS**

The Contractor shall be considered as having the legal status of an independent contractor vis-à-vis UNDP. The Contractor's personnel and sub-contractors shall not be considered in any respect as being the employees or agents of UNDP or the United Nations.

**2. SOURCE OF INSTRUCTIONS**

The Contractor shall neither seek nor accept instructions from any authority external to UNDP in connection with the performance of its services under this Contract. The Contractor shall refrain from any action which may adversely affect UNDP or the United Nations and shall fulfill its commitments with the fullest regard to the interests of UNDP.

**3. CONTRACTOR'S RESPONSIBILITY FOR EMPLOYEES**

The Contractor shall be responsible for the professional and technical competence of its employees and will select, for work under this Contract, reliable individuals who will perform effectively in the implementation of this Contract, respect the local customs, and conform to a high standard of moral and ethical conduct.

**4. ASSIGNMENT**

The Contractor shall not assign, transfer, pledge or make other disposition of this Contract or any part thereof, or any of the Contractor's rights, claims or obligations under this Contract except with the prior written consent of UNDP.

**5. SUB-CONTRACTING**

In the event the Contractor requires the services of sub-contractors, the Contractor shall obtain the prior written approval and clearance of UNDP for all sub-contractors. The approval of UNDP of a sub-contractor shall not relieve the Contractor of any of its obligations under this Contract. The terms of any sub-contract shall be subject to and conform with the provisions of this Contract.

**6. OFFICIALS NOT TO BENEFIT**

The Contractor warrants that no official of UNDP or the United Nations has received or will be offered by the Contractor any direct or indirect benefit arising from this Contract or the award thereof. The Contractor agrees that breach of this provision is a breach of an essential term of this Contract.

**7. INDEMNIFICATION**

The Contractor shall indemnify, hold and save harmless, and defend, at its own expense, UNDP, its officials, agents, servants and employees from and against all suits, claims, demands, and liability of any nature or kind, including their costs and expenses, arising out of acts or omissions of the Contractor, or the Contractor's employees, officers, agents or sub-contractors, in the performance of this Contract. This provision shall extend, inter alia, to claims and liability in the nature of workmen's compensation, products liability and liability arising out of the use of patented inventions or devices, copyrighted material or other intellectual property by the Contractor, its employees, officers, agents, servants or sub-contractors. The obligations under this Article do not lapse upon termination of this Contract.

**INSURANCE AND LIABILITIES TO THIRD PARTIES**

The Contractor shall provide and thereafter maintain insurance against all risks in respect of its property and any equipment used for the execution of this Contract.

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8.2 The Contractor shall provide and thereafter maintain all appropriate workmen's compensation insurance, or its equivalent, with respect to its employees to cover claims for personal injury or death in connection with this Contract.

8.3 The Contractor shall also provide and thereafter maintain liability insurance in an adequate amount to cover third party claims for death or bodily injury, or loss of or damage to property, arising from or in connection with the provision of services under this Contract or the operation of any vehicles, boats, airplanes or other equipment owned or leased by the Contractor or its agents, servants, employees or sub-contractors performing work or services in connection with this Contract.

8.4 Except for the workmen's compensation insurance, the insurance policies under this Article shall:

- (i) Name UNDP as additional insured;
- (ii) Include a waiver of subrogation of the Contractor's rights to the insurance carrier against UNDP;
- (iii) Provide that UNDP shall receive thirty (30) days written notice from the insurers prior to any cancellation or change of coverage.

8.5 The Contractor shall, upon request, provide UNDP with satisfactory evidence of the insurance required under this Article.

#### **ENCUMBRANCES/LIENS**

The Contractor shall not cause or permit any lien, attachment or other encumbrance by any person to be placed on file or to remain on file in any public office or on file with UNDP against any monies due or to become due for any work done or materials furnished under this Contract, or by reason of any other claim or demand against the Contractor.

#### **10. TITLE TO EQUIPMENT**

Title to any equipment and supplies that may be furnished by UNDP shall rest with UNDP and any such equipment shall be returned to UNDP at the conclusion of this Contract or when no longer needed by the Contractor. Such equipment, when returned to UNDP, shall be in the same condition as when delivered to the Contractor, subject to normal wear and tear. The Contractor shall be liable to compensate UNDP for equipment determined to be damaged or degraded beyond normal wear and tear.

#### **11. COPYRIGHT, PATENTS AND OTHER PROPRIETARY RIGHTS**

UNDP shall be entitled to all intellectual property and other proprietary rights including but not limited to patents, copyrights, and trademarks, with regard to products, or documents and other materials which bear a direct relation to or are produced or prepared or collected in consequence of or in the course of the execution of this Contract. At the UNDP's request, the Contractor shall take all necessary steps, execute all necessary documents and generally assist in securing such proprietary rights and transferring them to UNDP in compliance with the requirements of the applicable law.

#### **12. USE OF NAME, EMBLEM OR OFFICIAL SEAL OF UNDP OR THE UNITED NATIONS**

The Contractor shall not advertise or otherwise make public the fact that it is a Contractor with UNDP, nor shall the Contractor, in any manner whatsoever use the name, emblem or official seal of UNDP or the United Nations, or any abbreviation of the name of UNDP or the United Nations in connection with its business or otherwise.

#### **13. CONFIDENTIAL NATURE OF DOCUMENTS AND INFORMATION**

13.1 All maps, drawings, photographs, mosaics, plans, reports, recommendations, estimates, documents and all other data compiled by or received by the Contractor under this Contract shall be the property of UNDP, shall be treated as confidential and shall be delivered only to UNDP authorized officials on completion of work under this Contract.

13.2 The Contractor may not communicate at any time to any other person, Government or authority external to UNDP, any information known to it by reason of its association with UNDP which has not been made public except with the authorization of UNDP; nor shall the Contractor at any time use such information to private advantage. These obligations do not lapse upon termination of this Contract.

#### 14. FORCE MAJEURE; OTHER CHANGES IN CONDITIONS

14.1 Force majeure, as used in this Article, means acts of God, war (whether declared or not), invasion, revolution, insurrection, or other acts of a similar nature or force which are beyond the control of the Parties.

14.2 In the event of and as soon as possible after the occurrence of any cause constituting force majeure, the Contractor shall give notice and full particulars in writing to UNDP, of such occurrence or change if the Contractor is thereby rendered unable, wholly or in part, to perform its obligations and meet its responsibilities under this Contract. The Contractor shall also notify UNDP of any other changes in conditions or the occurrence of any event which interferes or threatens to interfere with its performance of this Contract. The notice shall include steps proposed by the Contractor to be taken including any reasonable alternative means for performance that is not prevented by force majeure. On receipt of the notice required under this Article, UNDP shall take such action as, in its sole discretion; it considers to be appropriate or necessary in the circumstances, including the granting to the Contractor of a reasonable extension of time in which to perform its obligations under this Contract.

14.3 If the Contractor is rendered permanently unable, wholly, or in part, by reason of force majeure to perform its obligations and meet its responsibilities under this Contract, UNDP shall have the right to suspend or terminate this Contract on the same terms and conditions as are provided for in Article 15, "Termination", except that the period of notice shall be seven (7) days instead of thirty (30) days.

#### 15. TERMINATION

15.1 Either party may terminate this Contract for cause, in whole or in part, upon thirty days notice, in writing, to the other party. The initiation of arbitral proceedings in accordance with Article 16 "Settlement of Disputes" below shall not be deemed a termination of this Contract.

15.2 UNDP reserves the right to terminate without cause this Contract at any time upon 15 days prior written notice to the Contractor, in which case UNDP shall reimburse the Contractor for all reasonable costs incurred by the Contractor prior to receipt of the notice of termination.

15.3 In the event of any termination by UNDP under this Article, no payment shall be due from UNDP to the Contractor except for work and services satisfactorily performed in conformity with the express terms of this Contract. The Contractor shall take immediate steps to terminate the work and services in a prompt and orderly manner and to minimize losses and further expenditures.

15.4 Should the Contractor be adjudged bankrupt, or be liquidated or become insolvent, or should the Contractor make an assignment for the benefit of its creditors, or should a Receiver be appointed on account of the insolvency of the Contractor, UNDP may, without prejudice to any other right or remedy it may have, terminate this Contract forthwith. The Contractor shall immediately inform UNDP of the occurrence of any of the above events.

#### 16. SETTLEMENT OF DISPUTES

##### 16.1. Amicable Settlement

The Parties shall use their best efforts to settle amicably any dispute, controversy or claim arising out of, or relating to this Contract or the breach, termination or invalidity thereof. Where the parties wish to seek such an amicable settlement through conciliation, the conciliation shall take place in accordance with the UNCITRAL Conciliation Rules then obtaining, or according to such other procedure as may be agreed between the parties.

##### 16.2. Arbitration

Unless, any such dispute, controversy or claim between the Parties arising out of or relating to this Contract or the breach, termination or invalidity thereof is settled amicably under the preceding paragraph of this Article within sixty (60) days after receipt by one Party of the other Party's request for such amicable settlement, such dispute, controversy or claim shall be referred by either Party to arbitration in accordance with the UNCITRAL Arbitration

Rules then obtaining, including its provisions on applicable law. The arbitral tribunal shall have no authority to award punitive damages. The Parties shall be bound by any arbitration award rendered as a result of such arbitration as the final adjudication of any such controversy, claim or dispute.

#### 17. PRIVILEGES AND IMMUNITIES

Nothing in or relating to this Contract shall be deemed a waiver, express or implied, of any of the privileges and immunities of the United Nations, including its subsidiary organs.

#### 18. TAX EXEMPTION

18.1 Section 7 of the Convention on the Privileges and Immunities of the United Nations provides, inter-alia, that the United Nations, including its subsidiary organs, is exempt from all direct taxes, except charges for public utility services, and is exempt from customs duties and charges of a similar nature in respect of articles imported or exported for its official use. In the event any governmental authority refuses to recognize the United Nations exemption from such taxes, duties or charges, the Contractor shall immediately consult with UNDP to determine a mutually acceptable procedure.

18.2 Accordingly, the Contractor authorizes UNDP to deduct from the Contractor's invoice any amount representing such taxes, duties or charges, unless the Contractor has consulted with UNDP before the payment thereof and UNDP has, in each instance, specifically authorized the Contractor to pay such taxes, duties or charges under protest. In that event, the Contractor shall provide UNDP with written evidence that payment of such taxes, duties or charges has been made and appropriately authorized.

#### 19 CHILD LABOUR

19.1 The Contractor represents and warrants that neither it, nor any of its suppliers is engaged in any practice inconsistent with the rights set forth in the Convention on the Rights of the Child, including Article 32 thereof, which, inter alia, requires that a child shall be protected from performing any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical mental, spiritual, moral or social development.

19.2 Any breach of this representation and warranty shall entitle UNDP to terminate this Contract immediately upon notice to the Contractor, at no cost to UNDP.

#### 20. MINES

20.1 The Contractor represents and warrants that neither it nor any of its suppliers is actively and directly engaged in patent activities, development, assembly, production, trade or manufacture of mines or in such activities in respect of components primarily utilized in the manufacture of Mines. The term "Mines" means those devices defined in Article 2, Paragraphs 1, 4 and 5 of Protocol II annexed to the Convention on Prohibitions and Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects of 1980.

20.2 Any breach of this representation and warranty shall entitle UNDP to terminate this Contract immediately upon notice to the Contractor, without any liability for termination charges or any other liability of any kind of UNDP.

#### 21. OBSERVANCE OF THE LAW

The Contractor shall comply with all laws, ordinances, rules, and regulations bearing upon the performance of its obligations under the terms of this Contract.

#### 22. AUTHORITY TO MODIFY

No modification or change in this Contract, no waiver of any of its provisions or any additional contractual relationship of any kind with the Contractor shall be valid and enforceable against UNDP unless provided by an amendment to this Contract signed by the authorized official of UNDP.

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ANNEX II

STATEMENT OF WORK

Ministry of Food and Disaster Management

EC-FUNDED COMPONENT ACTIVITIES

TERMS OF REFERENCE

**CDMP EC-Funded Component 4a: Earthquake  
and Tsunami Preparedness**

RFP II.1 Assess state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms

SEPTEMBER 09, 2007

Comprehensive Disaster Management Programme (CDMP)  
Disaster Management and Relief Bhaban (6<sup>th</sup> Floor), 92-93 Mohakhali C/A  
Dhaka-1212, Bangladesh

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II

## ACRONYMS

BBS	Bangladesh Bureau of Statistics
BRAC	Bangladesh Agricultural Research Council
BWDB	Bangladesh Water Development Board
CDMP	Comprehensive Disaster Management Programme
DFID	Department for International Development
DMC	Disaster Management Committee
EC	European Commission
GIS	Geographic Information System
GoB	Government of Bangladesh
GSB	Geological Survey of Bangladesh
LGED	Local Government Engineering Department
IWM	Institute of Water Modelling
MoFDM	Ministry of Food and Disaster Management
NGO	Non-government Organization
SIA	Sub-Implementing Agency
SPARRSO	Bangladesh Space Research and Remote Sensing Organization
SRDI	Soil Resource Development Institute
UNDP	United Nations Development Programme

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III

## 1 Introduction

### 1.1. Project Background

The Comprehensive Disaster Management Programme (CDMP) of the Government of Bangladesh (GoB) is being implemented by the Ministry of Food and Disaster Management (MoFDM) and is supported by the United Nations Development Programme (UNDP), UK Department for International Development – Bangladesh (DFID-B) and the European Commission (EC). CDMP is designed to strengthen the Bangladesh disaster management system and more specifically to achieve a paradigm shift from reactive response to a proactive risk reduction culture. This programme has adopted a more holistic approach, embracing processes of hazard identification and mitigation, community preparedness and integrated response efforts, where relief and recovery activities are planned within an all-risk management framework. CDMP seeks to raise the capacities of at-risk communities while lowering their vulnerability to specific hazards.

Since its inception in 2004, CDMP has made significant progress toward the review of disaster management policy and the roles and responsibilities of Disaster Management Committees (DMCs) at all levels. CDMP is a high profile multi-hazard, multi-sector and multi-stakeholders programme through which a substantial capacity building programme is being implemented to facilitate field level operations associated with Community Risk Assessments. In July 2005 the European Commission Delegation to Bangladesh, concerned about the capacity of vulnerable communities to withstand earthquake, tsunami and other hazards, assessed national disaster management programme and proposed project design to address some of the gaps they identified.

### 1.2. Scope of Work

In August, 2006 the European Commission and UNDP signed a cooperation Agreement related to the funding of three new components within the CDMP framework. **Component 4a: Earthquake and Tsunami Preparedness** is one of them. Component 4a recognizes growing urban vulnerability to earthquakes caused by increasing population densities and unplanned development and responds to the tsunami risk which the 2004 Indonesian tsunami brought to public attention. This component aims to facilitate the preparation of earthquake emergency plans with a view to strengthen the capacity of the city dwellers to face, manage and operate the plan effectively in the event of earthquakes. At the same time, the component aims to prepare coastal dwellers against the impact of tsunamis and to understand the vulnerability of areas to tsunami events.

In order to accomplish the activities of component 4a, the assignments given below are identified to undertake:

- Assess status of earthquake contingency planning, design interim plans and ultimately finalize them
- Assess state of information systems, and facilitate geo-hazard information sharing among GoB and NGO GIS platforms
- Catalog geological data sources
- Prepare regional fault maps, urban geology engineering maps and seismic hazard maps
- Strengthen capacity of non-technical decision-makers to use these resources
- Update available information of cyclone shelter management for tsunami and storm surge preparedness

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- Prepare tsunami and storm surge inundation risk maps for the entire coastal region
- Evaluate tsunami and storm surge-vulnerable infrastructure and its adaptation to serve in a tsunami event
- Appraise economic exposure of coastal livelihood to tsunami and storm surge events.

CDMP, as a strategic institutional and programming approach of the GoB, is authorized to implement these assignments through sub contracting partnerships. Requests for Proposal (RFPs) are being sought from applicants whose Expressions of Interest (Eols) were short listed for undertaking the assignments listed above.

After short-listing the agencies in the Eol evaluation process, the activities advertised have been reorganized and differentiated into clusters and corresponding RFPs, with consideration of the logical and temporal dependencies among the activities. Clustering of activities into RFPs is intended to maximize synergy in the execution of related activities, minimize needs for inter-agency communication and project management complexities. RFPs are being sought in the following five categories:

- RFP I: Contingency planning with regard to earthquake hazard
- RFP II: Information inventory and data sharing
- RFP III: Seismic hazard and vulnerability mapping
- RFP IV: Generation of the tsunami inundation risk maps for the infrastructures and economic exposures of the coastal districts of Bangladesh
- RFP V: Training, advocacy and Awareness with regard to earthquake and tsunami hazard

### 1.3. RFP II:

This document is concerned with RFP II. This assignment is mainly related to policy development of the GIS data standardization and sharing as well as inventory of geological data. The activities under RFP II have been differentiated into two smaller areas, which are: RFP II.1 and RFP II.2. This document elaborated the activities and the corresponding tasks of assignment RFP II.1 **Assess state of information systems and facilitate geo-hazard information sharing among GoB and NGO GIS platforms** in the following sections.

The statement of work elaborated in section 2 below is to assist in articulating the content.

## 2 Statement of Work

This section specifies the activities to be executed and the outputs to be produced by the SIAs.

**RFP II.1** Assess state of information systems (i.e. national metadata standards and GIS compatibility issues), and facilitation geo-hazard information sharing among GoB and NGO GIS platforms

**General Deliverable:** Inception Report RFP II.1

This activity will investigate and bring together the information systems across government and non-government organizations. Different organizations have different

pieces of data that would be useful for planning and responding to earthquake disaster management. For instance many government agencies such as LGED, BARC, IWM, BWDB, SRDI, BBS, and SPARRSO have set up GIS programs. They have been building up geographical databases over the years. It has been observed that GIS data are not compatible among the organizations. The incompatibility mainly arises due to the differences in projection system and geo-referencing. On the other hand, the extent and standard of the metadata have not yet been determined. Therefore, in order to make the GIS data compatible and determine the standard of metadata, there is a need for developing a national GIS and metadata policy. Implementation of GIS policy will bring the GIS data from a heterogeneous to homogenous format. This will help the users in obtaining data with good precision employing minimum resources.

Presently, no data sharing protocol exists between the GoB organizations and NGO's GIS platform. Due to the non-existence of data sharing policy, organizations are found reluctant to disseminate the data among them. So, it is also necessary to develop a data sharing protocol/policy to facilitate information dissemination for disaster management.

The SIA will organize a workshop ensuring participation of GIS stakeholders to incorporate their ownership regarding the policies by incorporating relevant suggestions from them in the draft policies.

In the final phase of this activity, attention will be given to collect the digital data so far developed by the front line GIS organizations and will be stored in the CDMP data disseminating platform known as Data Management and Information Centre (DMIC). The GIS data that will be generated under component 4a will also be stored in this platform. A report will be prepared on the content of data bank indicating the application of the individual sets of data. Different organizations will be allowed to enter the data bank and extract the data for working on different aspect of disaster management.

**Deliverable:** Report on assessment and standardization of GIS and metadata/ National policy on GIS and metadata/Development of data sharing protocol/Collection of GIS data from different organizations under data sharing policy to store in CDMP

Given the statement of work described above, Table-1 below summarizes the tasks and timeframe of the assignment

Table 1: Task and timeframe of the assignment

RFP No	RFP topics/Activities	Tasks	Time frame
RFP11.1	RFP11.1: Assess state of information systems, and facilitate geo-hazard information sharing among GoB and NGO GIS platforms	Assessment of compatibility of GIS and metadata standard in the relevant organizations	December 2007-10 February 2008
		Develop draft national GIS and metadata policy	January 2007-28 February 2008
		Develop draft data sharing protocol to facilitate geo-hazard information sharing among GoB and NGO GIS platform	February-March 2008
		Organize workshop to evaluate and finalize national GIS policy, meta data standard and data sharing protocol	March 2008
		Finalize national GIS policy, metadata standard, data sharing protocol and inventory report of GIS data	March 2008- 1 April 2008
		Validation and implementation	April- 15 July

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		exercises of GIS regulations and protocol	2008
		Collection, reporting with application and submission of GIS and relevant data	January-15 August 2008

### 3 Deliverables

Six main reports have to be produced to accomplish the activities of the assignment. Timely delivery and compliant content are crucial. Noncompliance may affect payment, according to the contract. For each RFP, the inception report consists of conceptual development to accomplish the tasks, which has to be delivered within one month of contact signing agreement.

The outlines of the deliverables and the timeframe for their submission are given in the table below. The outline represents the minimum contents that should be included in the report. Any innovative methods, concepts and ideas beyond the outlines of the deliverables can be included in the work and corresponding reports.

Table 2: List of deliverables with their outlines and timeframe

RFP	Deliverables	General Outline of deliverables	Timeframe
II.1	Inception reports	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Method and materials for each activity</li> <li>▪ Description of sub-activities</li> <li>▪ Required resources within organization</li> <li>▪ Conclusion</li> </ul>	5 January 2008
	Report on the compatibility of GIS data and meta-data standard	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Incompatibility issue of GIS data</li> <li>▪ Metadata standard issue</li> <li>▪ Conclusion</li> </ul>	10 February, 2008
	Development of draft national GIS policy	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Development of national GIS policy</li> <li>▪ Standardization of metadata</li> <li>▪ Execution strategy of the GIS policy, metadata standard</li> <li>▪ Conclusion</li> </ul>	5 March, 2008
	Development of draft data sharing protocol	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Data sharing protocol</li> <li>▪ Execution strategy of the</li> <li>▪ Conclusion</li> </ul>	15 March, 2008
	Final report on national GIS policy, metadata standard and data sharing protocol and inventory report of GIS data	<ul style="list-style-type: none"> <li>▪ Introduction</li> <li>▪ Final GIS policy and data sharing protocol</li> <li>▪ Development of GIS data-bank with application</li> <li>▪ Conclusion</li> </ul>	5 April, 2008
	Validation and implementation exercises of GIS regulations and protocol		April- 15 July 2008
	Collection, reporting with application and submission of GIS and relevant data		January-15 August 2008

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**Appendix 3.1.1: Bangladesh GIS installation summary, Year 1994**

Organization	GIS softs	Hardware			Data availability	
		Plotter	Digitizer	Computer and Others	GIS	Tabular
BBS	pc Arc/Info, SPANS, Views, Popmap, Story Board, DB2, Oracle Views, RDBMS etc.			PS/2 Model 9595 Pentium, CD-Rom, Multimedia, Calcom 9500, Kurta Mod 3 HP Draftpro, HP Mod. 565 Optical Drives, OKI Data Microline 391, LAN, Servers and Workstations	Digital Maps of Bangladesh, Municipalities, Zillas and Thanas, Mouza and Union	Population and Demographic Databases
BCAS	pc Arc/Info, Idrisi, AutoCAD, Foxpro	A0 pen plotter	Digitizer, Tablet digitizer	486 and 386 microcomputer with color monitor, Laser printer	National Scale - Thana, Drought (rabi & kharif), MPO Land Types, Rivers, Flash Flood, Cyclone, Salinity	Population, Livestock, Crop Suitable Area, Water level and discharge information on 14 hydrological station
CDA	pc Arc/Info, ArcView, AutoCAD	A0 pen plotter	A0, A3	Three 80486-33 MHZ workstations with 8 RAM each and one CPU with a CD-ROM Drive connected to a standalone server 80486-33 with 16 MB RAM, a 2.5 GB backup tape drive and a one GB external hard disk connected through SCSI interfaces	Toposheets from SOB at 50000 scale, Thana Maps from SOB at 6336 scale, Selected maps from SOB at other scales, spot satellite images, Cadastral Maps at 3960 scales, Utilities maps at various scales	BBS data on area, income, etc. Census data on population, surveyed data

Organization	GIS softs	Hardware			Data availability	
		Plotter	Digitizer	Computer and Others	GIS	Tabular
DDC	pc Arc/Info, pc Tin, ArcCAD, ArcView, Idrisi, MapInfo	A0 pen plotter, A0 raster plotter	A0 digitizer	Pentium 80486 PC	50000 scale maps of 49 coastal thanas of Bangladesh with all physical infrastructure, 50000 scale road network map of greater Dhaka metro area, topographic map of area between 24°N, 98°E and 38°30'N, 89°45'E (part of Sirajgonj, Pabna and Natore), topographic features of Sirajgonj including spot levels	socioeconomic and demographic data on 49 coastal thanas of Bangladesh
DU	pc Arc/Info labkit, Idrisi, GIMMS	A3 calcomp plotter	A0 (1), A3 (2)	486, 386, 286 CPUs, Summagraphic and Calcomp Digitizer, A0 plotter	Maps from SOB, different city planning organisations are used	BBS sources, field generated data
FAP 25	pc Arc/Info (TIN, GRID)	Calcomp pen plotter	A0 (1)	Microcomputers. printers, color monitors	Finnmaps, BWDB maps	BBS data on area, census data, surveyed data
ISPAN	pc Arc/Info, Erdas, Idrisi, Earthview	A0 Pen (1)	A0 (2)	386 & 486 Microcomputers, Printers	Base data of national scale (rivers, administrative, hydrological, DEM, roads, etc.)	Water resources data
LGED	pc Arc/Info, ArcView, Idrisi, AutoCAD	Calcomp pen plotter	A0(1), A1(2)	Microcomputers. printers, color monitors		
NMIDP	pc Arc/Info	A1 plotter	Digitizer	Microcomputers. printers, color monitors	Depth of ground water, BWDB well location, DPHE & BADC monitoring wells, landsat of march 1993	Hydrological and ground water related databases
RAJUK	pcArc/Info, ArcView, AutoCAD	A0 Pen (1)	A0(1), A3(2)	Microcomputers. printers, color monitors	SoB topo, SoB Thana maps (scale 6336), SPOT images, Cadastral maps at 3960 scale	BBS area, imcome, census data, surveyed data

Organization	GIS softs	Hardware			Data availability	
		Plotter	Digitizer	Computer and Others	GIS	Tabular
SPARRSO	pc Arc/Info	Calcomp pen plotter	Altek digitizer	Microcomputers, printers, color monitors	Topo sheets, Landsat & AVHPP images, Forest cover map of Chittagong Forest Division, Soil map of Nabinagar, Brahmanbaria and Banchhampur thanas, Boundaries of 39 thanas	Population and agricultural statistics from BBS
SPARRSO	Erdas, ArcInfo, TIN	A1 plotter	Altek digitizer	Microcomputers, printers, color monitors	Landsat images, Waterbodies, potential fishing grounds etc.	

**Appendix 3.1.2: Bangladesh GIS installation summary, Year 1996**

Organization	GIS start	GIS softs	Hardware				Data availability		
			Plotter	Scanner	Digitizer	GPS	GIS	Tabular	Source of data
BARC	1995	IDRISI			Calcomp A0		AEZ data of BARC SRDI soil data Water resources of BWDB	BMD climate data	
BBS	May.90	pc Arc/Info, SPANS, Views, Popmap, Story Board	HP Draft Pro (2)	3	Calcomp 9500 (1), Kurta IS/Three (3)		Digital Maps of Bangladesh, Municipalities, Zillas and Thanas, Mouza and Union	Population and Demographic Databases	
BCAS	Jun.93	pc Arc/Info, Idrisi	A0 pen plotter		Summagraphics Micro Grid (A0-1)				ISPAN LGED Other published maps
BUET	1993	Arc/Info, Idrisi, ER Mapper	Calcomp A0	HP	A0 Summagraphics Micro Grid (1)				Landsat TM (SPARSO) Topo maps (SoB) Spot image (CIPROCO)
BWDB	May.95	SPANS	1		1				BWDB maps

Organization	GIS start	GIS softs	Hardware				Data availability		
			Plotter	Scanner	Digitizer	GPS	GIS	Tabular	Source of data
DDC	Sep.91	pc Arc/Info, pc Tin, ArcCAD, ArcView, Idrisi, MapInfo	A0 (6)	B/W A0(1), A3 (1)	4	Magellan (4)	50000 scale maps of 49 coastal thanas of Bangladesh with all physical infrastructure, 50000 scale road network map of greater Dhaka metro area, topographic map of area between 24°N, 98°E and 38°30'N, 89°45'E (part of Sirajgonj, Pabna and Natore), topographic features of Sirajgonj including spot levels	socioeconomic and demographic data on 49 coastal thanas of Bangladesh	SoB, LGED, BWDB, BBS, RAJUK, RHD, GSB, BMD and BIWTA
DMDP (RAJUK)	Mar.93	pcArc/Info	A0 Pen (1)		A0 (1), A3 (2)		SoB topo, DLRS maps, SPOT images	BBS database	SoB DLR BBS SOPT images
DOE		ArcInfo, ArcView, WS Imagine, Idrisi	3	A2 (1)	A0(4)				
DU	1993	pc Arc/Info, Idrisi	Summa Sketch A3 (2)		Summa Sketch A3 (2)				

Organization	GIS start	GIS softs	Hardware				Data availability		
			Plotter	Scanner	Digitizer	GPS	GIS	Tabular	Source of data
EGIS	Aug.91	pc Arc/Info, Erdas, Idrisi, Earthview, Erdas Imagine, Surfer, Arc/Info Unix	A0 (2)	1	A0 (2)	Magellan (3)	Administrative boundaries, road network, river system, navigation route, waterbodies, soil association, drought, inundation land type, agriculture land use, physiographic unit, forest, DEM, hydrometric stations, flood inundation data,	BBS, BARC, BWDB databases	SoB, DLRS, BWDB, BARC, LGED, FINNMAP, satellite images
Forest Department	Nov.95	pc ArcInfo	A0 (1), A1(1)	A4 (1)	A0 (1), A1(1)				Aerial photographs Forest inventory information
IDC (RHD)	Nov.95	pc Arc/Info, ArcView	A0 (1), A1(1)		A1 (1)		Roads, thana boundaries		
LGED	1991	pc Arc/Info, ArcView, Idrisi, AutoCAD, Arc CAD	2	1	2	Magellan (3), Trimble (2)	Thana Base map, District Base Map, Growth Center Connecting Road Map		SPOT images Aerial photos SoB topos BBS Feild data
NMIDP	Sep.93	pc Arc/Info, Idrisi, ArcView, AutoCAD	A1 (1)	HP Scanner (1)	Summargraphic (44"X60")				BWDB, DPHE, BADC, MPO, LGED, CDA, EGIS
RU	1993	IDRSI, MapInfo	1	1	1				IRS images, SPARRSO TM & SPOT images, BBS data

Organization	GIS start	GIS softs	Hardware				Data availability		
			Plotter	Scanner	Digitizer	GPS	GIS	Tabular	Source of data
SPARRSO	1991	Erdas, Arc/Infor, ERIM-GIS, I2S	1		3				Satellite images, Maps of SoB, DLR, SRDI, BWDB, BBS etc.
SRDI	1995	pc ArcInfo, unix ArcInfo, unix ArcView, ArcView	HP A0(1)		A0(1)		Soils database, salinity, soil fertility database etc.		
SWMC	Nov.94	pc Arc/Info	A1 (1)		A0 (2)		Coverages such as river, road, railway, district, thana boundary etc. and Digital Elevation Model are used		FAP 19 LGED SoB Topo SPOT images

**Appendix 3.1.3: Summary of Data Inventory in NWRD Phase 1**

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
BADC	Hydro-geological data	Yes	Yes	Yes	Hard Copy
	Water quality data	Yes	Yes	Yes	Hard Copy
	Rainfall data	Yes	Yes	Yes	Hard Copy
	Seed quality, variety and use of fertilizer data	Yes	Yes	Yes	Hard Copy
BARC	Land resources data	Yes	Yes	No	Yes
	Climate data	Yes	Yes	Yes	Yes
	Thana boundary	Yes	Yes	No	Yes
	Cropping pattern	Yes	Yes	No	Yes
	Soil suitability	No	Yes	No	Yes
	Tzone suitability	Yes	Yes	Yes	Yes
	Soil association	Yes	Yes	No	Yes
BBS	Bangladesh coverage	Yes	Yes	Yes	Digital
	District coverage	Yes	Yes	Yes	Digital
	Thana coverage	Yes	Yes	Yes	Digital
	Union coverage	Yes	Yes	Yes	Digital
	Dhaka City Corporation coverage by ward	Yes	Yes	Yes	Digital
BIWTA	Water Level Station (Geo. Co-ordinate)	Yes	Yes	Yes	Digital
	Weekly WL Data	Yes	Yes	Yes	Digital
	Monthly WL Data	Yes	Yes	Yes	Digital
	Yearly WL Data	Yes	Yes	Yes	Digital
BMD	<u>Surface Data</u>				
	Atmospheric Pressure (station & sea level)	Yes	Yes	Yes	Digital/Hard Copy
	Dry Bulb Temperature	Yes	Yes	Yes	Digital/Hard Copy
	Wet Bulb Temperature	Yes	Yes	Yes	Digital/Hard Copy
	Maximum Temperature	Yes	Yes	Yes	Digital/Hard Copy
	Minimum Temperature	Yes	Yes	Yes	Digital/Hard Copy
	Dew Point Temperature	Yes	Yes	Yes	Digital/Hard Copy
	Relative Humidity	Yes	Yes	Yes	Digital/Hard Copy
	Horizontal Visibility	Yes	Yes	Yes	Digital/Hard Copy
	Present Weather	Yes	Yes	Yes	Digital/Hard Copy
	Past Weather	Yes	Yes	Yes	Digital/Hard Copy
	Form of Cloud	Yes	Yes	Yes	Digital/Hard Copy
	Amount of Cloud	Yes	Yes	Yes	Digital/Hard Copy
	Direction of Cloud	Yes	Yes	Yes	Digital/Hard Copy
	Height of Base of Cloud	Yes	Yes	Yes	Digital/Hard Copy
Rainfall					

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
	Wind Direction	Yes	Yes	Yes	Digital/Hard Copy
	Wind Speed	Yes	Yes	Yes	Digital/Hard Copy
	Sun Shine Hour	Yes	Yes	Yes	Digital/Hard Copy
	Solar Radiation	Yes	Yes	Yes	Digital/Hard Copy
	Evaporation				
	<u>Upper Air Data:</u>				
	Wind Speed at Different Level	Yes	Yes	Yes	Digital/Hard Copy
	Wind Direction at Different Level	Yes	Yes	Yes	Digital/Hard Copy
	Temperature & Humidity	Yes	Yes	Yes	Digital/Hard Copy
	Geo-potential Height				
	<u>Agro-Meteorological Data:</u>				
	Gross Minimum Temperature (°c)	Yes	Yes	Yes	Digital/Hard Copy
	Soil Temperature at different depth	Yes	Yes	Yes	Digital/Hard Copy
	(°c)	Yes	Yes	Yes	Digital/Hard Copy
	Pan Water Temperature (°c)	Yes	Yes	Yes	Digital/Hard Copy
	Soil moisture (%)	Yes	Yes	Yes	Digital/Hard Copy
	Dew (Amount & Duration)	Yes	Yes	Yes	Digital/Hard Copy
	Evaporation	Yes	Yes	Yes	Digital/Hard Copy
	Radiation				
	<u>Seismic Data:</u>	Yes	Yes	Yes	Digital/Hard Copy
	Date of occurrence of Earthquake	Yes	Yes	Yes	Digital/Hard Copy
	Co-ordinate of Epicenter of Earthquake	Yes	Yes	Yes	Digital/Hard Copy
	Magnitude/Intensity of Earthquake				
BUET	Rainfall	No	No	Yes	Digital/Hard Copy
	Discharge	No	No	Yes	Digital/Hard Copy
	Data for the upper Meghna	Yes	No	Yes	Digital/Hard Copy
	Haor data	Yes	No	Yes	Digital/Hard Copy
	Rainfall data-2 (data from auto rain gauge)	Yes	No	Yes	Digital/Hard Copy
	Evaporation	Yes	Yes	Yes	Digital/Hard Copy
BWDB (Ground Water)	Ground Water Data	Yes	Yes	Yes	Hard Copy
	Ground Water Quality	Yes	Yes	Yes	Hard Copy
	Pumping Test	Yes	Yes	Yes	Hard Copy
BWDB (Surface Water)	Rainfall	Yes	Yes	Yes	Both
	Evaporation	Yes	Yes	Yes	Both
	Water level	Yes	Yes	Yes	Both
	Discharge	Yes	Yes	Yes	Both
	Sediment	Yes	Yes	Yes	Hard Copy
	Salinity	Yes	Yes	Yes	Hard Copy
	Temperature	Yes	Yes	Yes	Hard Copy
BWDB (River Morphology)	Location, R.L	Yes	Yes	Yes	Hard Copy
	River Cross Section Data	Yes	Yes	Yes	Hard Copy
	Position (Latitude, Longitude) of X-Sections	Yes	Yes	Yes	Hard Copy
	Max Min Depth, Avg. Depth, Bank link Data, Bank Movement Data	Yes	Yes	Yes	Hard Copy
CWASA	Ground Water Monitoring	Yes	Yes	Yes	Digital/Hard Copy
	Surface & quality	Yes	Yes	Yes	Digital/Hard Copy
	Pipe Line Network	Yes	Yes	Yes	Digital/Hard Copy
	Consumer Data	Yes	Yes	Yes	Digital

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
DOE	Groundwater data	Yes	Yes	Yes	Hard Copy
	Drinking water data	Yes	Yes	Yes	Hard Copy
	Sound Intensity	Yes	Yes	Yes	Hard Copy
	Industrial waste	Yes	Yes	Yes	Hard Copy
	Petroleum waste	Yes	Yes	Yes	Hard Copy
DoF	Seasonal fluctuation of water bodies of six districts	No	Yes	Yes	Digital/Hard Copy
	Large WB. above 25 Ha.	No	Yes	Yes	Digital/Hard Copy
	Small WB. below 25 Ha.	No	Yes	Yes	Digital/Hard Copy
	Annual total catch and area productivity's by sectors	No	Yes	No	Digital/Hard Copy
	Sample village flood type items	No	Yes	No	Digital/Hard Copy
DoF (FRSS)	Riverine Data	No	Yes	No	Digital/Hard Copy
	Pond Data	No	Yes	No	Digital/Hard Copy
	Subsistence Data	No	Yes	No	Digital/Hard Copy
DoFo	Sundarbans Reserved Forests	Yes	Yes	1985-1995	Digital/Hard Copy
	Chittagong Cox's Bazar and Sylhet Forest Divisions	Yes	Yes	1995	Digital/Hard Copy
	Four Coastal Afforestation Divisions	Yes	Yes	1995	Digital/Hard Copy
	Coastal Afforestation Division, Bhola	Yes	Yes	No	Digital/Hard Copy
	Coastal Afforestation Division, Patuakhali	Yes	Yes	No	Digital/Hard Copy
	Coastal Afforestation Division, Noakhali	Yes	Yes	No	Digital/Hard Copy
	Coastal Afforestation Division, Chittagong	Yes	Yes	No	Digital/Hard Copy
	Cox' Bazar Forest Division	Yes	Yes	No	Digital/Hard Copy
	Chittagong Forest Division	Yes	Yes	No	Digital/Hard Copy
	Sylhet Forest Division	Yes	Yes	No	Digital/Hard Copy
Sundarban Reserved Forest	Yes	Yes	Yes	Digital/Hard Copy	
DPHE	Arsenic (Laboratory & Field)	Yes	Yes		Digital/Hard Copy
	Ground Water Level	No	Yes	Yes	Digital/Hard Copy
	Coastal Belt data	Yes	Yes		Digital/Hard Copy
	Well Management Information Data	Yes	Yes	Yes	Digital/Hard Copy
	Tube Well Year Book	Yes	Yes		Digital/Hard Copy
DWASA (WRP-Lalmatia)	Bore Log (Lithology)	Yes	Yes	Yes	Hard Copy
	Pumping Test Data (W.L. Discharge)	Yes	Yes	Yes	Hard Copy
	Grain Size Data (Soil)	Yes	Yes	Yes	Hard Copy
	Well Fixture Data (Constriction)	Yes	Yes	Yes	Hard Copy
	Base Map of Dhaka City (Pipe Line, Tube Line, Sewerage Line)	Yes	Yes	Yes	Hard Copy
	Water Abstraction	Yes	Yes	Yes	Hard Copy
DWASA (Training Centre, Lalmatia)	Water Quality	Yes	Yes	Yes	Hard Copy
	Water Production	No	Yes	Yes	Hard Copy
	Surface Water Level	Yes	No	Yes	Hard Copy
	Ground Water Level	Yes	No	Yes	Hard Copy
	Meteorological	Yes	No	Yes	Hard Copy
		No	Yes	Yes	Hard Copy

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
DWASA (Kawran Bazar)	Color, pH, Taste	Yes	Yes	Yes	Hard Copy
	Temperature, Turbidity,	Yes	Yes	Yes	Hard Copy
	Acidity	Yes	Yes	Yes	Hard Copy
	Alkalinity	Yes	Yes	Yes	Hard Copy
	Chloride	Yes	Yes	Yes	Hard Copy
	Calcium Carbonate	Yes	Yes	Yes	Hard Copy
EGIS	Administrative Boundary	Yes	Yes	Yes	Digital/Hard Copy
	Infrastructure	Yes	Yes	No	Digital/Hard Copy
	Hydrography	Yes	Yes	No	Digital/Hard Copy
	Soil & Agroecology	Yes	Yes	No	Digital/Hard Copy
	Digital Elevation Model	Yes	Yes	No	Digital/Hard Copy
	Hydrometric Station	Yes	Yes	Yes	Digital/Hard Copy
	Demography	Yes	Yes	Yes	Digital/Hard Copy
	Flood Regime	Yes	Yes	Yes	Digital/Hard Copy
	LANDSAT MSS and TM Images, ERS, IRS RADARSAT and SPOT image	Yes	Yes	Yes	Digital/Hard Copy
GSB	Drainage Maps of Bangladesh	Yes		Yes	Digital/Hard Copy
	Geological Maps	Yes	Yes		Digital/Hard Copy
	Coastal Geomorphology	Yes	Yes	Yes	Digital/Hard Copy
BUET	Rainfall	Yes	Yes	Yes	Digital/Hard Copy
	Water Level	Yes	Yes	Yes	Digital/Hard Copy
	Discharge	Yes	Yes	Yes	Digital/Hard Copy
	Evaporation	Yes	Yes	Yes	Digital/Hard Copy
LGED	Thana Base Data	Yes	Yes	No	Digital/Hard Copy
	District Base Data	Yes	Yes	No	Digital/Hard Copy
	Water Level Data	No	Yes	Yes	Digital/Hard Copy
	Rainfall	No	Yes	Yes	Digital/Hard Copy
	MIS for SSWRDSP	No	Yes	Yes	Digital/Hard Copy
NMIDP	Agriculture	Yes	Yes	Yes	Digital/Hard Copy
	Environment	Yes	Yes	No	Digital/Hard Copy
	Hydrogeology	Yes	Yes		Digital/Hard Copy
	Base GIS Data	Yes	Yes	Yes	Digital/Hard Copy
	Monitoring & Evaluation	Yes	Yes	Yes	Digital/Hard Copy
	Institutional Development	No	Yes	Yes	Digital/Hard Copy
	Report	No	Yes	Yes	Digital/Hard Copy
Market & Private Sector	Yes	Yes	Yes	Digital/Hard Copy	
R&H	Roads: (A) National (B) Regional (C) Feeder-A	Yes	Yes		Digital/Hard Copy
	65 RHD Road Division, 16 RHD Road Circle-7 Zone & Bangladesh Road Map	Yes	Yes		Digital/Hard Copy
	Roughness, Traffic, Road Condition & Deflection Database Link with GIS	Yes	Yes		Digital/Hard Copy

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
RRI	Index Properties of Soil	No	Yes	Yes	Hard Copy
	Mechanical Properties of Soil	No	Yes	Yes	Hard Copy
	Consolidation Characteristics	No	Yes	Yes	Hard Copy
	Strength Characteristics	No	Yes	Yes	Hard Copy
	Sediment	Yes	Yes	Yes	Hard Copy
	Water Quality	Yes	Yes	Yes	Hard Copy
	Cement Test	Yes	Yes	Yes	Hard Copy
	Sand Test Data	Yes	Yes	Yes	Hard Copy
	Coarse Aggregate Test Data	Yes	Yes	Yes	Hard Copy
	Brick Test Data	Yes	Yes	Yes	Hard Copy
Concrete Test Data	Yes	Yes	Yes	Hard Copy	
SOB	dB TOPO (1:50000)	Yes	Yes	Yes	Digital/Hard Copy
SRDI	Land and Soil	Yes	Yes	No	Hard Copy
	Fertility and Land use	Yes	Yes	Yes	Hard Copy
	Salinity	Yes	Yes	Yes	Hard Copy
SWMC	Rainfall	Yes	Yes	Yes	Digital
	Evaporation	Yes	Yes	Yes	Digital
	Water Level	Yes	Yes	Yes	Digital
	Discharge	Yes	Yes	Yes	Digital
	River cross-section	Yes	Yes		Digital
	Ground Water Level	Yes	Yes	Yes	Digital
	Sediment		Yes	Yes	Digital
	Salinity		Yes	Yes	Digital
	Road Coverage	Yes	Yes		Digital
	District Coverage	Yes	Yes		Digital
	Thana Coverage	Yes	Yes		Digital
	Division Coverage	Yes	Yes		Digital
	FAP Region Coverage	Yes	Yes		Digital
	NAM Catchment	Yes	Yes		Digital
	Hydrometric Station	Yes	Yes		Digital
	Hydrometeorologic Stations	Yes	Yes		Digital
	National DEM	Yes	Yes		Digital
	River Coverage	Yes	Yes		Digital
	Railway Coverage	Yes	Yes		Digital
UNICEF	Nutrition	Yes	Yes	Yes	Digital/Hard Copy
	Diarrhea	Yes	Yes	Yes	Digital/Hard Copy
	Other Health	Yes	Yes	Yes	Digital/Hard Copy
	Water and Sanitation	Yes	Yes	Yes	Digital/Hard Copy
	Education	Yes	Yes	Yes	Digital/Hard Copy
	General Information	Yes	Yes	Yes	Digital/Hard Copy

Agencies	Name of Data set	Data Type			Format
		Spatial	Attribute	Time Series	
WARPO	Water Level (Tidal, Non-Tidal)	No	Yes	Yes	Digital/Hard Copy
	Discharge (Tidal, Non-Tidal)	No	Yes	Yes	Digital/Hard Copy
	Temperature (BMD)	No	Yes	Yes	Digital/Hard Copy
	Humidity (BMD)	No	Yes	Yes	Digital/Hard Copy
	Sunshine Hour (BMD)	No	Yes	Yes	Digital/Hard Copy
	Wind Speed (BMD)	No	Yes	Yes	Digital/Hard Copy
	Salinity (BWDB)	No	Yes	Yes	Digital/Hard Copy
	Rainfall (BMD, WARPO, BWDB)	No	Yes	Yes	Digital/Hard Copy
	Evaporation (BMD, BWDB)	No	Yes	Yes	Digital/Hard Copy
	Water Balance Model Output (WARPO)	Yes	Yes	Yes	Digital/Hard Copy
	Daily GW Level (WARPO)	Yes	Yes	Yes	Digital/Hard Copy
	Weekly GW Level (BWDB)	Yes	Yes	Yes	Digital
	Lithology (BWDB)	Yes	Yes		Digital
	Lithology (BADC)	Yes	Yes		Digital
	Potential Recharge	Yes	Yes	Yes	Digital
	Depth Storage	Yes	Yes		Digital
	Resources Development For DIFT	Yes	Yes		Digital
	Technology	Yes	Yes		Digital
	32 Crops Data (BBS)	No	No	Yes	Digital
	39 Crops Data (BBS)	No	No	Yes	Digital
	Mode wise Irrigation Area (BBS)	No	No	Yes	Digital
	Crop Production Limitations in Bangladesh	No	No	Yes	Hardcopy
	Sediment	No	No	Yes	Hardcopy
	Distribution of Soil Parameters by Flood Phase	No	No	Yes	Both
	Textural Distribution of Soil	No	No	Yes	Both
	Land Category Based Cropping Pattern	No	No	Yes	Both

Source: Data Inventory in NWRD Phase 1, year 1999

**Appendix 3.1.4: Summary of NWRD Data Inventory Phase 2**

SI No.	Name of Organization	Form-A	Form-B
1	Association of Development Agencies in Bangladesh	Data is not maintained	Data is not maintained
2	Bangladesh Agricultural Development Corporation	Collected	Collected
3	Bangladesh Agricultural Research Council	Collected	Collected
4	Bangladesh Bureau of Studies	Collected	Collected
5	Bangladesh Institute of Development Statistic	Not collected (restricted)	Not collected (restricted)
6	Bangladesh Inland Water Transport Authority	Collected	Collected
7	Bangladesh Inland Water Transport Corporation	Collected	Collected
8	Bangladesh Meteorological Department	Collected	Collected
9	Barind Multipurpose Authority	Not collected	Not collected
10	Bangladesh Petroleum Corporation	Collected	Collected
11	Bangladesh Road Transport Authority	Collected	Collected
12	Bangladesh Small Cottage Industries Corporation	Data is not maintained	Data is not maintained
13	Bangladesh Textile Mills Corporation	Data is not maintained	Data is not maintained
14	Bangladesh Water Development Board	Collected	Collected
15	Co-operative American Relief Everywhere	Not collected	Not collected
16	Center for Environmental and Geographic Information System	Collected	Collected
17	Coastal Embankment Rehabilitation Project	Collected	Collected
18	Coastal Fisher-folk Community Network	Collected	Collected
19	Chittagong Water Supply and Sewerage Authority	Not collected	Not collected
20	Department of Agriculture Extension	Collected	Collected
21	Department for International Development	Not collected	Not collected
22	Department of Land Record Survey	Collected	Collected
23	Disaster Management Bureau	Collected	Collected
24	Department of Environment	Not collected	Not collected
25	Department of Fisheries	Collected	Collected
26	Department of Forestry	Collected	Collected
27	Department of Livestock	Collected	Collected
28	Department of Public Health Engineering	Collected	Collected
29	Dhaka Water Supply and Sewerage Authority	Collected	Collected
30	Economic Relation Department, Finance Ministry	Collected	Collected
31	Geological Survey of Bangladesh	Collected	Collected
32	International Union for Conservation of Nature	Collected	Collected
33	Institute of Water and Flood Management	Collected	Collected

<b>Sl No.</b>	<b>Name of Organization</b>	<b>Form-A</b>	<b>Form-B</b>
34	Institute of Water Modeling	Not Collected	Not Collected
35	Local Government Engineering Department	Collected	Collected
36	North East Minor Irrigation Project	Not collected	Not collected
37	Power Development Board	Collected	Collected
38	Roads & Highways Department	Collected	Collected
39	Rural Electrification Board	Collected	Collected
40	River Research Institute	Collected	Collected
41	Survey of Bangladesh	Not collected	Not collected
42	Space Research and Remote Sensing Organization	Not collected	Not collected
43	Soil Resources Development Institute	Collected	Collected
44	Bangladesh Telephone & Telegraph Board	Collected	Collected
45	United Nation International Children Emergency Fund	Not collected	Not collected
46	Department of Water Resources Engineering, BUET	Collected	Collected

*Source: Data Inventory in NWRD Phase 2, 2004*

**Appendix 3.1.5: Summary of ICRD Data Inventory**

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
1	Bangladesh Agricultural Development Council (BADC)	1. Ground water monitoring	Y	N	N	Regionwise, Country,
		2. Irrigation equipment and Irrigated area survey	Y	N	N	
		3. Irrigation water qualities analysis and Monitoring	Y	N	N	
		4. Preservation of bore log data Observation well	N	N	N	Regionwise, Country
2	Bangladesh Agricultural Research Council (BARC)	1. Digital maps at 1:250,000 scale of District boundary, Thana/Upazilla boundary, Urban boundaries and Roads, Rivers and Railways	Y	Y	N	Country (1997)
		2. Location maps of Climatic stations of BMD, river water level, discharge monitoring and rainfall stations of BWDB	Y	Y	Y	Country (1997)
		3. Climatic Resources datasets	Y	Y	Y	Country (2002)
		4. Water level and Discharge stations of BWDB	Y	Y	Y	Country (2003)
		5. Database (mapping unit is soil association) at 1:250,000 scale. AEZ inventory maps published in 1988	Y	Y	N	Country (1997)
		6. Land type map was generated based on the LRI and Digital Elevation Model (DEM) at 300m grid	Y	Y	N	Country (1997)
		7. Crop suitability assessment was made for 48 crops using land factors and agro-climate in the AEZ study	Y	Y	N	Regionwise (2000)
		8. The BARC GIS project has generated Cropping system database for 30 AEZ and 88 sub-zones by Land type	Y	Y	N	Country (1999)
		9. Upazila information with maps at 1:50,000 scale. A list of all the digitized Thana/Upazilla	Y	Y	N	Regionwise (2004)
		10. Available data of different socio-economic variables required for agricultural production and productivity assessments	Y	Y	N	Regionwise (1999)
3	Bangladesh Bureau of Statistics (BBS)	1. Bangladesh coverage	Y	Y	Y	Country
		2. District coverage	Y	Y	Y	
		3. Thana coverage	Y	Y	Y	
		4. Union coverage	Y	Y	Y	
		5. Dhaka city corporation coverage by ward	Y	Y	Y	Dhaka
		6. Population census	Y	Y	Y	Country
4	Bangladesh	1. Information on Haor	Y	Y	N	Country

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
	Haor and Wetland Development Board BHWDB	2. Information on Wetlands	Y	Y	N	
5	Bangladesh Institute of Development Studies (BIDS)	1. Institutional group data (Gofs, NGOs, CSOs,LFP,PBOs)		Y		Coastal zone
		2. Occupational Group data (LOG, LPGs, PSEs)		Y		Regionwise
		3. Livelihood data		Y		
		4. Affected and non-affected by CERP-I and CERP II survey data		Y		CERP Project area
		5. Continental Shelf Area of Bangladesh.	Y	Y		Country
		6. Stock and Yield of Marine Fisheries in Bangladesh		Y		
		7. Yearwise production of Marine Fish by Type of Fishery		Y	Y	Districtwise
		8. Shrimp Export from Bangladesh (1973-1985)		Y		Country
		9. Number and area of Major water Shrimp Farming in Bangladesh (1982-84)		Y		Greater Khulna Region
		10. Distribution of income from Shrimp fields		Y		
		11. Rate of erosions at different Island		Y		
		12. Accretion data by district		Y		
		13. Pattern of Land Distribution in Project areas in Coastal zone		Y		Coastal zone
6	Bangladesh Inland Water Transport Authority (BIWTA)	1. Tide table	N	Y	Y	Country
		2. Water level data	N	Y	Y	Country
7	Bangladesh Inland Water Transport Corporation (BIWTC)	1. Map of Main Communication Network of BIWTC	Y	Y	N	Country
		2. Basic Information of Vessels BIWTC	N	Y	N	
		3. Information of Services of BIWTC	N	Y	N	
		4. Information of Dockyards of BIWTC	N	Y	N	
		5. Information of Manning Scale	N	Y	N	
		6. Information of Stations and Ghat of BIWTC	N	Y	N	
8	Bangladesh Meteorological Department (BMD)	1. Surface Data (From 10(1) to 10(19))		Y	Y	Country
		2. Upper Air Data (From 10(20) to 10(24))		Y	Y	
		3. Agromet data (From 10(25) to 10(31))		Y	Y	
		4. Seismic Data (From 10(32) to 10(34))		Y	Y	
		5. Astronomical Data (From 10(3 5) to 10(4 1))		Y	Y	

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
9	Bangladesh Parjatan Corporation (BPC)	1. Tourist Location and Archeological Sites and Monuments	N	Y	N	Country
		2. Foreign Exchange Earnings from Tourism	N	Y	N	
		3. Visitor Arrivals and Outbound Travel by Month	N	Y	N	
		4. Visitor Arrivals and Outbound Travel by Nationality	N	Y	N	
		5. Visitor Arrivals and Outbound Travel by Regions	N	Y	N	
		6. Visitor Arrivals and Outbound Travel by Purpose of Visit	N	Y	N	
		7. Visitor Arrivals & Outbound Travel by Air & Land Ports	N	Y	N	
		8. Outbound Travel to SAARC countries	N	Y	N	
		9. Tourist Arrivals (BPC Hotels and Motels)	N	Y	N	
		10. Top Ten Tourist Generating Countries	N	Y	N	
		11. Top Ten Destinations of Bangladesh Nationals	N	Y	N	
10	Bangladesh Petroleum Corporation	1. Contribution of the national exchequer	N	Y	N	Country
		2. Sales statement of Petroleum Products	N	Y	N	
		3. Demand of petroleum products	N	Y	N	
		4. Base Oil Distribution to Blending Plants	N	Y	N	
11	Bangladesh Power Development Board (BPDB)	1. Statistical data for Power Business	N	Y	Y	Country
		2. Billing and Accounting System	N	Y	Y	
		3. Daily Generation	N	Y	Y	
		4. Power Generation Line	Y	Y	N	
		5. Power Stations	Y	Y	N	
		6. Grid Sub-station	Y	Y	N	
12	Bangladesh Railway (BR)	1. Information of District-wise Route K.M.	N	Y	N	Country
		2. Information of Locomotives	N	Y	N	
		3. Information of Freight Wagons	N	Y	N	
		4. Information of Passenger Traffic	N	Y	N	
		5. Information of Principal Commodity Carried	N	Y	N	
		6. Information of Earnings from Principal Commodities	N	Y	N	
		7. Information of Traffic Density (West and East Zone)	N	Y	N	
		8. Passenger and Freight Revenue	N	Y	N	
		9. Map of Railway Network of Bangladesh	Y	Y	N	
		10. Location of Railway Stations of Bangladesh	Y	Y	N	
13	Bangladesh	1. Rice Germplasm and Gene Bank		Y		Districtwise

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
	Rice Research Institute (BRI)	2. Rice Variety vs. Yield		Y		
		3. Hydro-Meteorological Data		Y	Y	
		4. Improved Technology for Rice Production		Y	Y	
		5. Soil, Groundwater and River Water Salinity		Y		
		6. Drought Management		Y		
		7. Irrigation and Water Management Technology for Rice		Y		
		8. Soil Fertility Management		Y		
		9. Farm Mechanization		Y		
		10. Bio-Technological Information for Rice		Y		
		11. Technology Dissemination and Training Facilities.		Y		
		12. Rice Pest and Disease Management		Y		
		13. Rice Agronomy & Farming System Research		Y		
		14. Hybrid and Super Rice		Y		
		15	Bangladesh Water Development Board (BWDB)	1. National Water Level	Y	
2. Tidal Water Level	Y			Y	Y	
3. National Discharge	Y			Y	Y	
4. Tidal Discharge	Y			Y	Y	
5. Rainfall	Y			Y	Y	
6. Evaporation	Y			Y	Y	
7. River Cross Section	Y			Y	Y	
8. Sediment	Y			Y	Y	
9. Salinity	Y			Y	Y	
10. Surface Water Quality	Y			Y	Y	
11. Ground Water Table	Y			Y	Y	
12. Lithology	Y			Y	Y	
13. Bore Log	Y			Y	Y	
16	Co-operative of American Relief for Everywhere (CARE)	1. Road data	Y	Y	Y	Country
		2. Mouza data	Y	Y	Y	
		3. River	Y	Y		
		4. Water bodies	Y	Y		
		5. District Head Quarter	Y	Y		
		6. Rail	Y	Y		
		7. Admin. boundaries	Y	Y		
17	Chittagong City corporation (CCC)	1. Road map of Chittagong City Corporation	Y	Y		Chittagong
		2. Demography Information		Y		
		3. Educational Institutions Information		Y		
		4. Information of Health facilities		Y		
18	Chittagong	1. Base map of Chittagong City	Y	Y		

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/Extent
			GIS data	Attribute data	Time series	
	Development Authority (CDA)	2. Land use Map	Y	Y		
		3. Household Information		Y		
		4. Road Inventory		Y		
		5. Spot Height		Y		
		6. Industrial Information		Y		
		7. Future Requirement Information (upto 2005)		Y		
		19	Chittagong Port Authority (CPA)	1. Navigation Information	Y	
2. Hydrographic Information	Y			Y	Y	
3. Statistical Information (Export and Import)				Y	N	
4. Daily Berthing Schedule				Y	Y	
20	Chittagong Water Supply and Sewerage Authority (CWASA)	1. Base Map of Distribution Network	Y	Y	N	Chittagong
		2. Base Map of Chittagong city	Y	Y	N	
		3. Bore Log	Y	Y	N	
		4. Grain Size Data (Soil)	Y	Y	N	
		5. Water Supply Data	Y	Y	N	
		6. Daily Water Production	N	Y	N	
		7. Deep Tube-well wise Average Daily Production	N	Y	N	
		8. Monthly Power Consumption in the Plants & Tube-wells	N	Y	N	
		9. Length of Pipelines	N	Y	N	
		10. History of Water Rates	N	Y	N	
		11. Tariff Rates	N	Y	N	
21	Char Development and Settlement Project (CDSP)	1. Moisture content of the soil during dry season		Y		Project area
		2. Nutrient content of the soil of 10 Project Sites		Y		
		3. Soil salinity of 10 project sites		Y		
		4. Crops grown in different seasons		Y		
		5. Condition of 55 perennial and 35 seasonal ponds in 3 Project Sites		Y		
		6. Fresh water use in char areas of Project Sites		Y		
		7. Livelihood condition of settler households		Y		
		8. Hourly water level of 2 station		Y		
		9. Daily water level of 7 stations		Y		
		10. Daily water salinity of 6 stations inside and outside the polder		Y		
		11. Daily ground water level of 6 stations		Y		
		12. Ground water salinity of 6 stations		Y		
		13. Water salinity of tube-wells in 4 Polders		Y		

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
		14. Daily rainfall data of 6 stations		Y		Bamni CDSPII project area Companyganj Nijhum Dwip Noakhali Project area
		15. Status of khatians of 4497 plots		Y		
		16. Administrative map of 14 Project Sites	Y	Y		
		17. Administrative map of Bamni	Y	Y		
		18. Administrative map of CDSPII project area				
		19. Administrative map of Companyganj				
		20. Administrative map of Nijhum Dwip				
		21. Cyclone Shelter design of BWDB	Y	Y		
		22. Forest map of Noakhali	Y	Y		
		23. Crop management data, CDSP project area		Y		
		24. Cost-benefit data for different crops		Y		
22	Coastal Embankment Rehabilitation Project (CERP)	1. Access Ramps and Cattle Passes Improvement		Y		Project area
		2. Co-ordinates & Elevations of Cross section, Embankment survey, Polde61/1		Y		
		3. Cyclone in Full Wind and No Wind on Land in 1960, 1960, 1961, 1963, 1965, 1966, 1970, 1974, 1983, 1985, 1986, 1988, 1991, 1995		Y		
		4. Cyclone in Full and No Wind on Land for Return Period 100y, 10y, 20y, 25y, 35y, 50y		Y		
		5. Different type polder information		Y		
		6. Drainage and surface sluices information		Y		
		7. Embankment Protective work and Rehabilitation work under 2ND CERP		Y		
		8. Embankment Settler (ES) farm budget on Kurushkul seaside embankment		Y		
		9. Engineering information about revetments		Y		
		10. Existing sluice rehabilitation and repairment		Y		
		11. Interior embankment, flood wall information		Y		
		12. Inventory of Khal, Road, Sluice at Polder 61/1, Sitakunda		Y		
		13. Investment cost of vegetation establishment (Kurushkul 61/1)		Y		
		14. List of Work Proposed under 2ND CERP at Polder 61/1, Sitakunda		Y		
		15. Layout of Kurushkul 61/1 Riverside and Seaside Embankment for 100 m section		Y		
		16. Link roads and culverts improvement information		Y		

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
		17. Long section data of embankment and different polders		Y		
		18. New and Retired Embankments informations		Y		
		19. New and replacement sluice informations		Y		
		20. Polder data summary, Polder database, Polder informations, Polder no.		Y		
		21. Population and avg exchange rate data during implementation		Y		
		22. Proposed Hydraulic structure Rehabilitation (Drainage and Surface Sluices) at Polder 61/1, Sitakunda		Y		
		23. Proposed Protective Work under 2nd CERP at Polder 61/1, Sitakunda		Y		
		24. Re-excavation of Khals		Y		
		25. Resectioning of embankments		Y		
		26. Shrimp and salt intake informations		Y		
		27. Socio-economic information		Y		
		28. Embankment of CERP area	Y	Y		
		29. Polder Boundary of CERP area				
		30. Ponds, Rivers, Roads, Sluices, Villages of CERP area	Y	Y		
		31. Elevation of Fin map	Y	Y		
23	Department of Agricultural Extension (DAE)	1. National Minor Irrigation census (NMIC)	N	Y	Y	Regionwise
24	Department of Environment (DoE)	1. Summary, Inorganic constituents, Bangladesh		Y		Regionwise
		2. Heavy Metal concentration in river water		Y		
		3. Intake of Inorganic and Organic Arsenic compounds		Y		
		4. Summary of Protected Areas		Y		Country
		5. Groundwater data	Y	Y		Divisionwise
		6. Drinking water data	Y	Y		Divisionwise
		7. Sound Intensity	Y	Y		Dhaka
		8. Industrial waste	Y	Y		Country
		9. Petroleum waste	Y	Y		Country
		10. Air Quality Data		Y		Dhaka, Country
25	Department of Fisheries (DoF)	1. FRSS Published and raw		Y		Country
		2. Contour diagrams, shape files of faunal assemblages	Y	Y		Selected sample sites under

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
		3. Distribution of PL fishing gear composition & Abundance in different geographical areas		Y		Fourth Fisheries Project (FFP)
		4. Sluices, regulators, fish passes, etc		Y		
		5. Known shrimp farming areas and attributes	Y	Y		
		6. Distribution of species composition & species abundance in different geographical areas.		Y		
		7. Map layout & pie distribution relating to the total catch.	Y	Y		
		8. Terrestrial and Aquatic macrophytes		Y		
		9. Plankton- Chlorophyll-a, Phytoplankton etc.		Y		
		10. Fish Species composition, Fish Yield		Y		
		11. Fishing effort		Y		
		12. Database and map preparation on Geographical distribution of catch composition of Shrimp PL fishing	Y	Y		
		13. Map preparation on abundance of Jatka	Y	Y		
		14. Map and GIS database preparation for Hilsa (Habitat, Sanctuaries, spawning ground, Global distribution)	Y	Y		
		15. Max and min water area	Y	Y		
		16. Rivers, beels, floodplains and ponds	Y	Y		
		17. Seasonality, location and extent of rainfall		Y		
		18. Discharge of different river		Y		
		19. Restructuring FRAME of FRSS Data		Y		
		20. Historical time series catch data		Y	Y	
		21. Name of rivers, number of fishermen, boats, gears and gear type etc.		Y		
		22. Location of fish spawning ground, sanctuaries & hatcheries	Y	Y		
		23. Information on endangered species		Y		
		24. Total Phosphorus content		Y		
		25. Fishermen population profile by coastal thana & district and by types of fisheries		Y		Coastal zone
		26. Fishers- Male/female and type: full-time, part-time, subsistence, occasional		Y		
		27. Location and Number of landing center, landing period	Y	Y		
		28. Location of ice plants and processing plants		Y		

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
		29. Information on total catch per landing center		Y		
		30. Number of wholesale and retail markets		Y		
		31. Source and transportation of fish		Y		
		32. Producer price and Market price information		Y		
26	Department of Forest (FD)	1. Administrative unit of Forest Department	Y	Y		Country
		2. Legal Forest Type		Y		
		3. Forest Personal Information		Y		
		4. Coastal Forest Land	Y	Y		Coastal Area
27	Department of Livestock Services (DoLS)	1. Animal Disease reporting, Livestock health and Production Information System	N	N	Y	Country
28	Department of Public Health Engineering (DPHE)	1. Water Quality Parameters	Y	Y		Country
		2. Summary report of Union-wise Arsenic Contamination	Y	Y		
		3. Depth-wise Arsenic Contamination Level	Y	Y		
		4. Arsenic Contamination in Bangladesh	Y	Y		
		5. Geographical Distribution of Safe and Contaminated Tubewells at Different Depth	Y	Y		
30	Directorate of Health	1. Map of Prevalence of Underweight Children aged 0-59 months in 2000.		Y		Divisionwise
		2. Map of Probability of High Prevalence of Stunting among under -5 children.		Y		Upazillawise
		3. Map of Probability of High Prevalence of Underweight children		Y		Upazillawise
		4. Map of Prevalence of Chronic Energy Deficiency (CED) in women of reproductive age in 2000.		Y		Division
		5. Nutritional Status of Children		Y		Country
		6. Vaccination activity data		Y		Country
		7. Data on Exposure to Family planning		Y		Country
		8. Information on Satellite clinics		Y		Country
		9. Health services of different upazillas		Y		Upazilla
		10. Maps of Health service and Family planning				Country
31	Directorate of Land Record and Survey (DLRS)	1. Digital database of mouza maps of around 2000 sheets.	Y	Y		Country
		2. Preparation of all types of mouza maps with riverine area i.e. allusion and delusion area.	Y	Y		

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
32	Directorate of Secondary and Higher education	1. Information on Secondary and Higher Secondary Educational Institutions	N	Y	N	Coastal zone
33	Disaster Management Bureau (DMB)	1. Earthquake recovery equipment		Y		
		2. Disaster trained personnel		Y		
		3. Damages information		Y		Region, Country
		4. Cyclone shelter information		Y		Coastal zone
		5. List of local disaster action plan		Y		
		6. Natural hazard mapping	Y	Y		Regionwise, Country
		7. CYSMIS		Y		
		8. Flood monitoring		Y		Regionwise, Country
		9. Cyclone tracking		Y		Coastal zone
34	Geological Survey of Bangladesh (GSB)	1. Coastal geomorphology	Y	Y	N	Coastal zone
		2. Contour map	Y	Y	N	Country
		3. Digital maps of Bangladesh	Y	Y	N	
		4. Engineering map (CHT)	Y	Y	N	Regionwise
		5. Geological maps	Y	Y	N	Country
		6. RS Interpolate map	Y	Y	N	Regionwise
35	International Union for Nature Conservation (IUCN)	1. Sundarban biodiversity GIS series	Y	Y	Y	The Sundarbans
		2. Annotated bibliography on Sundarbans	N	Y	N	
		3. Red list of threatened fauna of Bangladesh	N	Y	N	
36	Institute of Water and Flood Management (IWF), BUET	1. Water level data	N	Y	N	BWDB stations
		2. Discharge data	N	Y	N	Dhaka city
		3. Rainfall data (BMD)	N	Y	N	Dhaka city
		4. Rainfall data (Through JICA project)	N	Y	N	Sylhet
		5. Data for upper Meghna	Y	Y	N	Regionwise
		6. Haor data	Y	Y	N	
		7. Wind data and GMS data	Y	Y	N	Country
37	Khulna Development Authority (KDA)	1. Administrative boundary	Y	Y		KDA area
		2. Road and Rail line	Y	Y		
		3. Waterbody	Y	Y		
		4. Housing area	Y	Y		
		5. Market	Y	Y		
		6. Crop field	Y	Y		
38	Local Government Engineering Department (LGED)	1. Base Map- Administrative Boundary	Y	Y	N	Country
		2. Base Map- Administrative Head Quarters	Y	Y	N	
		3. Base Map- Physical Infrastructures	Y	Y	N	
		4. Base Map- Socio-economic Infrastructures	Y	Y	N	

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
40	Meghna Estuary Study (MES)	1. Inventory of LRP Data		Y		Project area
		2. Cross Section Data		Y		
		3. Water Level Data - Part 1 & 2		Y		
		4. Morphology and Hydrodynamics Data - Part 1,2,3		Y		
		5. Char Level Fisheries Data		Y		
		6. Socio - Economic Survey Data - Part 1 & 2		Y		
		7. Water Management and Drainage Data		Y		
		8. Bathymetric Maps	Y	Y		
		9. Digitized LRP Maps	Y	Y		
42	Petro Bangla	1. Bangladesh Concession Status, June 2001	Y	Y		Regional
		2. Bangladesh Concession Status, June 2002	Y	Y		
		3. Bangladesh Concession Status, June 2003	Y	Y		
43	Rural Electrification Board (REB)	1. Energized Districts under PBSs	Y	Y	N	Country
		2. Year wise Line Construction	N	Y	Y	
		3. Year wise Construction of 33/11 KV Sub-station	N	Y	Y	
	Rural Electrification Board (REB)	4. Year wise Connection of Different Sectors	N	Y	Y	
		5. Year wise System Loss	N	Y	Y	
		6. Capacity and Peak Demand of Sub-station under PBSs	N	Y	Y	
44	Roads and Highway Department (RHD)	1. RHD Road Network	Y	Y		Country
		2. RHD Bridges and Culverts	Y	Y		
		3. RHD Ferry Locations	Y	Y		
		4. RHD Traffic Stations	Y	Y		
		5. Location Reference Point (LRP) Database	Y	Y		
		6. RHD Road Database		Y		
		7. Road Condition and Roughness		Y		
		8. Annual Average Daily Traffic Data (AADT)		Y		
		9. Road Inventory		Y		
		10. Bridge and Culverts Condition Database		Y		
45	River Research Institute (RRI)	1. Bathymetry		Y	N	Selected sample sites
		2. Satellite Images	Y	Y	N	
		3. Index Properties of Soil	Y	Y	N	
		4. Mechanical Properties of Soil	Y	Y	N	
		5. Consolidation Characteristics	Y	Y	N	
		6. Strength Characteristics	Y	Y	N	

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent		
			GIS data	Attribute data	Time series			
		7. Sediment	Y	Y	Y			
		8. Water Quality	Y	Y	Y			
		9. Cement Test	Y	Y	Y			
		10. Sand Test Data	Y	Y	Y			
		11. Coarse Aggregate Test Data	Y	Y	Y			
		12. Brick Test Data	Y	Y	Y			
		13. Concrete Test Data	Y	Y	Y			
		14. Physical model data	Y	Y	Y			
46	Survey of Bangladesh (SOB)	1. DB TOPO (Scale 1: 50000)	Y	Y		Country		
47	Space Research and Remote Sensing Organization (SPARRSO)	1. LANDSAT/SPOT/GMS/NOAA Images	Y	Y		Districtwise, Regionwise, Country		
48	Soil Resource Development Institute (SRDI)	1. Reconnaissance soil survey data	Y	Y		Country coverage		
		2. Land resource inventory	Y	Y				
		3. Physiography	Y	Y				
		4. Land use	Y	Y	Y			
		5. General soil type	Y	Y				
		6. Problem soil	Y	Y				
				7. Soil- water salinity	Y	Y	Y	Coastal Zone
				8. Upazila wise soil and land form	Y	Y	Y	Country coverage
				9. Crop suitability (Major crops)	Y	Y		
				10. Soil nutrient status map	Y	Y	Y	
				11. Soil texture	Y	Y		
				12. Soil reaction	Y	Y		
49	United Nations International Children Emergency Fund (UNICEF)	1. Households with Access to Drinking Water	Y	Y	N	Rural area, Country		
		2. Households with Access to Sanitary Latrines	Y	Y	N			
		3. Net Primary Enrollment Rate (Boys and Girls, 6-10 yrs)	Y	Y	Y			
				4. Child Health and Nutrition	Y	Y	Y	National, Divisional and District
				5. Maternal Health	Y	Y	Y	
				6. Water and Sanitation	Y	Y	Y	
				7. Child Development	Y	Y	Y	
				8. Education	Y	Y	Y	
				9. General Information	Y	Y	Y	
50	World Fish Center (WFC)	1. Catch Assessment Data		Y	Y	Regional, Zonal		
		2. Gear survey data		Y	Y			
		3. Fish Aggregation Device Survey		Y				
		4. Fish Market data		Y				
		5. Length Frequency Survey		Y				

Sl.	Name of Organization	Name of data set with Brief description of data layer	Data Type			Completeness/ Extent
			GIS data	Attribute data	Time series	
		6. Water Quality data		Y	Y	
		7. Stock assessment (beel) data		Y		
		8. Socio-economic (fishermen, household, income).		Y		
		9. Fish species data different beel.		Y		

Source: Data Inventory in ICRD, 2005

**Appendix 3.2.1: Final Questionnaire for GIS data assessment**

**GIS Data Status Assessment Form**

for

**Development of National GIS Policy, Metadata Data Standard and Data Sharing Protocol**

**Date:**

<b>1. Name of the Organization:</b>			
<b>2. Type of Organization:</b>		Govt./NGO/Donor Organisation/Educational Institute/Research Organisation/Other .....	
<b>3. Name and Designation of the Contact Person /Focal Point:</b>			
<b>Signature of Focal/Contact Person:</b>			
<b>4. Address:</b>	Phone:	Fax No:	
	Email:	Mobile No:	
<b>5. Number of IT&amp; GIS Professional</b>			
Educational Qualification	Trained (Number)		Non-trained (Number)
PhD			
Post Graduate			
Graduate			
Under Graduate			
Other			
<b>6. Description of GIS Hardware/Software available:</b>			
List of available Hardware:	Name of GIS Software (including version & no. of licenses):		Description of data storage system
Server		ArcGis	Data Backup Server
PC Server		ArcInfo	Database Management System (Oracle)
PC		ArcView	Database Management System (SQL)
Laptop		ERDAS	Tape Backup
Printer		MapInfo	CD/DVD
Plotter		ILWIS	HDD
LAN		TNTmips	Hardcopy
		Idrisi	
<b>7. GIS Data Collection Procedure and sources:</b>			

Primary collector/ secondary collector/ collator	Sources of data collection	Data collection process/methodology (digitize/GPS survey/other)
<b>8. Which projection system are used in your organization:</b> UTM=Universal Transverse Mercator BTM= Bangladesh Transverse Mercator LCC= Lambert Conformal Conic IIB=Indian Zone Grid IIB Other (Specify):	(Reasons for using the specific projection system)	

<b>9. Is there any data sharing / dissemination policy/protocol (Y/N):</b>	If yes, brief description Data Providing Form CD/Tape/Pen Drive Data Cost Data Security
	If no, how data is being disseminated?
<b>10. Do you have any metadata (information of data) system:</b>	yes/no (If yes, which metadata standard are you using?)

11. Descriptions of projects where GIS is used			
Name of the Project	Brief description on the use of GIS (eg, name of software, GIS related output, maps, data)	Year	Status (Completed/ ongoing)

<b>12. Form of data:</b>	Hardcopy	Digital	Both

<b>13. Usability:</b>		
Usable as exist	Usable but need further processing	Need conversion
<b>14. Data quality description:</b>		
Is there any quality control being done (if yes please describe)	Is there any quality guideline (if yes please describe)	
Standard format		
<b>16. Do you have any data documentation / Report</b>	y/n (If yes, please write the name of the report)	

**17. Please write your opinions and comments regarding the GIS data standardization, data sharing and data decimation policy/protocol:**

**18. Brief description of data set**

Name of data set with brief description of data layer	Source of data	Data Type			Completeness (Spatial/Temporal extent)	Data Acquisition Scale	Format (Shape file, dbf, Access database etc.)	Field of application	Accessibility		
		GIS data	Attribute data	Time series					Only GoB	All	Researcher

For further information please contact:

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 Motaleb Hossain Sarker  
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 Telephone: 8821570-2; 8817648-52, 01715 015419

CDMP  
 Dr. Maksud Kamal  
 Telephone: 880 2 9890937, 8821255



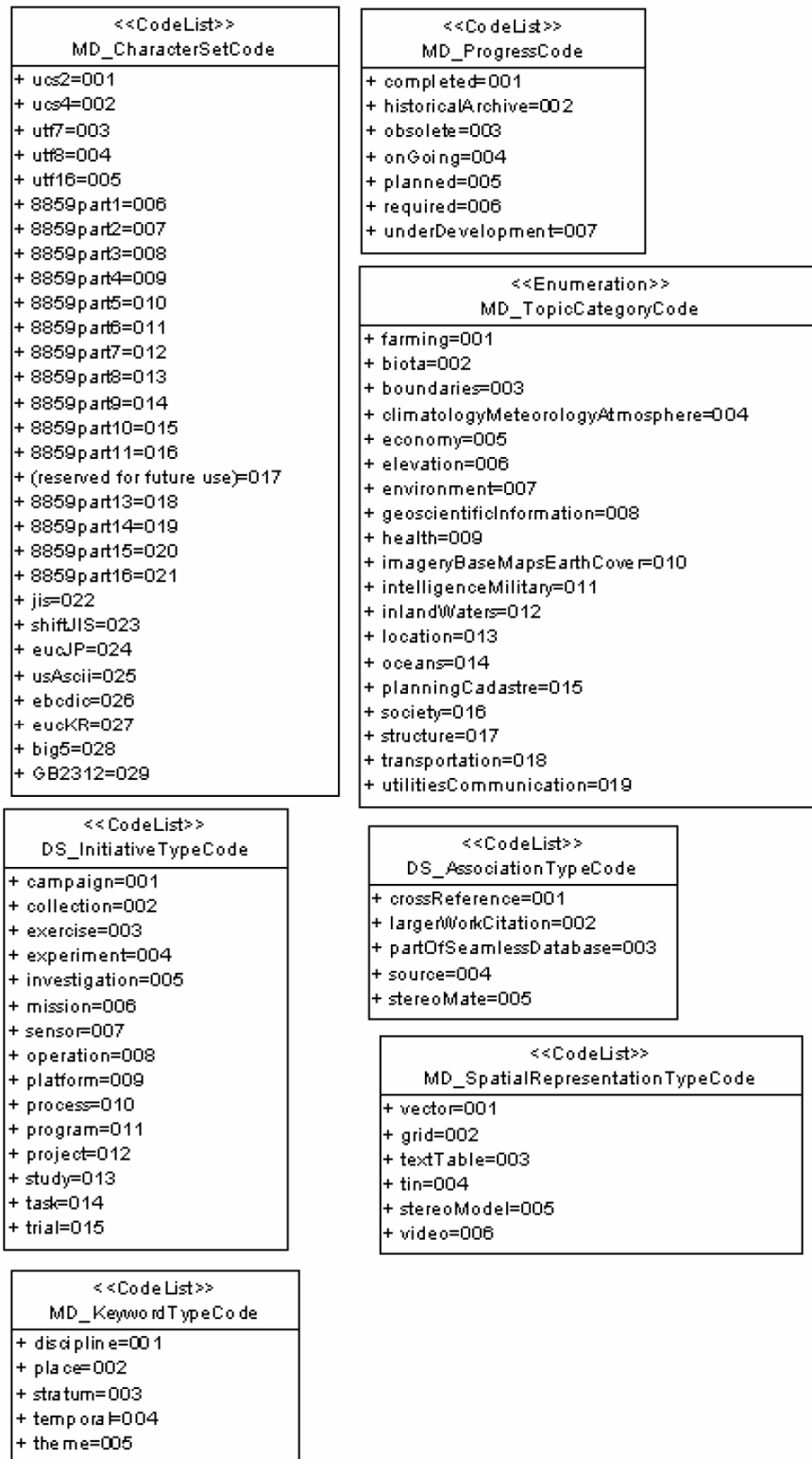


Figure A.3. Identification Information (Part-2)

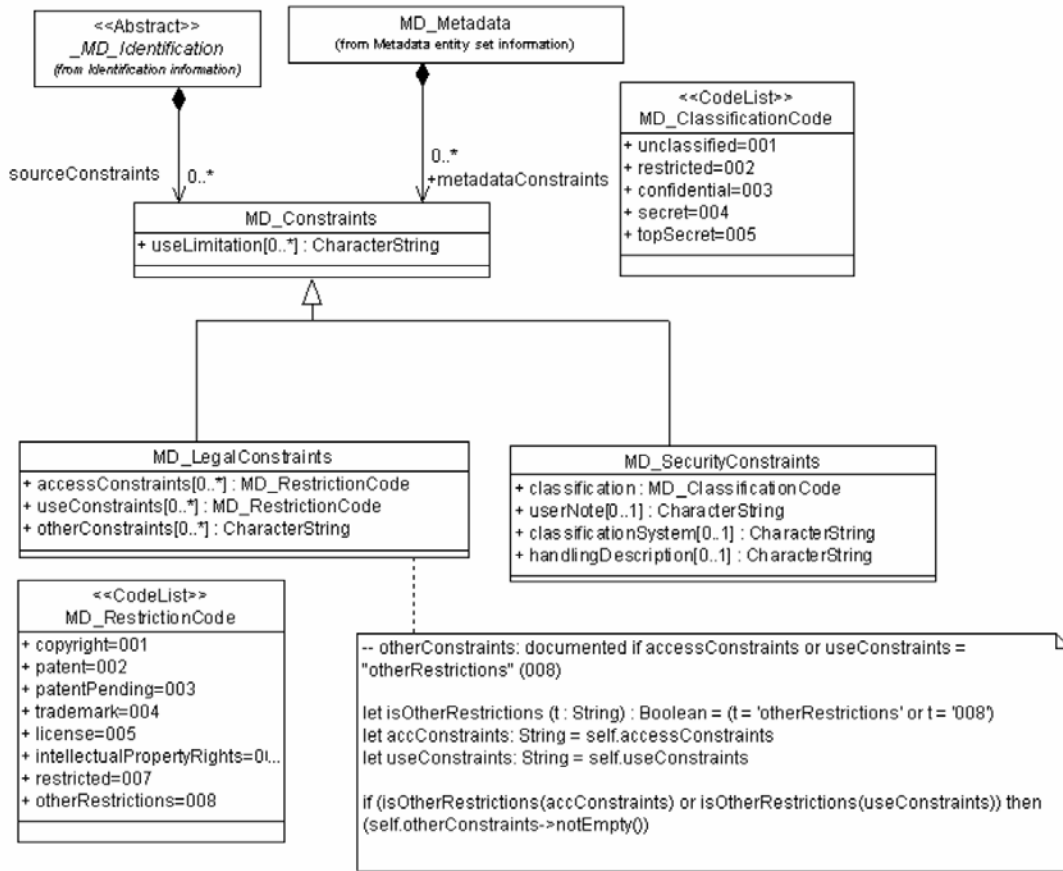


Figure A.3. Constraint Information

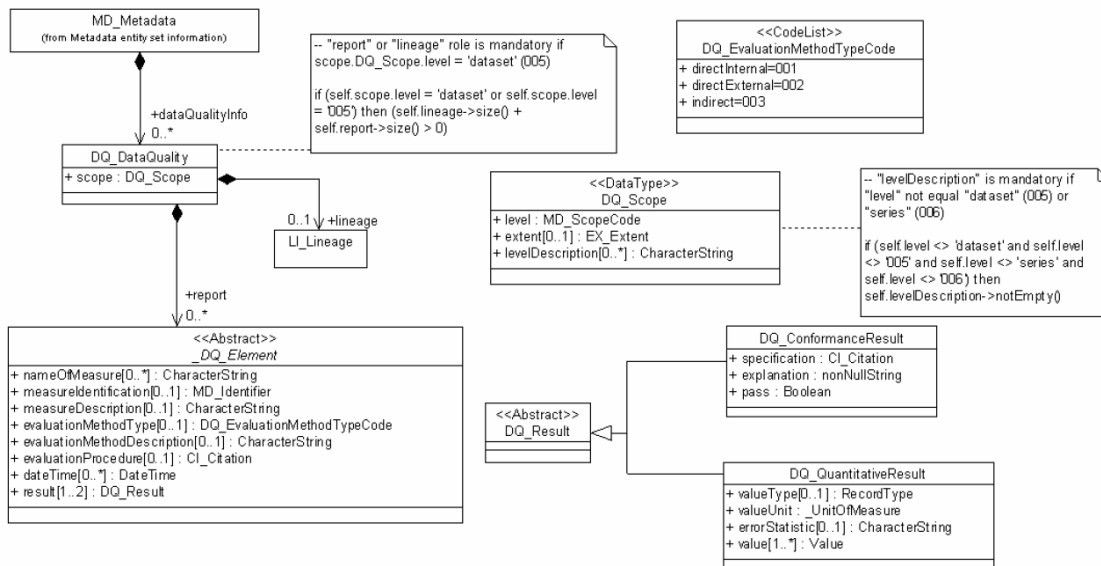


Figure A.5. Data Quality Information

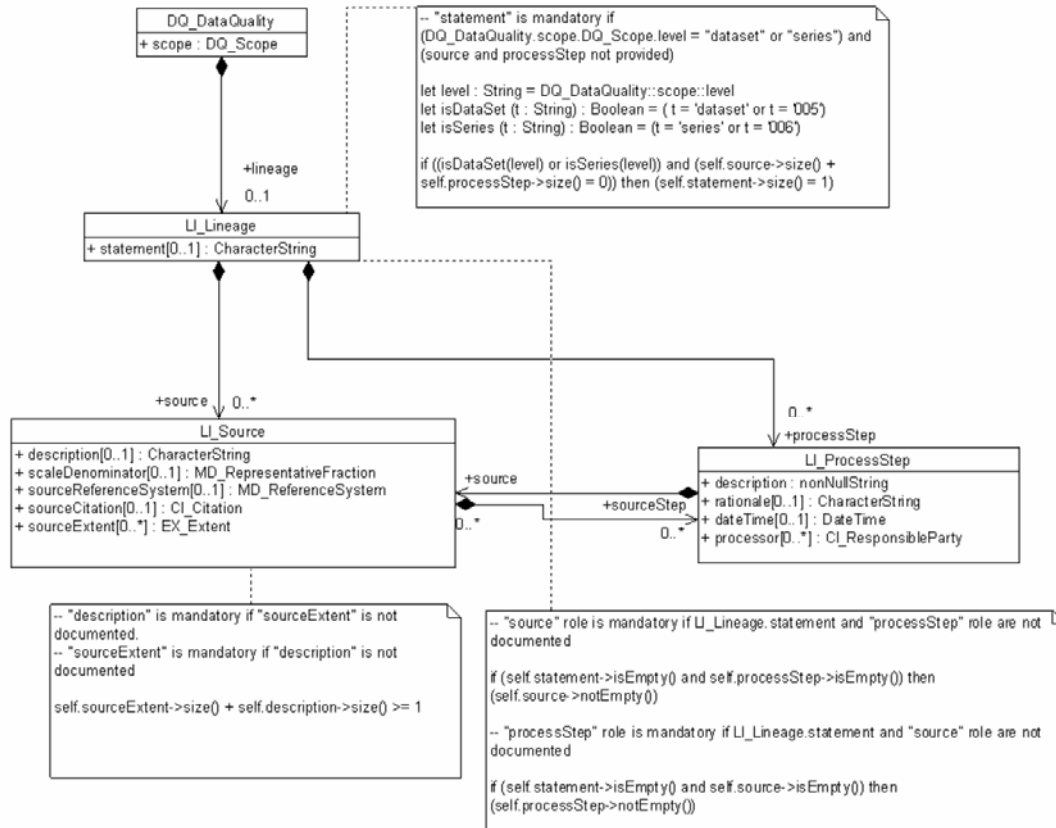


Figure A.6. Lineage Information

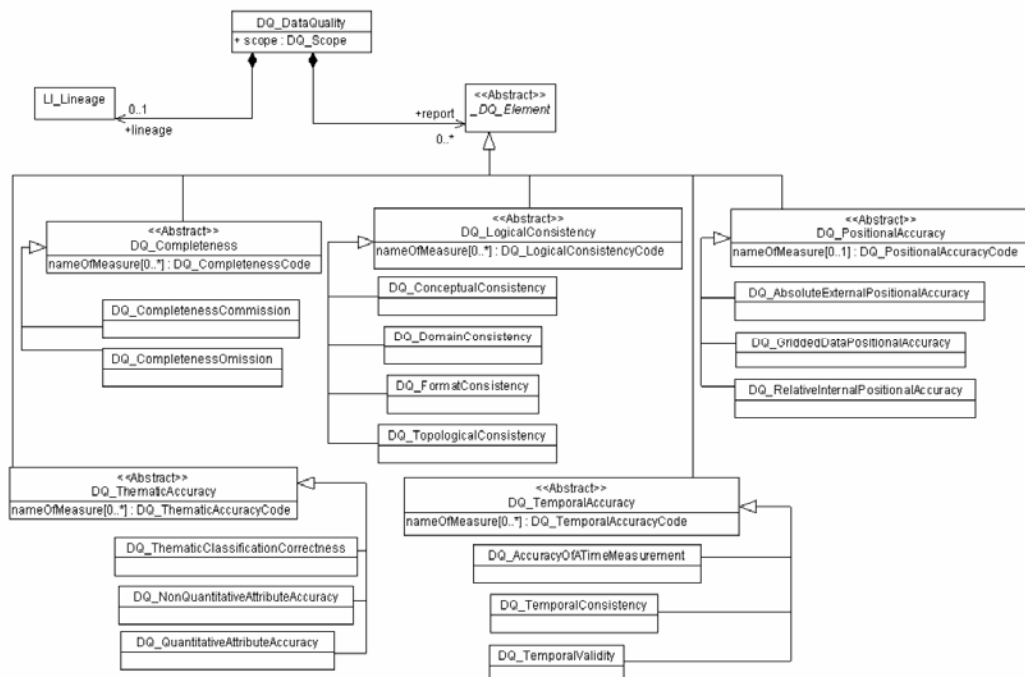


Figure A.7. Data Quality and Subclasses

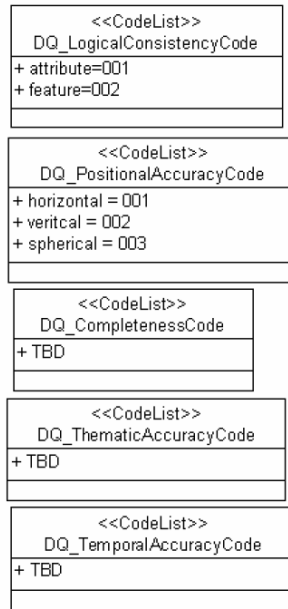


Figure A.8. Data Quality code lists

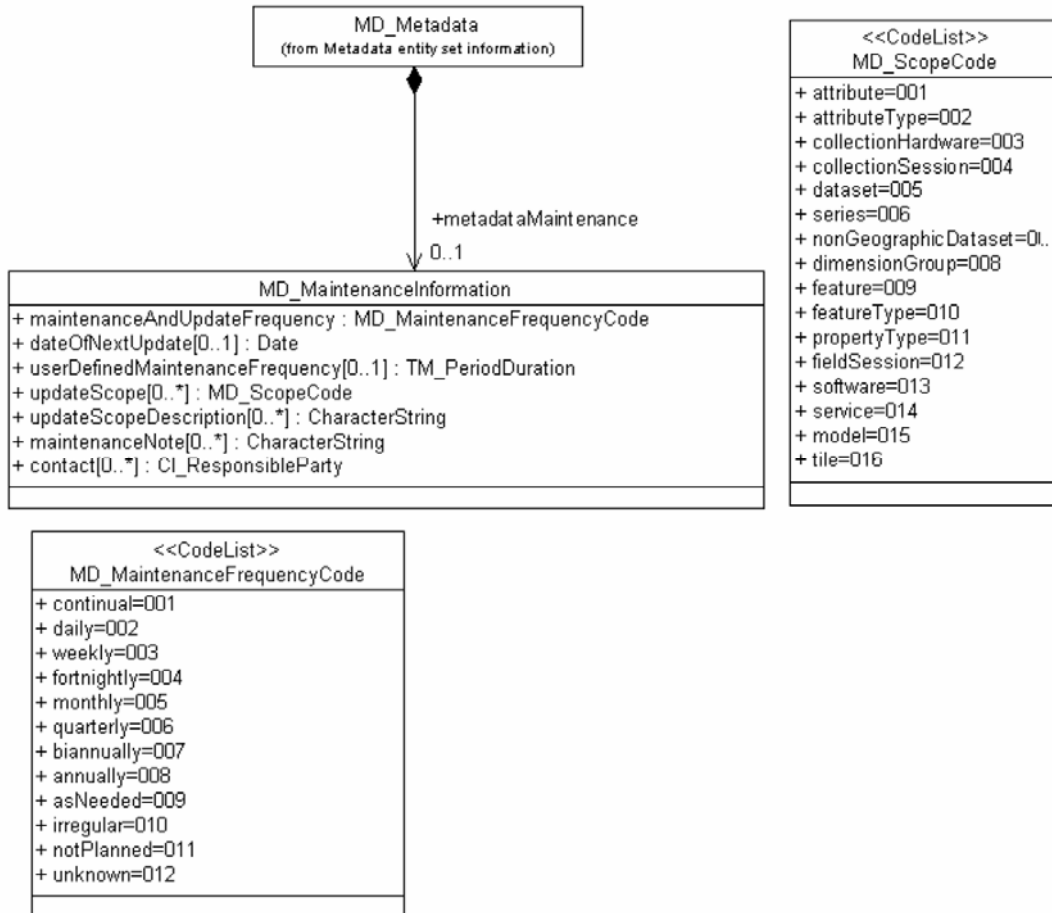


Figure A.9. Maintenance Information

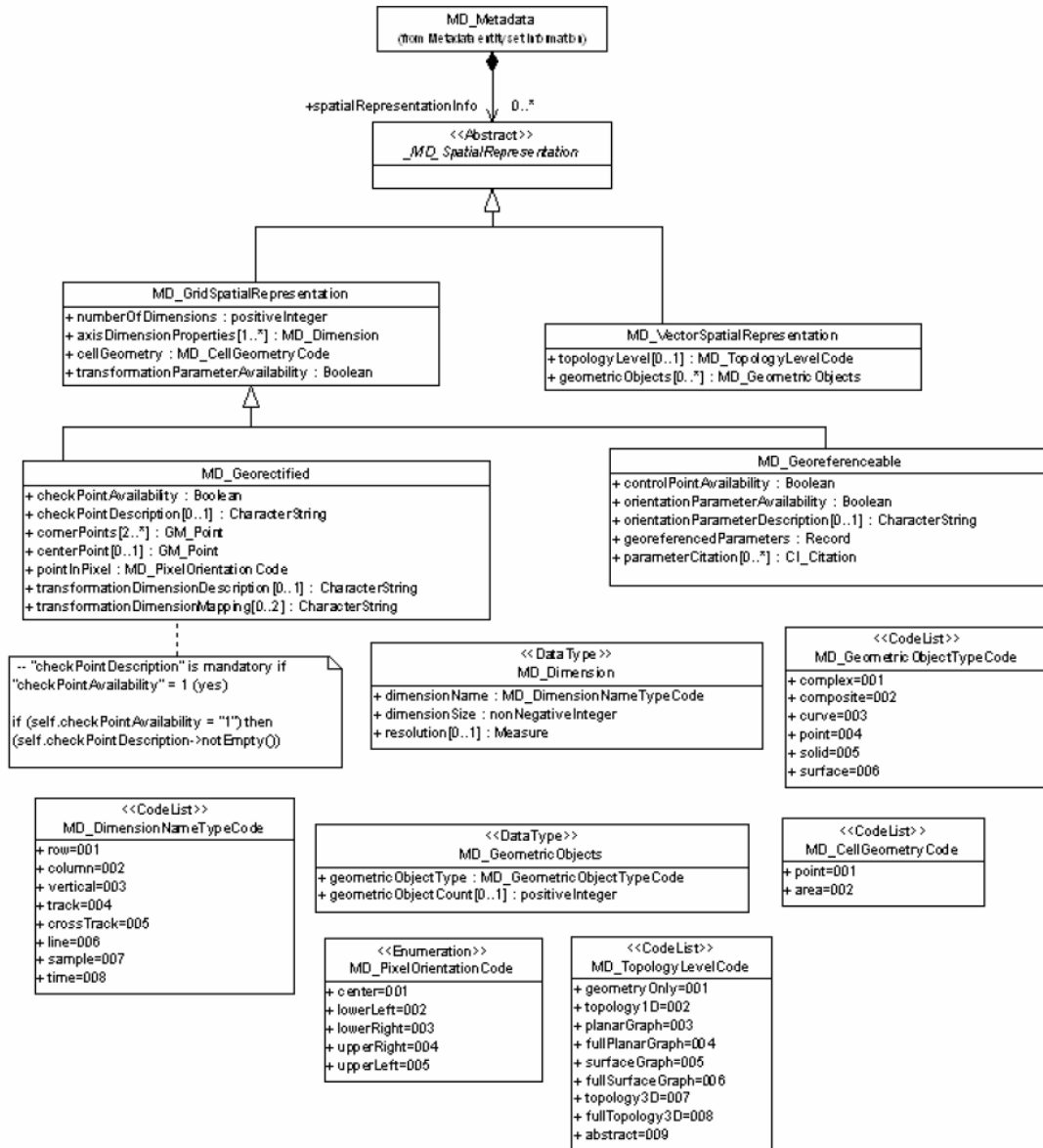


Figure A.10. Spatial Representation Information

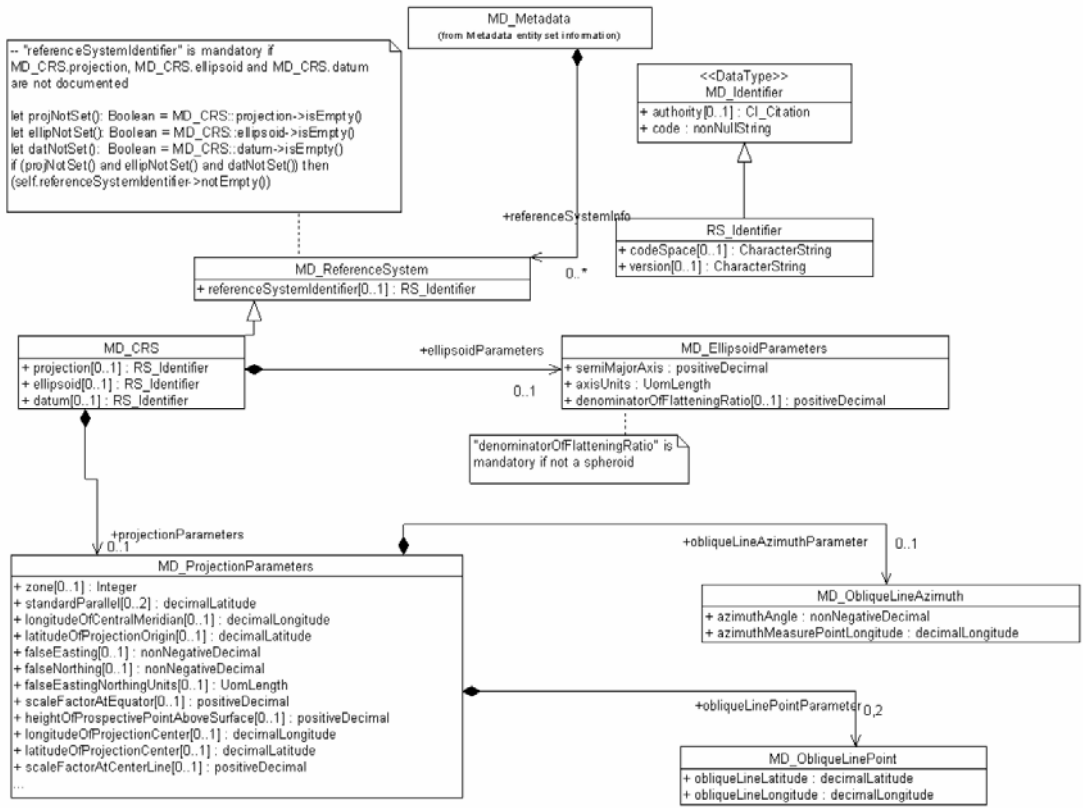


Figure A.11. Reference System Information

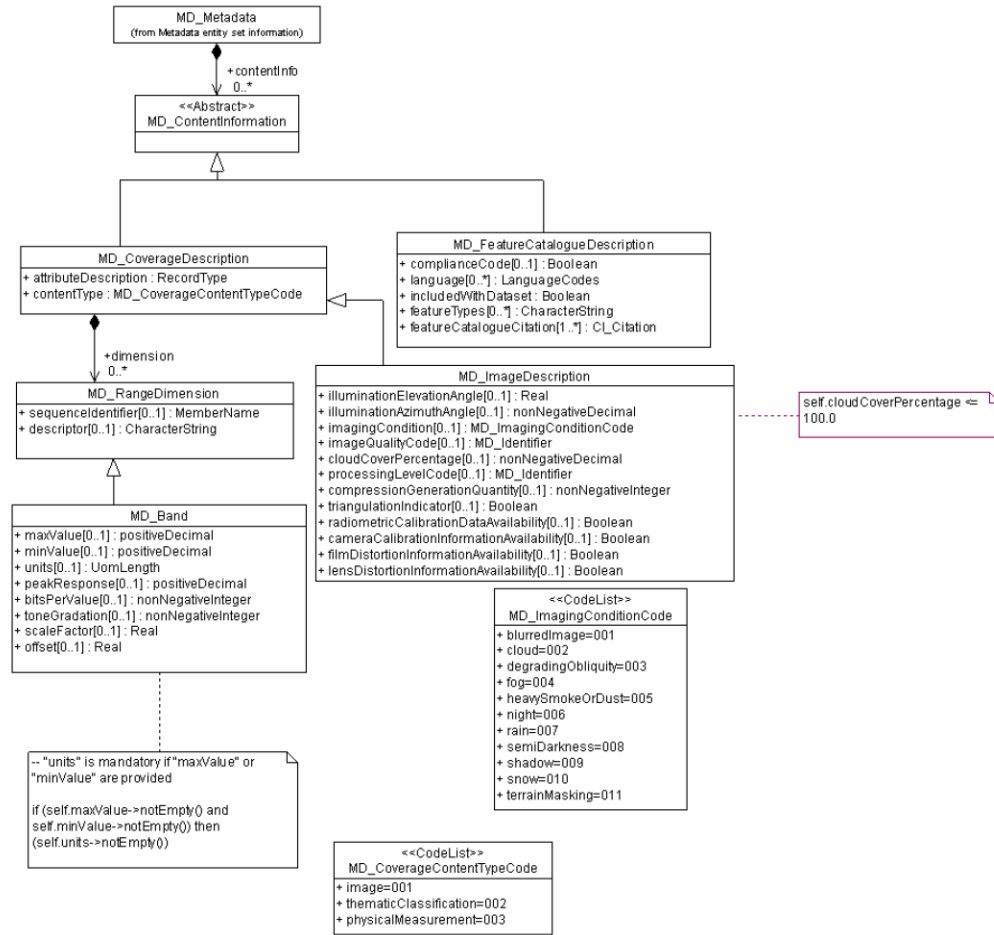


Figure A.12. Content Information

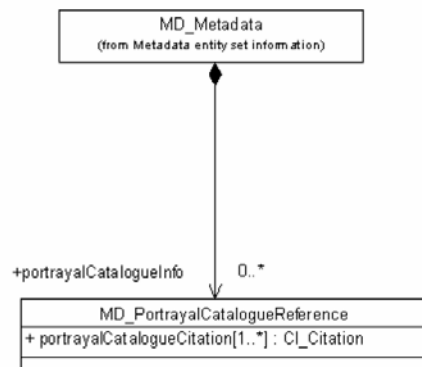


Figure A.13. Portrayal Catalogue Information

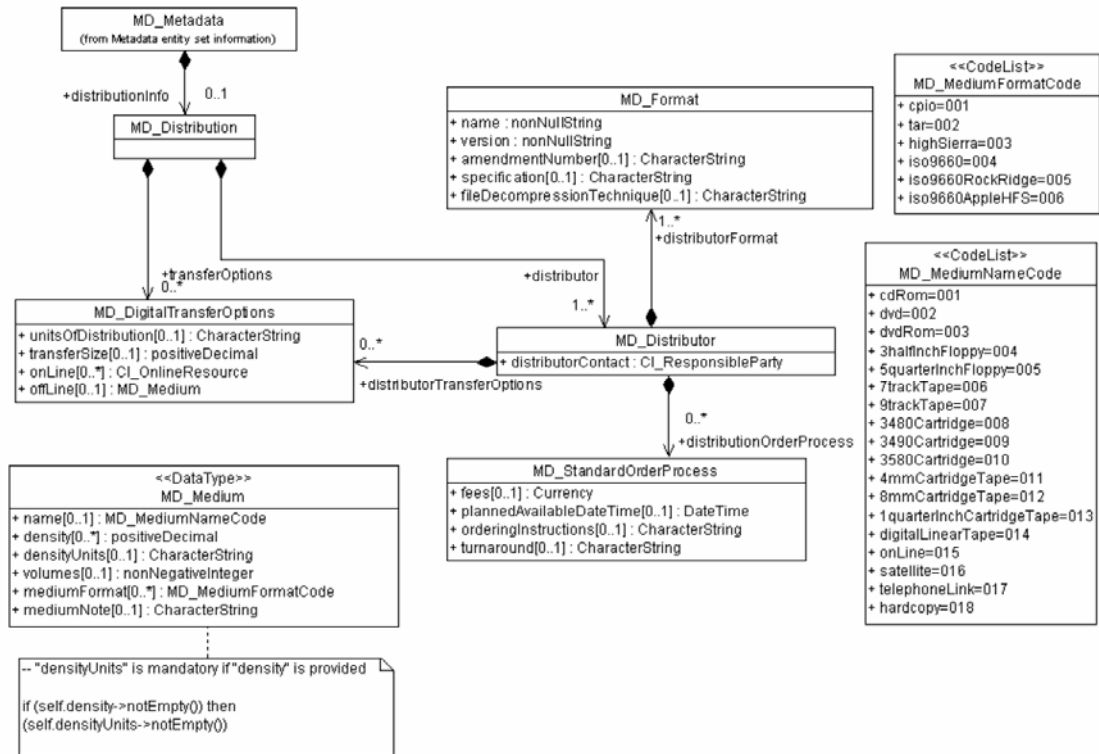


Figure A.14. Distribution Information

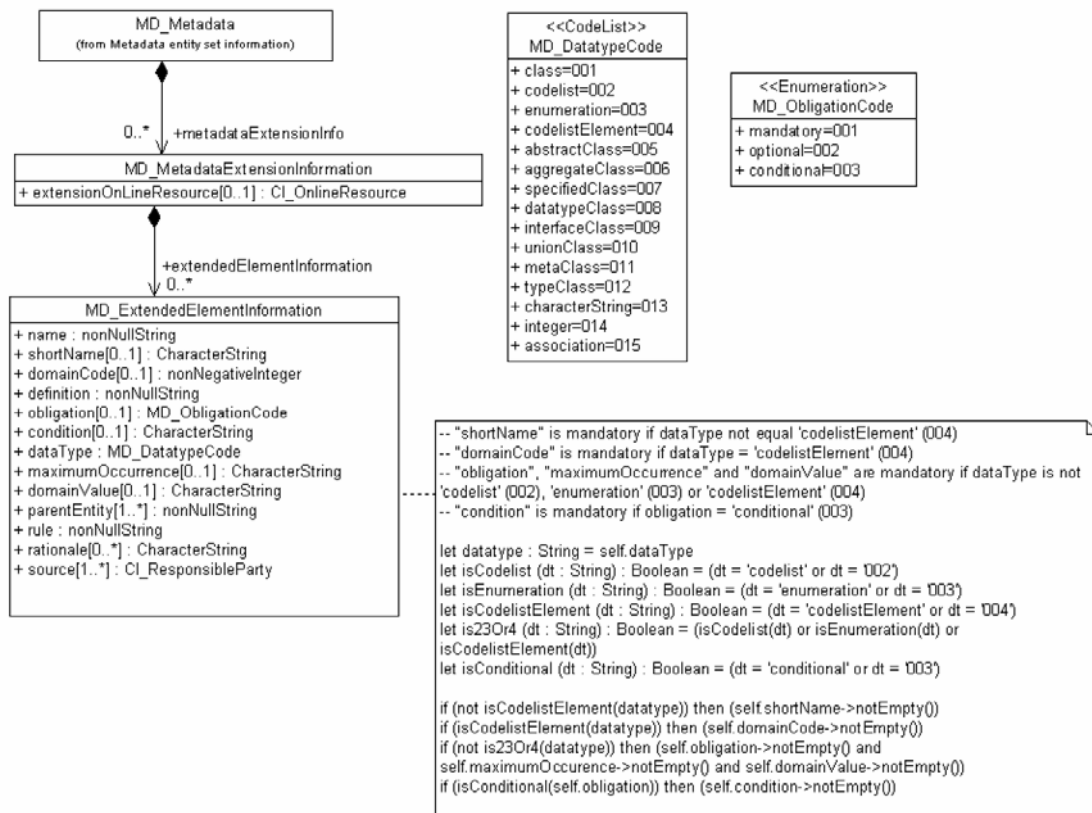


Figure A.15. Metadata Extension Information

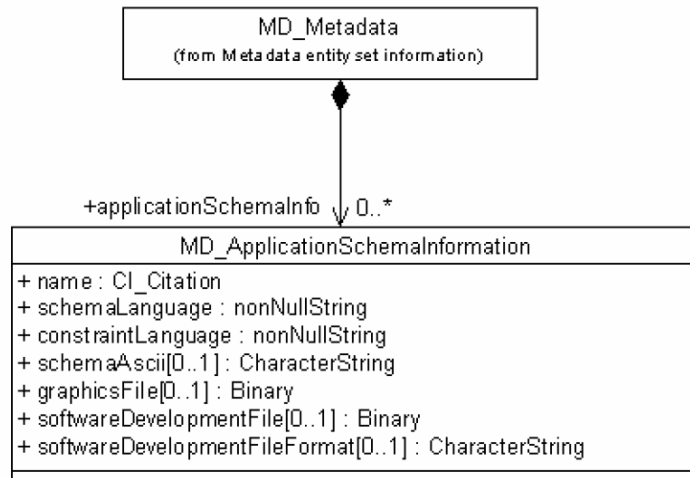


Figure A.16. Application Schema Information

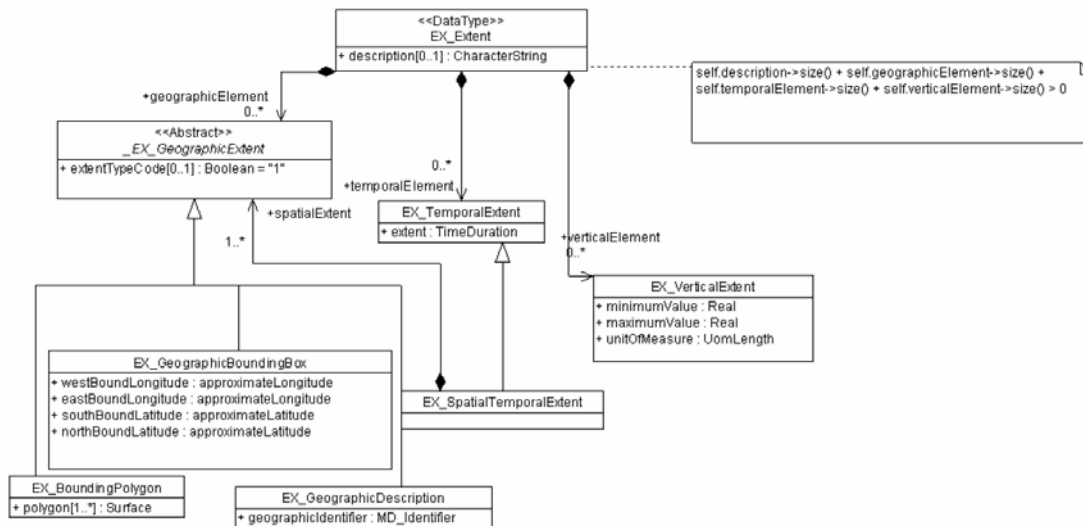


Figure A.17. Extent Information

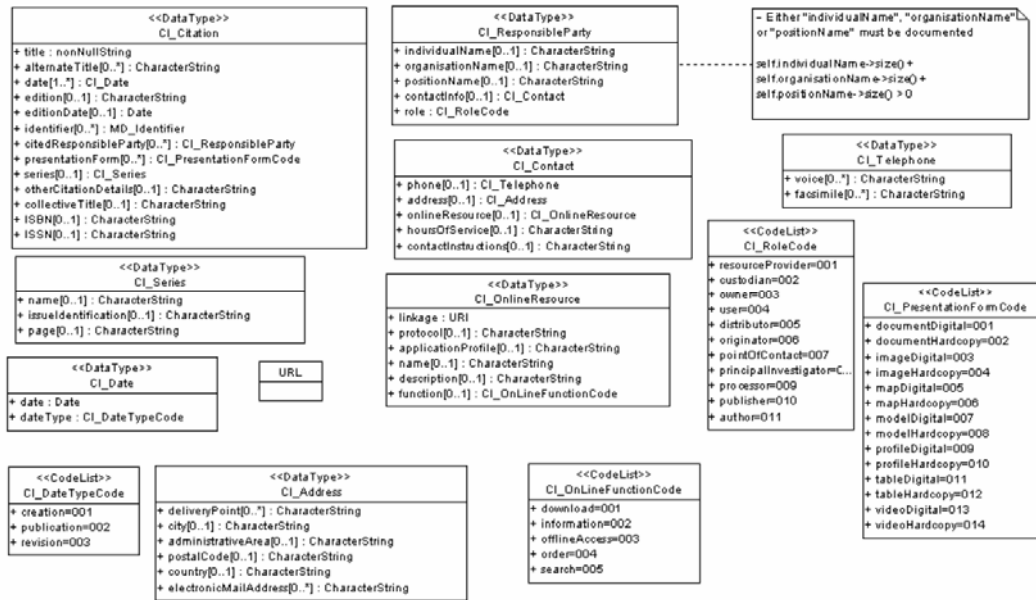


Figure A.18. Citation and responsible party Information

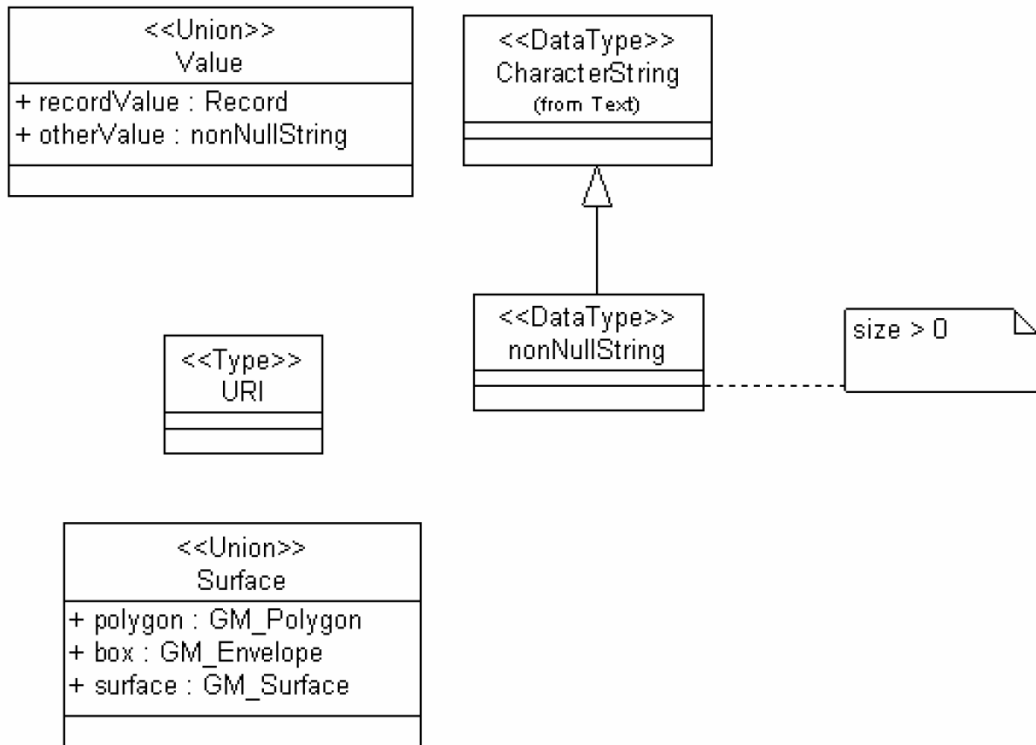


Figure A.19. Miscellaneous data types UML diagram

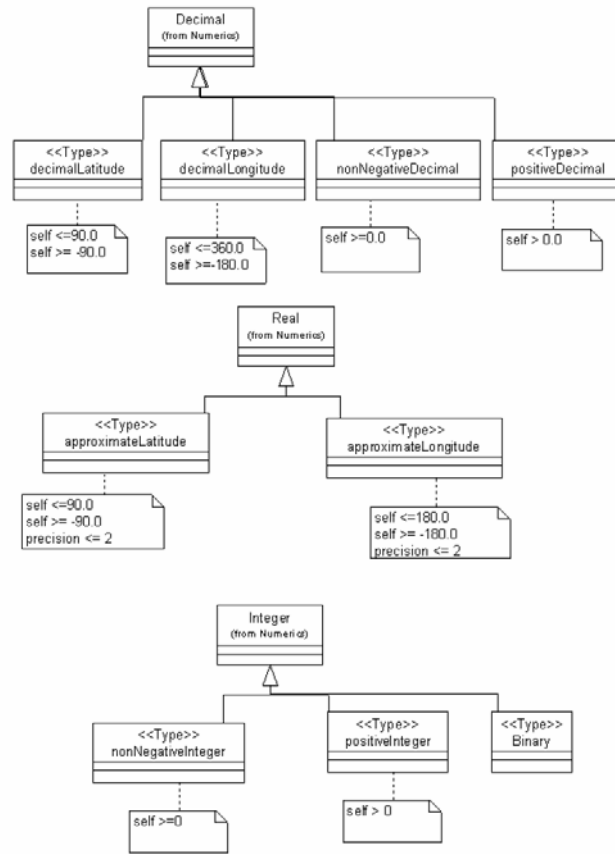


Figure A.20. Numeric Data types

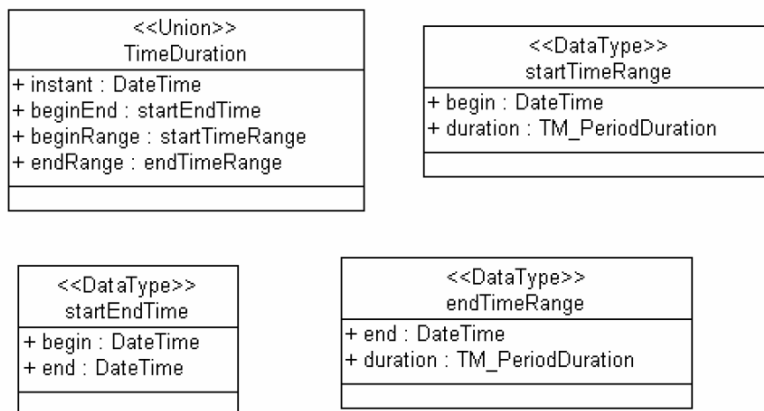


Figure A.21. Time types UML diagram

**B.2 Metadata package data dictionaries**

**B.2.1 Metadata entity set information**

- UML model shown in Figure A.1

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
1.	MD_Metadata	Metadata	root entity which defines metadata about a resource or resources	M	1	Class	Lines 2-22
2.	fileIdentifier	mdFileID	unique identifier for this metadata file	O	1	CharacterString	Free text
3.	language	mdLang	language used for documenting metadata	C / not defined by encoding?	1	CharacterString	ISO 639-2, other parts may be used
4.	characterSet	mdChar	full name of the character coding standard used for the metadata set	C / ISO/IEC 10646-1 not used and not defined by encoding	1	Class	MD_CharacterSetCode <<CodeList>> (B.5.10)
5.	parentIdentifier	mdParentID	file identifier of the metadata to which this metadata is a subset (child)	O	1	CharacterString	Free text
6.	hierarchyLevel	mdHrLv	scope to which the metadata applies (see annex H for more information about metadata hierarchy levels)	C/ hierarchyLevel is not equal to "dataset"?	N	Class	MD_ScopeCode <<CodeList>> (B.5.25)
7.	hierarchyLevelName	mdHrLvName	name of the hierarchy levels for which the metadata is provided	O	N	CharacterString	Free text
8.	contact	mdContact	party responsible for the metadata information	M	1	Class	CI_ResponsibleParty (B.3.2) <<DataType>>
9.	dateStamp	mdDateSt	date that the metadata was created	M	1	Class	Date (B.4.2)
10.	metadataStandardName	mdStanName	name of the metadata standard (including profile name) used	O	1	CharacterString	Free text
11.	metadataStandardVersion	mdStanVer	version (profile) of the metadata standard used	O	1	CharacterString	Free text
12.	<i>Role name:</i> spatialRepresentationInfo	spatReplInfo	digital representation of spatial information in the dataset	O	N	Association	MD_SpatialRepresentation <<Abstract>> (B.2.6)
13.	<i>Role name:</i> referenceSystemInfo	refSysInfo	description of the spatial and temporal reference systems used in the dataset	O	N	Association	MD_ReferenceSystem (B.2.7)
14.	<i>Role name:</i> metadataExtensionInfo	mdExtInfo	information describing metadata extensions	O	N	Association	MD_MetadataExtensionInformation (B.2.11)
15.	<i>Role name:</i> identificationInfo	dataIdInfo	basic information about the resource(s) to which the metadata applies	M	N	Association	MD_Identification <<Abstract>> (B.2.2)
16.	<i>Role name:</i> contentInfo	contInfo	provides information about the feature catalogue and describes the coverage and image data characteristics	O	N	Association	MD_ContentInformation (B.2.8)
17.	<i>Role name:</i> distributionInfo	distInfo	provides information about the distributor of and options for obtaining the resource(s)	O	1	Association	MD_Distribution (B.2.10)

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18.	<i>Role name:</i> dataQualityInfo	dqInfo	provides overall assessment of quality of a resource(s)	O	N	Association	DQ_DataQuality (B 2.4)
19.	<i>Role name:</i> portrayalCatalogueInfo	porCatInfo	provides information about the catalogue of rules defined for the portrayal of a resource(s)	O	N	Association	MD_PortrayalCatalogueReference (B 2.9)
20.	<i>Role name:</i> metadataConstraints	mdConst	provides restrictions on the access and use of data	O	N	Association	MD_Constraints (B 2.3)
21.	<i>Role name:</i> applicationSchemaInfo	appSchInfo	provides information about the conceptual schema of a dataset	O	N	Association	MD_ApplicationSchemaInformation (B 2.12)
22.	<i>Role name:</i> metadataMaintenance	mdMaint	provides information about the frequency of metadata updates, and the scope of those updates	O	1	Association	MD_MaintenanceInformation (B 2.5)

**B.2.2 Identification information (includes data and service identification)**

- UML model shown in Figure A.2

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
23.	<i>MD_Identification</i>	Ident	basic information required to uniquely identify a resource or resources	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	Lines 24-35
24.	citation	idCitation	citation data for the resource(s)	M	1	Class	CI_Citation (B.3.2) <<DataType>>
25.	abstract	idAbs	brief narrative summary of the content of the resource(s)	M	1	CharacterString	Free text
26.	purpose	idPurp	summary of the intentions with which the resource(s) was developed	O	1	CharacterString	Free text
27.	credit	idCredit	recognition of those who contributed to the resource(s)	O	N	CharacterString	Free text
28.	status	idStatus	status of the resource(s)	O	N	Class	MD_ProgressCode <<CodeList>> (B.5.23)
29.	pointOfContact	idPoC	identification of, and means of communication with, person(s) and organizations(s) associated with the resource(s)	O	N	Class	CI_ResponsibleParty (B.3.2) <<DataType>>
30.	<i>Role name:</i> resourceMaintenance	resMaint	provides information about the frequency of resource updates, and the scope of those updates	O	N	Association	MD_MaintenanceInformation (B 2.5)

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
31.	<i>Role name:</i> graphicOverview	graphOver	provides a graphic that illustrates the resource(s) (should include a legend for the graphic)	O	N	Association	MD_BrowseGraphic (B 2.2.1)
32.	<i>Role name:</i> resourceFormat	dsFormat	provides a description of the format of the resource(s)	O	N	Association	MD_Format (B 2.10.3)
33.	<i>Role name:</i> descriptiveKeywords	descKeys	provides category keywords, their type, and reference source	O	N	Association	MD_Keywords (B 2.2.2)
34.	<i>Role name:</i> resourceSpecificUsage	idSpecUse	provides basic information about specific application(s) for which the resource(s) has/have been or is being used by different users	O	N	Association	MD_Usage (B 2.2.5)
35.	<i>Role name:</i> resourceConstraints	resConst	provides information about constraints which apply to the resource(s)	O	N	Association	MD_Constraints (B 2.3)
36.	MD_DataIdentification	DataIdent	information required to identify a dataset	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	Lines 37-46 and 24-35
37.	spatialRepresentationType	spatRpType	method used to spatially represent geographic information	O	N	Class	MD_SpatialRepresentationTypeCode <<CodeList>> (B.5.26)
38.	spatialResolution	dataScale	factor which provides a general understanding of the density of spatial data in the dataset	O	N	Class	MD_Resolution <<Union>> (B.2.2.4)
39.	language	dataLang	language(s) used within the dataset	M	N	CharacterString	ISO 639-2, other parts may be used
40.	characterSet	dataChar	full name of the character coding standard used for the dataset	C/ISO/IEC 10646-1 not used?	1	Class	MD_CharacterSetCode <<CodeList>> (B.5.10)
41.	topicCategory	tpCat	main theme(s) of the dataset	M	N	Class	MD_TopicCategoryCode <<CodeList>> (B.5.27)
42.	geographicBox	geoBox	minimum bounding rectangle within which data is available	C / hierarchyLevel equals "dataset" and geographicDescription not documented?	N	Class	EX_GeographicBoundingBox (B.3.1.1)
43.	geographicDescription	geoDesc	description of the geographic area within which data is available	C / if hierarchyLevel equals "dataset" and geographicBox not documented?	N	Class	EX_GeographicDescription (B.3.1.1)
44.	environmentDescription	envirDesc	description of the dataset in the producer's processing environment, including items such as the software, the computer operating system, file name, and the dataset size	O	1	CharacterString	Free text
45.	extent	dataExt	additional extent information including the bounding polygon, vertical, and temporal extent of the dataset	O	N	Class	EX_Extent <<DataType>> (B.3.1)

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	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
46.	supplementalInformation	supplInfo	any other descriptive information about the dataset	O	1	CharacterString	Free text
47.	MD_ServiceIdentification	SerIdent	identification of capabilities which a service provider makes available to a service user through a set of interfaces that define a behaviour - See ISO 19119 – Services for further information	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	Lines 24-35

**B.2.2.1 Browse graphic information**

48.	MD_BrowseGraphic	BrowGraph	graphic that provides an illustration of the dataset (should include a legend for the graphic)	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 49-51
49.	fileName	bgFileName	name of the file that contains a graphic that provides an illustration of the dataset	M	1	CharacterString	Free text
50.	fileDescription	bgFileDesc	text description of the illustration	O	1	CharacterString	Free text
51.	fileType	bgFileType	format in which the illustration is encoded Examples: CGM, EPS, GIF, JPEG, PBM, PS, TIFF, XWD	O	1	CharacterString	Free text

**B.2.2.2 Keyword information**

52.	MD_Keywords	Keywords	keywords, their type and reference source	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 53-55
53.	keyword	keyword	commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject	M	N	CharacterString	Free text
54.	type	keyTyp	subject matter used to group similar keywords	O	1	Class	MD_KeywordTypeCode <<CodeList>> (B.5.17)
55.	thesaurusName	thesaName	name of the formally registered thesaurus or a similar authoritative source of keywords	O	1	Class	CI_Citation (B.3.2) <<DataType>>

**B.2.2.3 Representative fraction information**

56.	MD_RepresentativeFraction	RepFract	derived from Scale where MD_RepresentativeFraction.denominator = 1 / Scale.measure And Scale.targetUnits = Scale.sourceUnits	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 57-58
57.	denominator	rfDenom	the number below the line in a vulgar fraction	M	1	Integer	Integer > 0
58.	<i>Role name (derived): /Scale</i>	derScale	role indicating that MD_RepresentativeFraction is derived from Scale	(Not applicable)	(Not applicable)	Derived Association	Scale (B.4.3)

**B.2.2.4 Resolution information**

59.	MD_Resolution	Resol	level of detail expressed as a scale factor or a ground distance	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	Lines 60-61
60.	equivalentScale	equScale	level of detail expressed as the scale of a comparable hardcopy map or chart	C / distance not documented?	1	Class	MD_RepresentativeFraction <<DataType>> (B.2.2.3)
61.	distance	scaleDist	ground sample distance	C / equivalentScale not documented?	1	Class	Distance (B.4.3)

**B.2.2.5 Usage information**

62.	MD_Usage	Usage	brief description of ways in which the resource(s) is/are currently used	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 63-65
63.	specificUsage	specUsage	brief description of the resource and/or resource series usage	M	1	CharacterString	Free text
64.	usageDateTime	usageDate	date and time of the first use or range of uses of the resource and/or resource series	O	1	Class	DateTime (B.4.2)

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65.	userDeterminedLimitations	usrDetLim	applications, determined by the user for which the resource and/or resource series is not suitable	O	1	CharacterString	Free text
66.	userContactInfo	usrCntInfo	identification of and means of communicating with person(s) and organization(s) using the resource(s)	M	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)

**B.2.3 Constraint information (includes legal and security)**

- UML model shown in Figure A.3

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
67.	MD_Constraints	Consts	restrictions on the access and use of a resource or metadata	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)	Line 68
68.	useLimitation	useLimit	limitation affecting the fitness for use of the resource. Example, "not to be used for navigation"	O	N	CharacterString	Free text
69.	MD_LegalConstraints	LegConsts	restrictions and legal prerequisites for accessing and using the resource	Use obligation from referencing object	N	Specified Class (MD_Constraints)	Lines 70-72 and 68
70.	accessConstraints	accessConsts	access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
71.	useConstraints	useConsts	constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations or warnings on using the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
72.	otherConstraints	othConsts	other restrictions and legal prerequisites for accessing and using the resource	C / accessConstraints or useConstraints equal "otherRestrictions"?	N	CharacterString	Free text
73.	MD_SecurityConstraints	SecConsts	handling restrictions imposed on the resource for national security or similar security concerns	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Constraints)	Lines 74-77 and 68
74.	classification	class	name of the handling restrictions on the resource	M	1	Class	MD_ClassificationCode <<CodeList>> (B.5.11)

75.	userNote	userNote	explanation of the application of the legal constraints or other restrictions and legal prerequisites for obtaining and using the resource	O	1	CharacterString	Free text
76.	classificationSystem	classSys	name of the classification system	O	1	CharacterString	Free text
77.	handlingDescription	handDesc	additional information about the restrictions on handling the resource	O	1	CharacterString	Free text

### B.2.4 Data quality information

- UML model shown in Figures A.4, A.5 (Lineage) and A.6 (Data quality classes and subclasses)

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
78.	DQ_DataQuality	DataQual	quality information for the data specified by a data quality scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 79-81
79.	scope	dqScope	the specific data to which the data quality information applies	M	1	Class	DQ_Scope <<DataType>> (B.2.4.4)
80.	<i>Role name:</i> report	dqReport	quantitative quality information for the data specified by the scope	C / scope.DQ_Scope.level equals 'dataset'?	N	Association	DQ_Element <<Abstract>> (B.2.4.2)
81.	<i>Role name:</i> lineage	dataLineage	non-quantitative quality information about the lineage of the data specified by the scope	C / scope.DQ_Scope.level equals 'dataset'?	1	Association	LI_Lineage (B.2.4.1)

## B.2.4.1 Lineage information

82.	LI_Lineage	Lineage	information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality)	Lines 83-85
83.	statement	statement	general explanation of the data producer's knowledge about the lineage of a dataset	C / (DQ_DataQuality.scope. DQ_Scope.level = "dataset" or "series") and source and processStep not provided?	1	CharacterString	Free text
84.	<i>Role name:</i> processStep	prcStep	information about an event in the creation process for the data specified by the scope	C / statement and source not provided?	N	Association	LI_ProcessStep (B.2.4.1.1)
85.	<i>Role name:</i> source	dataSource	information about the source data used in creating the data specified by the scope	C / statement and processStep not provided?	N	Association	LI_Source (B.2.4.1.2)

## B.2.4.1.1 Process step information

86.	LI_ProcessStep	ProcessStep	information about an event in the creation process for the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage)	Lines 86-91
87.	description	stepDesc	description of the event, including related parameters or tolerances	M	1	CharacterString	Free Text
88.	rationale	stepRat	requirement or purpose for the process step	O	1	CharacterString	Free Text
89.	dateTime	stepDateTm	date and time or range of date and time on or over which the process step occurred	O	1	Class	DateTime (B.4.2)
90.	processor	stepProc	identification of, and means of communication with, person(s) and organization(s) associated with the process step	O	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
91.	<i>Role name:</i> source	stepSrc	information about the source data used in creating the data specified by the scope	O	N	Association	LI_Source (B.2.4.1.2)

**B.2.4.1.2 Source information**

92.	LI_Source	Source	information about the source data used in creating the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage)	Lines 93-98
93.	description	srcDesc	detailed description of the level of the source data	C / sourceExtent not provided?	1	CharacterString	Free Text
94.	scaleDenominator	srcScale	denominator of the representative fraction on a source map	O	1	Class	MD_RepresentativeFraction <<DataType>> (B.2.2.3)
95.	sourceReferenceSystem	srcRefSys	spatial reference system used by the source data	O	1	Class	MD_ReferenceSystem (B.2.7)
96.	sourceCitation	srcCitatn	recommended reference to be used for the source data	O	1	Class	CI_Citation <<DataType>> (B.3.2)
97.	sourceExtent	srcExt	information about the spatial, vertical and temporal extent of the source data	C / description not provided?	N	Class	EX_Extent <<DataType>> (B.3.1)
98.	<i>Role name:</i> sourceStep	srcStep	information about an event in the creation process for the source data	O	N	Association	LI_ProcessStep (B.2.4.1.1)

**B.2.4.2 Data quality element information**

99.	DQ_Element	DQElement	type of test applied to the data specified by a data quality scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality) <<Abstract>>	Lines 100-107
100.	nameOfMeasure	measName	name of the test applied to the data	O	N	CharacterString	Free text
101.	measureIdentification	measId	code identifying a registered standard procedure	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)
102.	measureDescription	measDesc	description of the measure being determined	O	1	CharacterString	Free text
103.	evaluationMethodType	evalMethType	type of method used to evaluate quality of the dataset	O	1	Class	DQ_EvaluationMethodTypeCode <<CodeList>> (B.5.6)
104.	evaluationMethodDescription	evalMethDesc	description of the evaluation method	O	1	CharacterString	Free text
105.	evaluationProcedure	evalProc	reference to the procedure information	O	1	Class	CI_Citation <<DataType>> (B.3.2)
106.	dateTime	measDateTm	date or range of dates on which a data quality measure was applied	O	1	Class	Date Time (B.4.2)

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107.	result	measResult	value (or set of values) obtained from applying a data quality measure or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	M	2	Class	DQ_Result <<DataType>> (B.2.4.3)
108.	DQ_Completeness	DQComplete	presence and absence of features, their attributes and their relationships	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
109.	DQ_CompletenessCommission	DQCompComm	excess data present in the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	Lines 100-107
110.	DQ_CompletenessOmission	DQCompOm	data absent from the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	Lines 100-107
111.	DQ_LogicalConsistency	DQLogConsis	degree of adherence to logical rules of data structure, attribution and relationships (data structure can be conceptual, logical or physical)	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
112.	DQ_ConceptualConsistency	DQConcConsis	adherence to rules of the conceptual schema	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
113.	DQ_DomainConsistency	DQDomConsis	adherence of values to the value domains	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
114.	DQ_FormatConsistency	DQFormConsis	degree to which data is stored in accordance with the physical structure of the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107

115.	DQ_TopologicalConsistency	DQTopConsis	correctness of the explicitly encoded topological characteristics of the dataset as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
116.	DQ_PositionalAccuracy	DQPosAcc	accuracy of the position of features	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
117.	DQ_AbsoluteExternalPositionalAccuracy	DQAbsExtPosAcc	closeness of reported coordinate values to values accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
118.	DQ_GriddedDataPositionalAccuracy	DQGridDataPosAcc	closeness of gridded data position values to values accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
119.	DQ_RelativeInternalPositionalAccuracy	DQRelIntPosAcc	closeness of the relative positions of features in the scope to their respective relative positions accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
120.	DQ_TemporalAccuracy	DQTempAcc	accuracy of the temporal attributes and temporal relationships of features	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
121.	DQ_AccuracyOfATimeMeasurement	DQAccTimeMeas	correctness of the temporal references of an item (reporting of error in time measurement)	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107
122.	DQ_TemporalConsistency	DQTempConsis	correctness of ordered events or sequences, if reported	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107

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123.	DQ_TemporalValidity	DQTempValid	validity of data specified by the scope with respect to time	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107
124.	DQ_ThematicAccuracy	DQThemAcc	accuracy of quantitative attributes and the correctness of non-quantitative attributes and of the classifications of features and their relationships	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
125.	DQ_ThematicClassificationCorrectness	DQThemClassCor	comparison of the classes assigned to features or their attributes to a universe of discourse	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107
126.	DQ_NonQuantitativeAttributeAccuracy	DQNonQuantAcc	correctness of non-quantitative attributes	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107
127.	DQ_QuantitativeAttributeAccuracy	DQQuantAcc	accuracy of quantitative attributes	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107

**B.2.4.3 Result information**

128.	DQ_Result	Result	generalization of more specific result classes	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
129.	DQ_ConformanceResult	ConResult	Information about the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	Lines 130-132

130.	specification	conSpec	citation of product specification or user requirement against which data is being evaluated	M	1	Class	CI_Citation <<DataType>> (B.3.2)
131.	explanation	conExpl	explanation of the meaning of conformance for this result	M	1	CharacterString	Free text
132.	pass	conPass	indication of the conformance result where 0 = fail and 1 = pass	M	1	Boolean	1 = yes 0 = no
133.	DQ_QuantitativeResult	QuanResult	Information about the value (or set of values) obtained from applying a data quality measure	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	Lines 134-137
134.	valueType	quanValType	value type for reporting a data quality result	O	1	Class	RecordType <<Metaclass>> (B.4.3)
135.	valueUnit	quanValUnit	value unit for reporting a data quality result	O	1	Class	Measure (B.4.3)
136.	errorStatistic	errStat	statistical method used to determine the value	O	1	CharacterString	Free text
137.	value	quanVal	quantitative value or values, content determined by the evaluation procedure used	M	N	Class	Record (B.4.3)

#### B.2.4.4 Scope information

138.	DQ_Scope	DQScope	description of the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 139-141
139.	level	scpLvl	hierarchical level of the data specified by the scope	M	1	Class	MD_ScopeCode <<CodeList>> (B.5.25)
140.	extent	scpExt	information about the spatial, vertical and temporal extent of the data specified by the scope	O	1	Class	EX_Extent <<DataType>> (B.3.1)
141.	levelDescription	scpLvlDesc	detailed description about the level of the data specified by the scope	C / level not equal "dataset" or "series"?	N	Class	MD_ScopeDescription <<Union>> (B.2.5.1)

**B.2.5 Maintenance information**

- UML model shown in Figure A.7

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
142.	MD_MaintenanceInformation	MaintInfo	information about the scope and frequency of updating	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)	Lines 143-148
143.	maintenanceAndUpdateFrequency	maintFreq	frequency with which changes and additions are made to the resource after the initial resource is completed	M	1	Class	MD_MaintenanceFrequencyCode <<CodeList>> (B.5.18)
144.	dateOfNextUpdate	dateNext	scheduled revision date for resource	O	1	Class	Date (B.4.2)
145.	userDefinedMaintenanceFrequency	usrDefFreq	maintenance period other than those defined	O	1	Class	TM_PeriodDuration (B.4.5)
146.	updateScope	maintScp	scope of data to which maintenance is applied	O	N	Class	MD_ScopeCode <<CodeList>> (B.5.25)
147.	updateScopeDescription	upScpDesc	additional information about the range or extent of the resource	O	N	Class	MD_ScopeDescription <<Union>> (B.2.5.1)
148.	maintenanceNote	maintNote	information regarding specific requirements for maintaining the resource	O	N	CharacterString	Free text

**B.2.5.1 Scope description information**

149.	MD_ScopeDescription	ScpDesc	description of the class of information covered by the information	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	Lines 150-155
150.	attributes	attribSet	attributes to which the information applies	C / features, featureInstances, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_AttributeType (B.4.4)
151.	features	featSet	features to which the information applies	C / attributes, featureInstances, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_FeatureType (B.4.4)

152.	featureInstances	featIntSet	feature instances to which the information applies	C / attributes, features, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_FeatureType (B.4.4)
153.	attributeInstances	attribIntSet	attribute instances to which the information applies	C / attributes, features, featureInstances, dataset and other not documented?	1	Set (B.4.7)	GF_AttributeType (B.4.4)
154.	dataset	datasetSet	dataset to which the information applies	C / attributes, features, featureInstances, attributeInstances, and other not documented?	1	CharacterString	Free text
155.	other	other	class of information that does not fall into the other categories to which the information applies	C / attributes, features, featureInstances, attributeInstances, and dataset not documented?	1	CharacterString	Free text

### B.2.6 Spatial representation information (includes grid and vector representation)

- UML model shown in Figure A.8

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
156.	<i>MD_SpatialRepresentation</i>	SpatRep	digital mechanism used to represent spatial information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	
157.	MD_GridSpatialRepresentation	GridSpatRep	information about grid spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	Lines 158-161
158.	numberOfDimensions	numDims	number of independent spatial-temporal axes	M	1	Integer	Integer
159.	axisDimensionsProperties	axDimProps	information about spatial-temporal axis properties	M	1	Sequence (B.4.7)	MD_Dimension <<DataType>> (B.2.6.1)
160.	cellGeometry	cellGeo	identification of grid data as point or cell	M	1	Class	MD_CellGeometryCode <<CodeList>> (B.5.9)
161.	transformationParameterAvailability	tranParaAv	indication of whether or not parameters for transformation exists	M	1	Boolean	1 = yes 0 = no

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162.	MD_Georectified	Georect	grid whose cells are regularly spaced in a geographic (i.e., lat / long) or map coordinate system defined in the Spatial Referencing System (SRS) so that any cell in the grid can be geolocated given its grid coordinate and the grid origin, cell spacing, and orientation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified (MD_GridSpatialRepresentation)	Lines 163-170 and 158-161
163.	checkPointAvailability	chkPtAv	indication of whether or not geographic position points are available to test the accuracy of the georeferenced grid data	M	1	Boolean	1 = yes 0 = no
164.	checkPointDescription	chkPtDesc	description of geographic position points used to test the accuracy of the georeferenced grid data	C / checkPointAvailability equals "yes"?	1	CharacterString	Free text
165.	cornerPoints	cornerPts	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cells at opposite ends of grid coverage along two diagonals in the grid spatial dimensions. There are four corner points in a georectified grid; at least two corner points along one diagonal are required	M	1	Sequence (B.4.7)	GM_Point <<Type>> (B.4.6)
166.	centerPoint	centerPt	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cell halfway between opposite ends of the grid in the spatial dimensions	O	1	Class	GM_Point <<Type>> (B.4.6)
167.	pointInPixel	ptInPixel	point in a pixel corresponding to the Earth location of the pixel	M	1	Class	MD_PixelOrientationCode <<Enumeration>> (B.5.22)
168.	transformationDimensionDescription	transDimDesc	description of the information about which grid dimensions are the spatial dimensions	O	1	CharacterString	Free text
169.	transformationDimensionMapping	transDimMap	information about which grid dimensions are the spatial dimensions	O	2	CharacterString	Free text
170.	MD_Georeferenceable	Georef	grid with cells irregularly spaced in any given geographic/map projection coordinate system, whose individual cells can be geolocated using geolocation information supplied with the data but cannot be geolocated from the grid properties alone	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_GridSpatialRepresentation)	Lines 171-175 and 158-161
171.	controlPointAvailability	ctrlPtAv	indication of whether or not control point(s) exists	M	1	Boolean	1 = yes 0 = no
172.	orientationParameterAvailability	orieParaAv	indication of whether or not orientation parameters are available	M	1	Boolean	1 = yes 0 = no
173.	orientationParameterDescription	orieParaDs	description of parameters used to describe sensor orientation	O	1	CharacterString	Free text
174.	parameters	georefPars	terms which support grid data georeferencing	M	1	Class	Record (B.4.3)

175.	parameterCitation	paraCit	reference providing description of the parameters	O	N	Class	CI_Citation <<DataType>> (B.3.2)
176.	MD_VectorSpatialRepresentation	VectSpatRep	information about the vector spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	Lines 177-178
177.	topologyLevel	topLvl	code which identifies the degree of complexity of the spatial relationships	O	1	Class	MD_TopologyLevelCode <<CodeList>> (B.5.28)
178.	geometricObjects	geometObjs	information about the geometric objects used in the dataset	O	N	Class	MD_GeometricObjects <<DataType>> (B.2.6.2)

#### B.2.6.1 Dimension information

179.	MD_Dimension	Dimen	axis properties	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 180-182
180.	dimensionName	dimName	name of the axis	M	1	Class	MD_DimensionNameTypeCode <<CodeList>> (B.5.14)
181.	dimensionSize	dimSize	number of elements along the axis	M	1	Integer	Integer
182.	resolution	dimResol	degree of detail in the grid dataset	O	1	Class	Measure (B.4.3)

#### B.2.6.2 Geometric object information

183.	MD_GeometricObjects	GeometObjs	number of objects, listed by geometric object type, used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 184-185
184.	geometricObjectType	geoObjTyp	name of point and vector spatial objects used to locate zero-, one-, and two-dimensional spatial locations in the dataset	M	1	Class	MD_GeometricObjectTypeCode <<CodeList>> (B.5.15)
185.	geometricObjectCount	geoObjCnt	total number of the point or vector object type occurring in the dataset	O	1	Integer	> 0

**B.2.7 Reference system information (includes temporal, coordinate and geographic identifiers)**

- UML model shown in Figure A.9

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
186.	MD_ReferenceSystem	RefSystem	information about the reference system.	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 187-188
187.	referenceSystemIdentifier	refSysID	name of reference system	C / MD_CRS.projection, MD_CRS.ellipsoid, and MD_CRS.datum not documented?	1	Class	RS_Identifier (B.2.7.2)
188.	<i>role name (derived): /Reference System</i>	derRefSys	relationship indicating that MD_ReferenceSystem (as well as its attributes and aggregates) is derived from RS_ReferenceSystem	(Not applicable)	(Not applicable)	Derived Association	RS_ReferenceSystem <<Abstract>> (B.2.7)
189.	MD_CRS	MdCoRefSys	metadata about a coordinate system in which attributes have been derived from SC_CRS as defined in ISO 19111 – Spatial referencing by coordinates	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ReferenceSystem)	Lines 190-194 and 187-188
190.	projection	projection	identity of the projection used	O	1	Class	RS_Identifier (B.2.7.2)
191.	ellipsoid	ellipsoid	identity of the ellipsoid used	O	1	Class	RS_Identifier (B.2.7.2)
192.	datum	datum	identity of the datum used	O	1	Class	RS_Identifier (B.2.7.2)
193.	<i>role name: ellipsoidParameters</i>	ellParas	set of parameters that describe the ellipsoid	O	1	Association	MD_EllipsoidParameters (B.2.7.1)
194.	<i>role name: projectionParameters</i>	projParas	set of parameters that describe the projection	O	1	Association	MD_ProjectionParameters (B.2.7.5)
195.	<i>RS_ReferenceSystem</i>	RefSys	description of the spatial and temporal reference systems used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Abstract>>	Lines 196-197
196.	name	refSysName	name of reference system used	M	1	Class	RS_Identifier (B.2.7.2)
197.	domainOfValidity	domOValid	range which is valid for the reference system	O	N	Class	EX_Extent <<DataType>> (B.3.1)

198.	TM_ReferenceSystem	TMRefSys	documented in ISO 19108 – Temporal schema	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem)	Lines 196-197
199.	SI_SpatialReferenceSystemUsingGeographicIdentifiers	SIRefSys	documented in ISO 19112 – Spatial referencing by geographic identifiers	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem)	Lines 196-197
200.	SC_CRS	SCRefSys	documented in ISO 19111 – Spatial referencing by coordinates	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem) <<Abstract>>	Lines 196-197

### B.2.7.1 Ellipsoid parameter information

201.	MD_EllipsoidParameters	EllParas	set of parameters that describe the ellipsoid	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CRS)	Lines 202-204
202.	semiMajorAxis	semiMajAx	radius of the equatorial axis of the ellipsoid	M	1	Real	> 0.0

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203.	axisUnits	axisUnits	units of the semi-major axis	M	1	Class	UomLength (B.4.3)
204.	denominatorOfFlatteningRatio	denFlatRatio	ratio of the difference between the equatorial and polar radii of the ellipsoid to the equatorial radius when the numerator is set to 1	C / not a spheroid?	1	Real	> 0,0

**B.2.7.2 Identifier information**

205.	MD_Identifier	MdIdent	value uniquely identifying an object within a namespace	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	Lines 206-207
206.	authority	identAuth	person or party responsible for maintenance of the namespace	O	1	Class	CI_Citation <<DataType>> (B.3.2)
207.	code	identCode	alphanumeric value identifying an instance in the namespace	M	1	CharacterString	Free text
208.	RS_Identifier	Rsident	identifier used for reference systems	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identifier)	Lines 206-207

**B.2.7.3 Oblique line azimuth information**

209.	MD_ObliqueLineAzimuth	ObLineAzi	method used to describe the line along which an oblique mercator map projection is centred using the map projection origin and an azimuth	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ProjectionParameters)	Lines 210-211
210.	azimuthAngle	aziAngle	angle measured clockwise from north, and expressed in degrees	M	1	Real	Real
211.	azimuthMeasurePointLongitude	aziPtLongitude	longitude of the map projection origin	M	1	Real	Real

**B.2.7.4 Oblique line point information**

212.	MD_ObliqueLinePoint	ObLinePt	method used to describe the line along which an oblique mercator map projection is centred using two points near the limits of the mapped region that define the centre line	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ProjectionParameters)	Lines 213-214
213.	obliqueLineLatitude	obLineLat	latitude of a point defining the oblique line	M	1	Real	Real
214.	obliqueLineLongitude	obLineLong	longitude of a point defining the oblique line	M	1	Real	Real

**B.2.7.5 Projection parameter information**

215.	MD_ProjectionParameters	ProjParas	set of parameters that describe the projection	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CRS)	Lines 216-231
216.	zone	zone	unique identifier for 100,000 metre grid zone	O	1	Integer	Integer
217.	standardParallel	stanParal	line of constant latitude at which the surface of the Earth and the plane or developable surface intersect	O	2	Real	Real
218.	longitudeOfCentralMeridian	longCntMer	line of longitude at the centre of a map projection generally used as the basis for constructing the projection	O	1	Real	Real
219.	latitudeOfProjectionOrigin	latProjOri	latitude chosen as the origin of rectangular coordinates for a map projection	O	1	Real	Real
220.	falseEasting	falseEastng	value added to all "x" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units	O	1	Real	Real
221.	falseNorthing	falseNorthng	value added to all "y" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units	O	1	Real	Real
222.	falseEastingNorthingUnits	falseENUnits	units of false northing and false easting	O	1	Class	UomLength (B.4.3)

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223.	scaleFactorAtEquator	sclFacEqu	ratio between physical distance and corresponding map distance, along the equator	O	1	Real	> 0,0
224.	heightOfProspectivePointAboveSurface	hgtProsPt	height of viewpoint above the Earth, expressed in metres	O	1	Real	>0,0
225.	longitudeOfProjectionCenter	longProjCnt	longitude of the point of projection for azimuthal projections	O	1	Real	Real
226.	latitudeOfProjectionCenter	latProjCnt	latitude of the point of projection for azimuthal projections	O	1	Real	Real
227.	scaleFactorAtCenterLine	sclFacCnt	ratio between physical distance and corresponding map distance, along the centre line	O	1	Real	Real
228.	straightVerticalLongitudeFromPole	stVrLongPl	longitude to be oriented straight up from the North or South Pole	O	1	Real	Real
229.	scaleFactorAtProjectionOrigin	sclFacPrOr	multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance at the projection origin	O	1	Real	Real
230.	<i>role name:</i> obliqueLineAzimuthParameter	obLnAziPars	parameters describing the oblique line azimuth	O	1	Association	MD_ObliqueLineAzimuth (B.2.7.3)
231.	<i>role name:</i> obliqueLinePointParameter	obLnPtPars	parameters describing the oblique line point	O	2	Association	MD_ObliqueLinePoint (B.2.7.4)

**B.2.8 Content information (includes Feature catalogue and Coverage descriptions)**

- UML model shown in Figure A.10

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
232.	MD_ContentInformation	ContInfo	description of the content of a dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	
233.	MD_FeatureCatalogueDescription	FetCatDesc	information identifying the feature catalogue	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	Lines 234-238
234.	complianceCode	compCode	indication of whether or not the cited feature catalogue complies with ISO 19110	O	1	Boolean	0-not compliant 1-compliant

235.	language	catLang	language(s) used within the catalogue	O	N	CharacterString	ISO 639-2, other parts can be used
236.	includedWithDataset	incWithDS	indication of whether or not the feature catalogue is included with the dataset	M	1	Boolean	0=no 1=yes
237.	featureTypes	catFetTypes	subset of feature types from cited feature catalogue occurring in dataset	O	N	Class	GenericName (B.4.8)
238.	featureCatalogueCitation	catCitation	complete bibliographic reference to one or more external feature catalogues	M	N	Class	CI_Citation <<DataType>> (B.3.2)
239.	MD_CoverageDescription	CovDesc	information about the content of a grid data cell	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	Lines 240-242
240.	attributeDescription	attDesc	description of the attribute described by the measurement value	M	1	Class	RecordType <<Metaclass>> (B.4.3)
241.	contentType	contentType	type of information represented by the cell value	M	1	Class	MD_CoverageContentTypeCode <<CodeList>> (B.5.12)
242.	<i>Role name:</i> dimension	covDim	information on the dimensions of the cell measurement value	O	N	Class	MD_RangeDimension (B.2.8.1)
243.	MD_ImageDescription	ImgDesc	information about an image's suitability for use	O	Use maximum occurrence from referencing object	Specified Class (MD_CoverageDescription)	Lines 244-255 and 241-242
244.	illuminationElevationAngle	illElevAng	illumination elevation measured in degrees clockwise from the target plane at intersection of the optical line of sight with the Earth's surface. For images from a scanning device, refer to the centre pixel of the image	O	1	Real	-90 – 90
245.	illuminationAzimuthAngle	illAziAng	illumination azimuth measured in degrees clockwise from true north at the time the image is taken. For images from a scanning device, refer to the centre pixel of the image	O	1	Real	0.00 – 360
246.	imagingCondition	imagCond	conditions affected the image	O	1	Class	MD_ImagingConditionCode <<CodeList>> (B.5.16)
247.	imageQualityCode	imagQuCode	specifies the image quality	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)
248.	cloudCoverPercentage	cloudCovPer	area of the dataset obscured by clouds, expressed as a percentage of the spatial extent	O	1	Real	0.0 – 100.0
249.	processingLevelCode	prcTypCde	image distributor's code that identifies the level of radiometric and geometric processing that has been applied	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)

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250.	compressionGenerationQuantity	cmpGenQuan	count of the number the number of lossy compression cycles performed on the image	O	1	Integer	Integer
251.	triangulationIndicator	trianInd	indication of whether or not triangulation has been performed upon the image	O	1	Boolean	0-no 1-yes
252.	radiometricCalibrationDataAvailability	radCalDatAv	indication of whether or not the radiometric calibration information for generating the radiometrically calibrated standard data product is available	O	1	Boolean	0-no 1-yes
253.	cameraCalibrationInformationAvailability	camCallnAv	indication of whether or not constants are available which allow for camera calibration corrections	O	1	Boolean	0-no 1-yes
254.	filmDistortionInformationAvailability	filmDistlnAv	indication of whether or not Calibration Reseau information is available	O	1	Boolean	0-no 1-yes
255.	lensDistortionInformationAvailability	lensDistlnAv	indication of whether or not lens aberration correction information is available	O	1	Boolean	0-no 1-yes

**B.2.8.1 Range dimension information (includes Band information)**

256.	MD_RangeDimension	RangeDim	information on the range of each dimension of a cell measurement value	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CoverageDescription)	Lines 257-258
257.	sequenceIdentifier	seqID	number that uniquely identifies instances of bands of wavelengths on which a sensor operates	O	1	Class	MemberName (B.4.8)
258.	descriptor	dimDescrp	description of the range of a cell measurement value	O	1	CharacterString	Free text
259.	MD_Band	Band	range of wavelengths in the electromagnetic spectrum	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_RangeDimension)	Lines 260-267 and 257-258
260.	maxValue	maxVal	longest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	Real
261.	minValue	minVal	shortest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	Real
262.	units	valUnit	units in which sensor wavelengths are expressed	C / minValue or maxValue provided?	1	Class	UomLength (B.4.3)

263.	peakResponse	pkResp	wavelength at which the response is the highest	O	1	Real	Real
264.	bitsPerValue	bitsPerVal	maximum number of significant bits in the uncompressed representation for the value in each band of each pixel	O	1	Integer	Integer
265.	toneGradation	toneGrad	number of discrete numerical values in the grid data	O	1	Integer	Integer
266.	scaleFactor	sclFac	scale factor which has been applied to the cell value	O	1	Real	Real
267.	offset	offset	the physical value corresponding to a cell value of zero	O	1	Real	Real

### B.2.9 Portrayal catalogue information

- UML model shown in Figure A.11

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
268.	MD_PortrayalCatalogueReference	PortCatRef	information identifying the portrayal catalogue used	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Line 269
269.	portrayalCatalogueCitation	portCatCit	bibliographic reference to the portrayal catalogue cited	M	N	Class	CI_Citation <<Data Type>> (B.3.2)

### B.2.10 Distribution information

- UML model shown in Figure A.12

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
270.	MD_Distribution	Distrib	information about the distributor of and options for obtaining the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 271-273

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	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
271.	<i>Role name:</i> distributionFormat	distFormat	provides a description of the format of the data to be distributed	C / MD_Distributor.distributorFormat not documented?	N	Association	MD_Format (B.2.10.3)
272.	<i>Role name:</i> distributor	distributor	provides information about the distributor	O	N	Association	MD_Distributor (B.2.10.2)
273.	<i>Role name:</i> transferOptions	distTranOps	provides information about technical means and media by which a resource is obtained from the distributor	O	N	Association	MD_DigitalTransferOptions (B.2.10.1)

**B.2.10.1 Digital transfer options information**

274.	MD_DigitalTransferOptions	DigTranOps	technical means and media by which a resource is obtained from the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Distributor)	Lines 275-278
275.	unitsOfDistribution	unitsODist	tiles, layers, geographic areas, etc., in which data is available	O	1	CharacterString	Free text
276.	transferSize	transSize	estimated size of a unit in the specified transfer format, expressed in megabytes. The transfer size is > 0.0	O	1	Real	> 0.0
277.	onLine	onLineSrc	information about online sources from which the resource can be obtained	O	N	Class	CI_OnLineResource <<DataType>> (B.3.2.4)
278.	offLine	offLineMed	information about offline media on which the resource can be obtained	O	1	Class	MD_Medium <<DataType>> (B.2.10.4)

**B.2.10.2 Distributor information**

279.	MD_Distributor	Distributor	information about the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution)	Lines 280-283
280.	distributorContact	distorCont	party from whom the resource may be obtained. This list need not be exhaustive	M	1	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
281.	<i>Role name:</i> distributionOrderProcess	distorOrdPrc	provides information about how the resource may be obtained, and related instructions and fee information	O	N	Association	MD_StandardOrderProcess (B.2.10.5)

282.	<i>Role name:</i> distributorFormat	distorFormat	provides information about the format used by the distributor	C / MD_Distribution.distrib ionFormat not documented?	N	Association	MD_Format (B.2.10.3)
283.	<i>Role name:</i> distributorTransferOptions	distorTran	provides information about the technical means and media used by the distributor	O	N	Association	MD_DigitalTransferOptions (B.2.10.1)

### B.2.10.3 Format information

284.	MD_Format	Format	description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Identification)	Lines 285-290
285.	name	formatName	name of the data transfer format(s)	M	1	CharacterString	Free text
286.	version	formatVer	version of the format (date, number, etc.)	M	1	CharacterString	Free text
287.	amendmentNumber	formatAmdNum	amendment number of the format version	O	1	CharacterString	Free text
288.	specification	formatSpec	name of a subset, profile, or product specification of the format	O	1	CharacterString	Free text
289.	fileDecompression Technique	fileDecmTech	recommendations of algorithms or processes that can be applied to read or expand resources to which compression techniques have been applied	O	1	CharacterString	Free text
290.	<i>Role name:</i> formatDistributor	formatDist	provides information about the distributor's format	O	N	Association	MD_Distributor (B.2.10.2)

### B.2.10.4 Medium information

291.	MD_Medium	Medium	information about the media on which the resource can be distributed	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 292-297
292.	name	medName	name of the medium on which the resource can be received	O	1	Class	MD_MediumNameCode <<CodeList>> (B.5.20)
293.	density	medDensity	density at which the data is recorded	O	N	Real	> 0,0
294.	densityUnits	medDenUnits	units of measure for the recording density	C / density documented?	1	CharacterString	Free text

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295.	volumes	medVol	number of items in the media identified	O	1	Integer	> 0,0
296.	mediumFormat	medFormat	method used to write to the medium	O	N	Class	MD_MediumFormatCode <<CodeList>> (B.5.19)
297.	mediumNote	medNote	description of other limitations or requirements for using the medium	O	1	CharacterString	Free text

### B.2.10.5 Standard order process information

298.	MD_StandardOrderProcesses	StanOrdProcs	common ways in which the resource may be obtained or received, and related instructions and fee information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distributor)	Lines 299-302
299.	fees	resFees	fees and terms for retrieving the resource. Include monetary units (as specified in ISO 4217)	O	1	CharacterString	Free text
300.	plannedAvailableDateTime	planAvDtTm	date and time when the dataset will be available	O	1	Class	DateTime (B.4.2)
301.	orderingInstructions	ordInstr	general instructions, terms and services provided by the distributor	O	1	CharacterString	Free text
302.	turnaround	ordTurn	typical turnaround time for the filling of an order	O	1	CharacterString	Free text

### B.2.11 Metadata extension information

- UML model shown in Figure A.13

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
303.	MD_MetadataExtensionInformation	MdExtInfo	information describing metadata extensions	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 304-305

304.	extensionOnLineResource	extOnRes	information about on-line sources containing the community profile name and the extended metadata elements. Information for all new metadata elements	O	1	Class	Cl_OnLineResource <<Data Type>> (B.3.2.4)
305.	<i>Role name:</i> extendedElementInformation	extEleInfo	provides information about a new metadata element, not found in ISO 19115, which is required to describe geographic data	O	N	Association	MD_ExtendedElementInformation (B.2.11.1)

### B.2.11.1 Extended element information

306.	MD_ExtendedElementInformation	ExtEleInfo	new metadata element, not found in ISO 19115, which is required to describe geographic data	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_MetadataExtensionInformation)	Lines 307-319
307.	name	extEleName	name of the extended metadata element.	M	1	CharacterString	Free text
308.	shortName	extShortName	short form suitable for use in an implementation method such as XML or SCML. NOTE other methods may be used	C / dataType notEqual "codelistElement"?	1	CharacterString	Free text
309.	domainCode	extDomCode	three digit code assigned to the extended element	C / is dataType "codelistElement"?	1	Integer	Integer
310.	definition	extEleDef	definition of the extended element	M	1	CharacterString	Free text
311.	obligation	extEleOb	obligation of the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	Class	MD_ObligationCode <<enumeration>> (B.5.21)
312.	condition	extEleCond	condition under which the extended element is mandatory	C / obligation = "Conditional"?	1	CharacterString	Free text
313.	dataType	eleDataType	code which identifies the kind of value provided in the extended element	M	1	Class	MD_DatatypeCode <<CodeList>> (B.5.13)
314.	maximumOccurrence	extEleMxOc	maximum occurrence of the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	CharacterString	N or any integer
315.	domainValue	extEleDomVal	valid values that can be assigned to the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	CharacterString	Free text
316.	parentEntity	extEleParEnt	name of the metadata entity(s) under which this extended metadata element may appear. The name(s) may be standard metadata element(s) or other extended metadata element(s).	M	N	CharacterString	Free text

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317.	rule	extEleRule	specifies how the extended element relates to other existing elements and entities	M	1	CharacterString	Free text
318.	rationale	extEleRat	reason for creating the extended element	O	N	CharacterString	Free text
319.	source	extEleSrc	name of the person or organization creating the extended element	M	N	Class	CI_ResponsibleParty <<Data Type>> (B.3.2)

### B.2.12 Application schema information

- UML model shown in Figure A.14

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
320.	MD_ApplicationSchemaInformation	AppSchInfo	information about the application schema used to build the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 321-328
321.	name	asName	name of the application schema used	M	1	Class	CI_Citation <<Data Type>> (B.3.2)
322.	schemaLanguage	asSchLang	identification of the schema language used	M	1	CharacterString	Free text
323.	constraintLanguage	asCstLang	formal language used in Application Schema	M	1	CharacterString	Free text
324.	schemaAscii	asAscii	full application schema given as an ASCII file	O	1	CharacterString	Free text
325.	graphicsFile	asGraFile	full application schema given as a graphics file	O	1	CharacterString	Free text
326.	softwareDevelopmentFile	asSwDevFile	full application schema given as a software development file	O	1	Binary	Binary
327.	softwareDevelopmentFileFormat	asSwDevFiFt	software dependent format used for the application schema software dependent file	O	1	CharacterString	Free text
328.	<i>Role name:</i> featureCatalogueSupplement	featCatSup	information about the spatial attributes in the application schema for the feature types	O	1	Association	MD_SpatialAttributeSupplement (B.2.12.2)

**B.2.12.1 Feature type list information**

329.	MD_FeatureTypeList	FeatTypList	list of names of feature types with the same spatial representation (same as spatial attributes)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_SpatialAttributeSupplement)	Lines 330-331
330.	spatialObject	spatObj	instance of a type defined in the spatial schema	M	1	CharacterString	Free text
331.	spatialSchemaName	spatSchName	name of the spatial schema used	M	1	CharacterString	Free text

**B.2.12.2 Spatial attribute supplement information**

332.	MD_SpatialAttributeSupplement	SpatAttSup	spatial attributes in the application schema for the feature types	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ApplicationSchemaInfo)	Line 333
333.	<i>Role name:</i> theFeatureTypeList	featTypeList	provides information about the list of feature types with the same spatial representation	M	N	Association	MD_FeatureTypeList (B.2.12.1)

**B.3 Data type information****B.3.1 Extent information**

- UML model shown in Figure A.15

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
334.	EX_Extent	Extent	information about spatial, vertical, and temporal extent	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 335-338

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335.	description	exDesc	spatial and temporal extent for the referring object	C / geographicElement and temporalElement and verticalElement not documented?	1	CharacterString	Free text
336.	<i>Role name:</i> geographicElement	geoEle	provides geographic component of the extent of the referring object	C / description and temporalElement and verticalElement not documented?	N	Association	EX_GeographicExtent <<Abstract>> (B.3.1.1)
337.	<i>Role name:</i> temporalElement	tempEle	provides temporal component of the extent of the referring object	C / description and geographicElement and verticalElement not documented?	N	Association	EX_TemporalExtent (B.3.1.2)
338.	<i>Role name:</i> verticalElement	vertEle	provides vertical component of the extent of the referring object	C / description and geographicElement and temporalElement not documented?	N	Association	EX_VerticalExtent (B.3.1.3)

**B.3.1.1 Geographic extent information**

339.	EX_GeographicExtent	GeoExtent	geographic area of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent and EX_SpatialTemporalExtent) <<Abstract>>	Line 340
340.	extentTypeCode	exTypeCode	indication of whether the bounding polygon encompasses an area covered by the data or an area where data is not present	O	1	Boolean	0 – exclusion 1 – inclusion
341.	EX_BoundingPolygon	BoundPoly	boundary enclosing the dataset, expressed as the closed set of (x,y) coordinates of the polygon (last point replicates first point)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Line 342 and 340
342.	polygon	polygon	sets of points defining the bounding polygon	M	N	GM_Object (B.4.6)	-90 to 90 latitude -180 to 180 longitude
343.	EX_GeographicBoundingBox	GeoBndBox	geographic position of the dataset NOTE This is only an approximate reference so specifying the co-ordinate system is unnecessary	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Lines 344-347 and 340
344.	westBoundLongitude	westBL	western-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Angle (B.4.3)	-180.0 <= West Bounding Longitude Value <= 180.0

345.	eastBoundLongitude	eastBL	eastern-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Angle (B.4.3)	-180.0 <= East Bounding Longitude Value <= 180.0
346.	southBoundLatitude	southBL	southern-most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90.0 <= South Bounding Latitude Value <= 90.0; South Bounding Latitude Value <= North bounding Latitude Value
347.	northBoundLatitude	northBL	northern-most, coordinate of the limit of the dataset extent expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90.0 <= North Bounding Latitude Value <= 90.0; North Bounding Latitude Value >= South Bounding Latitude Value
348.	EX_GeographicDescription	GeoDesc	Description of the geographic area using identifiers	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Line 349 and 340
349.	geographicIdentifier	geoid	identifier used to represent a geographic area	M	1	Class	MD_Identifier (B.2.7.2)

### B.3.1.2 Temporal extent information

350.	EX_TemporalExtent	TempExtent	time period covered by the content of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	Line 351
351.	extent	exTemp	date and time for the content of the dataset	M	1	Class	TM_Primitive (B.4.5)
352.	EX_SpatialTemporalExtent	SpatTempExt	extent with respect to date/time and spatial boundaries	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_TemporalExtent)	Line 353 and 351
353.	role name: spatialExtent	exSpat	spatial extent component of composite spatial and temporal extent	M	N	Association	EX_GeographicExtent <<Abstract>> (B.3.1.f)

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**B.3.1.3 Vertical extent information**

354.	EX_VerticalExtent	VertExtent	vertical domain of dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	Lines 355-358
355.	minimumValue	vertMinVal	lowest vertical extent contained in the dataset	M	1	Real	Real
356.	maximumValue	vertMaxVal	highest vertical extent contained in the dataset	M	1	Real	Real
357.	unitOfMeasure	vertUoM	vertical units used for vertical extent information Examples: metres, feet, millimetres, hectopascals	M	1	CharacterString	UomLength (B.4.3)
358.	<i>role name:</i> verticalDatum	vertDatum	provides information about the origin from which the maximum and minimum elevation values are measured	M	1	Association	SC_VerticalDatum (B.4.9)

**B.3.2 Citation and responsible party information**

- UML model shown in Figure A.16

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
359.	CI_Citation	Citation	standardized resource reference	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 360-373
360.	title	resTitle	name by which the cited resource is known	M	1	CharacterString	Free text
361.	alternateTitle	resAltTitle	short name or other language name by which the cited information is known. Example: "DCW" as an alternative title for "Digital Chart of the World"	O	N	CharacterString	Free text
362.	date	resRefDate	reference date for the cited resource	M	N	Class	CI_Date (B.3.2.3) <<DataType>>
363.	edition	resEd	version of the cited resource	O	1	CharacterString	Free text
364.	editionDate	resEdDate	date of the edition	O	1	Class	Date (B.4.2)

365.	identifier	citId	unique identifier for the resource EXAMPLE: Universal Product Code (UPC), National Stock Number (NSN)	O	N	CharacterString	Free text
366.	identifierType	citIdType	reference form of the unique identifier (ID) Example: Universal Product Code (UPC), National Stock Number (NSN)	O	N	CharacterString	Free text
367.	citedResponsibleParty	citRespParty	name and position information for an individual or organization that is responsible for the resource	O	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
368.	presentationForm	presForm	mode in which the resource is represented	O	N	Class	CI_PresentationFormCode <<CodeList>> (B.5.4)
369.	series	datasetSeries	information about the series, or aggregate dataset, of which the dataset is a part	O	1	Class	CI_Series <<DataType>> (B.3.2.5)
370.	otherCitationDetails	otherCitDet	other information required to complete the citation that is not recorded elsewhere	O	1	CharacterString	Free text
371.	collectiveTitle	collTitle	common title with holdings note NOTE title identifies elements of a series collectively, combined with information about what volumes are available at the source cited	O	1	CharacterString	Free text
372.	ISBN	isbn	international Standard Book Number	O	1	CharacterString	Free text
373.	ISSN	issn	international Standard Serial Number	O	1	CharacterString	Free text
374.	CI_ResponsibleParty	RespParty	identification of, and means of communication with, person(s) and organizations associated with the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 375-379
375.	individualName	rpIndName	name of the responsible person- surname, given name, title separated by a delimiter	C / organisationName and positionName not documented?	1	CharacterString	Free text
376.	organisationName	rpOrgName	name of the responsible organization	C / individualName and positionName not documented?	1	CharacterString	Free text
377.	positionName	rpPosName	role or position of the responsible person	C / individualName and organisationName not documented?	1	CharacterString	Free text
378.	contactInfo	rpCntInfo	address of the responsible party	O	1	Class	CI_Contact <<DataType>> (B.3.2.2)
379.	role	role	function performed by the responsible party	M	1	Class	CI_RoleCode <<CodeList>> (B.5.5)

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**B.3.2.1 Address information**

380.	CI_Address	Address	location of the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 381-386
381.	deliveryPoint	delPoint	address line for the location (as described in ISO 11180, annex A)	O	N	CharacterString	Free text
382.	city	city	city of the location	O	1	CharacterString	Free text
383.	administrativeArea	adminArea	state, province of the location	O	1	CharacterString	Free text
384.	postalCode	postCode	ZIP or other postal code	O	1	CharacterString	Free text
385.	country	country	country of the physical address	O	1	CharacterString	ISO 3166-3, other parts may be used
386.	electronicMailAddress	eMailAdd	address of the electronic mailbox of the responsible organization or individual	O	N	CharacterString	Free text

**B.3.2.2 Contact information**

387.	CI_Contact	Contact	information required to enable contact with the responsible person and/or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 388-392
388.	phone	cntPhone	telephone numbers at which the organization or individual may be contacted	O	1	Class	CI_Telephone <<Data Type>> (B.3.2.6)
389.	address	cntAddress	physical and email address at which the organization or individual may be contacted	O	1	Class	CI_Address <<Data Type>> (B.3.2.1)
390.	onLineResource	cntOnlineRes	on-line information that can be used to contact the individual or organization	O	1	Class	CI_OnLineResource <<Data Type>> (B.3.2.4)
391.	hoursOfService	cntHours	time period (including time zone) when individuals can contact the organization or individual	O	1	CharacterString	Free text
392.	contactInstructions	cntInstr	supplemental instructions on how or when to contact the individual or organization	O	1	CharacterString	Free text

**B.3.2.3 Date information**

393.	CI_Date	DateRef	reference date and event used to describe it	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 394-395
394.	date	refDate	reference date for the cited resource	M	1	Class	Date (B.4.2)
395.	dateType	refDateType	event used for reference date	M	1	Class	CI_DateTypeCode <<CodeList>> (B.5.2)

**B.3.2.4 OnLine resource information**

396.	CI_OnLineResource	OnlineRes	information about on-line sources from which the dataset, specification, or community profile name and extended metadata elements can be obtained	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 397-402
397.	linkage	linkage	location (address) for on-line access using a Uniform Resource Locator address or similar addressing scheme such as <a href="http://www.stalkart.no/fsotc211">http://www.stalkart.no/fsotc211</a>	M	1	Class	URL (IETF RFC1738 IETF RFC 2056)
398.	protocol	protocol	connection protocol to be used	O	1	CharacterString	Free text
399.	applicationProfile	appProfile	name of an application profile that can be used with the online resource	O	1	CharacterString	Free text
400.	name	orName	name of the online resource	O	1	CharacterString	Free text
401.	description	orDesc	detailed text description of what the online resource is/does	O	1	CharacterString	Free text
402.	function	orFunct	code for function performed by the online resource	O	1	Class	CI_OnLineFunctionCode <<CodeList>> (B.5.3)

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**B.3.2.5 Series information**

403.	CI_Series	DatasetSeries	information about the series, or aggregate dataset, to which a dataset belongs	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 404-406
404.	name	seriesName	name of the series, or aggregate dataset, of which the dataset is a part	O	1	CharacterString	Free text
405.	issueidentification	issId	information identifying the issue of the series	O	1	CharacterString	Free text
406.	page	artPage	details on which pages of the publication the article was published	O	1	CharacterString	Free text

**B.3.2.6 Telephone information**

407.	CI_Telephone	Telephone	telephone numbers for contacting the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 408-409
408.	voice	voiceNum	telephone number by which individuals can speak to the responsible organization or individual	O	N	CharacterString	Free text
409.	facsimile	faxNum	telephone number of a facsimile machine for the responsible organization or individual	O	N	CharacterString	Free text

## Appendix 4.2.2: ISO 19115 Metadata Dictionary

### B.2 Metadata package data dictionaries

#### B.2.1 Metadata entity set information

- UML model shown in Figure A.1

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
1.	MD_Metadata	Metadata	root entity which defines metadata about a resource or resources	M	1	Class	Lines 2-22
2.	fileIdentifier	mdFileID	unique identifier for this metadata file	O	1	CharacterString	Free text
3.	language	mdLang	language used for documenting metadata	C / not defined by encoding?	1	CharacterString	ISO 639-2, other parts may be used
4.	characterSet	mdChar	full name of the character coding standard used for the metadata set	C / ISO/IEC 10646-1 not used and not defined by encoding	1	Class	MD_CharacterSetCode <<CodeList>> (B.5.10)
5.	parentIdentifier	mdParentID	file identifier of the metadata to which this metadata is a subset (child)	O	1	CharacterString	Free text
6.	hierarchyLevel	mdHrLv	scope to which the metadata applies (see annex H for more information about metadata hierarchy levels)	C/ hierarchyLevel is not equal to "dataset"?	N	Class	MD_ScopeCode <<CodeList>> (B.5.25)
7.	hierarchyLevelName	mdHrLvName	name of the hierarchy levels for which the metadata is provided	O	N	CharacterString	Free text
8.	contact	mdContact	party responsible for the metadata information	M	1	Class	CI_ResponsibleParty (B.3.2) <<Data Type>>
9.	dateStamp	mdDateSt	date that the metadata was created	M	1	Class	Date (B.4.2)
10.	metadataStandardName	mdStanName	name of the metadata standard (including profile name) used	O	1	CharacterString	Free text
11.	metadataStandardVersion	mdStanVer	version (profile) of the metadata standard used	O	1	CharacterString	Free text
12.	<i>Role name:</i> spatialRepresentationInfo	spatReplInfo	digital representation of spatial information in the dataset	O	N	Association	MD_SpatialRepresentation <<Abstract>> (B.2.6)
13.	<i>Role name:</i> referenceSystemInfo	refSysInfo	description of the spatial and temporal reference systems used in the dataset	O	N	Association	MD_ReferenceSystem (B.2.7)
14.	<i>Role name:</i> metadataExtensionInfo	mdExtlInfo	information describing metadata extensions	O	N	Association	MD_MetadataExtensionInformation (B.2.11)
15.	<i>Role name:</i> identificationInfo	dataIdInfo	basic information about the resource(s) to which the metadata applies	M	N	Association	MD_Identification <<Abstract>> (B.2.2)
16.	<i>Role name:</i> contentInfo	contlInfo	provides information about the feature catalogue and describes the coverage and image data characteristics	O	N	Association	MD_ContentInformation (B.2.8)
17.	<i>Role name:</i> distributionInfo	distlInfo	provides information about the distributor of and options for obtaining the resource(s)	O	1	Association	MD_Distribution (B.2.10)

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
18.	<i>Role name:</i> dataQualityInfo	dqInfo	provides overall assessment of quality of a resource(s)	O	N	Association	DQ_DataQuality (B 2.4)
19.	<i>Role name:</i> portrayalCatalogueInfo	porCatInfo	provides information about the catalogue of rules defined for the portrayal of a resource(s)	O	N	Association	MD_PortrayalCatalogueReference (B 2.9)
20.	<i>Role name:</i> metadataConstraints	mdConst	provides restrictions on the access and use of data	O	N	Association	MD_Constraints (B 2.3)
21.	<i>Role name:</i> applicationSchemaInfo	appSchInfo	provides information about the conceptual schema of a dataset	O	N	Association	MD_ApplicationSchemaInformation (B 2.12)
22.	<i>Role name:</i> metadataMaintenance	mdMaint	provides information about the frequency of metadata updates, and the scope of those updates	O	1	Association	MD_MaintenanceInformation (B 2.5)

## B.2.2 Identification information (includes data and service identification)

- UML model shown in Figure A.2

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
23.	<i>MD_Identification</i>	Ident	basic information required to uniquely identify a resource or resources	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	Lines 24-35
24.	citation	idCitation	citation data for the resource(s)	M	1	Class	CI_Citation (B.3.2) <<DataType>>
25.	abstract	idAbs	brier narrative summary of the content of the resource(s)	M	1	CharacterString	Free text
26.	purpose	idPurp	summary of the intentions with which the resource(s) was developed	O	1	CharacterString	Free text
27.	credit	idCredit	recognition of those who contributed to the resource(s)	O	N	CharacterString	Free text
28.	status	idStatus	status of the resource(s)	O	N	Class	MD_ProgressCode <<CodeList>> (B.5.23)
29.	pointOfContact	idPoC	identification of, and means of communication with, person(s) and organizations(s) associated with the resource(s)	O	N	Class	CI_ResponsibleParty (B.3.2) <<DataType>>
30.	<i>Role name:</i> resourceMaintenance	resMaint	provides information about the frequency of resource updates, and the scope of those updates	O	N	Association	MD_MaintenanceInformation (B 2.5)

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
31.	<i>Role name:</i> graphicOverview	graphOver	provides a graphic that illustrates the resource(s) (should include a legend for the graphic)	O	N	Association	MD_BrowseGraphic (B 2.2.1)
32.	<i>Role name:</i> resourceFormat	dsFormat	provides a description of the format of the resource(s)	O	N	Association	MD_Format (B 2.10.3)
33.	<i>Role name:</i> descriptiveKeywords	descKeys	provides category keywords, their type, and reference source	O	N	Association	MD_Keywords (B 2.2.2)
34.	<i>Role name:</i> resourceSpecificUsage	idSpecUse	provides basic information about specific application(s) for which the resource(s) has/have been or is being used by different users	O	N	Association	MD_Usage (B 2.2.5)
35.	<i>Role name:</i> resourceConstraints	resConst	provides information about constraints which apply to the resource(s)	O	N	Association	MD_Constraints (B 2.3)
36.	MD_DataIdentification	DataIdent	information required to identify a dataset	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	Lines 37-46 and 24-35
37.	spatialRepresentationType	spatRp Type	method used to spatially represent geographic information	O	N	Class	MD_SpatialRepresentationTypeCode <<CodeList>> (B.5.26)
38.	spatialResolution	dataScale	factor which provides a general understanding of the density of spatial data in the dataset	O	N	Class	MD_Resolution <<Union>> (B.2.2.4)
39.	language	dataLang	language(s) used within the dataset	M	N	CharacterString	ISO 639-2. other parts may be used
40.	characterSet	dataChar	full name of the character coding standard used for the dataset	C/ISO/IEC 10646-1 not used?	1	Class	MD_CharacterSetCode <<CodeList>> (B.5.10)
41.	topicCategory	tpCat	main theme(s) of the dataset	M	N	Class	MD_TopicCategoryCode <<CodeList>> (B.5.27)
42.	geographicBox	geoBox	minimum bounding rectangle within which data is available	C / hierarchyLevel equals "dataset" and geographicDescription not documented?	N	Class	EX_GeographicBoundingBox (B.3.1.1)
43.	geographicDescription	geoDesc	description of the geographic area within which data is available	C / if hierarchyLevel equals "dataset" and geographicBox not documented?	N	Class	EX_GeographicDescription (B.3.1.1)
44.	environmentDescription	envirDesc	description of the dataset in the producer's processing environment, including items such as the software, the computer operating system, file name, and the dataset size	O	1	CharacterString	Free text
45.	extent	dataExt	additional extent information including the bounding polygon, vertical, and temporal extent of the dataset	O	N	Class	EX_Extent <<DataType>> (B.3.1)

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
46.	supplementalInformation	supplInfo	any other descriptive information about the dataset	O	1	CharacterString	Free text
47.	MD_ServiceIdentification	SerIdent	identification of capabilities which a service provider makes available to a service user through a set of interfaces that define a behaviour - See ISO 19119 – Services for further information	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identification)	Lines 24-35

### B.2.2.1 Browse graphic information

48.	MD_BrowseGraphic	BrowGraph	graphic that provides an illustration of the dataset (should include a legend for the graphic)	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 49-51
49.	fileName	bgFileName	name of the file that contains a graphic that provides an illustration of the dataset	M	1	CharacterString	Free text
50.	fileDescription	bgFileDesc	text description of the illustration	O	1	CharacterString	Free text
51.	fileType	bgFileType	format in which the illustration is encoded Examples: CGM, EPS, GIF, JPEG, PBM, PS, TIFF, XWD	O	1	CharacterString	Free text

### B.2.2.2 Keyword information

52.	MD_Keywords	Keywords	keywords, their type and reference source	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 53-55
53.	keyword	keyword	commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject	M	N	CharacterString	Free text
54.	type	keyTyp	subject matter used to group similar keywords	O	1	Class	MD_KeywordTypeCode <<CodeList>> (B.5.17)
55.	thesaurusName	thesaName	name of the formally registered thesaurus or a similar authoritative source of keywords	O	1	Class	CI_Citation (B.3.2) <<DataType>>

### B.2.2.3 Representative fraction information

56.	MD_RepresentativeFraction	RepFract	derived from Scale where MD_RepresentativeFraction.denominator = 1 / Scale.measure And Scale.targetUnits = Scale.sourceUnits	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 57-58
57.	denominator	rfDenom	the number below the line in a vulgar fraction	M	1	Integer	Integer > 0
58.	<i>Role name (derived):</i> /Scale	derScale	role indicating that MD_RepresentativeFraction is derived from Scale	(Not applicable)	(Not applicable)	Derived Association	Scale (B.4.3)

### B.2.2.4 Resolution information

59.	MD_Resolution	Resol	level of detail expressed as a scale factor or a ground distance	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	Lines 60-61
60.	equivalentScale	equScale	level of detail expressed as the scale of a comparable hardcopy map or chart	C / distance not documented?	1	Class	MD_RepresentativeFraction <<DataType>> (B.2.2.3)
61.	distance	scaleDist	ground sample distance	C / equivalentScale not documented?	1	Class	Distance (B.4.3)

### B.2.2.5 Usage information

62.	MD_Usage	Usage	brief description of ways in which the resource(s) is/are currently used	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Identification)	Lines 63-65
63.	specificUsage	specUsage	brief description of the resource and/or resource series usage	M	1	CharacterString	Free text
64.	usageDateTime	usageDate	date and time of the first use or range of uses of the resource and/or resource series	O	1	Class	DateTime (B.4.2)

65.	userDeterminedLimitations	usrDetLim	applications, determined by the user for which the resource and/or resource series is not suitable	O	1	CharacterString	Free text
66.	userContactInfo	usrCntInfo	identification of and means of communicating with person(s) and organization(s) using the resource(s)	M	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)

### B.2.3 Constraint information (includes legal and security)

- UML model shown in Figure A.3

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
67.	MD_Constraints	Consts	restrictions on the access and use of a resource or metadata	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)	Line 68
68.	useLimitation	useLimit	limitation affecting the fitness for use of the resource. Example, "not to be used for navigation"	O	N	CharacterString	Free text
69.	MD_LegalConstraints	LegConsts	restrictions and legal prerequisites for accessing and using the resource	Use obligation from referencing object	N	Specified Class (MD_Constraints)	Lines 70-72 and 68
70.	accessConstraints	accessConsts	access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
71.	useConstraints	useConsts	constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations or warnings on using the resource	O	N	Class	MD_RestrictionCode <<CodeList>> (B.5.24)
72.	otherConstraints	othConsts	other restrictions and legal prerequisites for accessing and using the resource	C / accessConstraints or useConstraints equal "otherRestrictions"?	N	CharacterString	Free text
73.	MD_SecurityConstraints	SecConsts	handling restrictions imposed on the resource for national security or similar security concerns	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Constraints)	Lines 74-77 and 68
74.	classification	class	name of the handling restrictions on the resource	M	1	Class	MD_ClassificationCode <<CodeList>> (B.5.11)

75.	userNote	userNote	explanation of the application of the legal constraints or other restrictions and legal prerequisites for obtaining and using the resource	O	1	CharacterString	Free text
76.	classificationSystem	classSys	name of the classification system	O	1	CharacterString	Free text
77.	handlingDescription	handDesc	additional information about the restrictions on handling the resource	O	1	CharacterString	Free text

## B.2.4 Data quality information

- UML model shown in Figures A.4, A.5 (Lineage) and A.6 (Data quality classes and subclasses)

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
78.	DQ_DataQuality	DataQual	quality information for the data specified by a data quality scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 79-81
79.	scope	dqScope	the specific data to which the data quality information applies	M	1	Class	DQ_Scope <<DataType>> (B.2.4.4)
80.	<i>Role name:</i> report	dqReport	quantitative quality information for the data specified by the scope	C / scope.DQ_Scope.level equals "dataset"?	N	Association	DQ_Element <<Abstract>> (B 2.4.2)
81.	<i>Role name:</i> lineage	dataLineage	non-quantitative quality information about the lineage of the data specified by the scope	C / scope.DQ_Scope.level equals "dataset"?	1	Association	LI_Lineage (B 2.4.1)

### B.2.4.1 Lineage information

82.	LI_Lineage	Lineage	information about the events or source data used in constructing the data specified by the scope or lack of knowledge about lineage	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality)	Lines 83-85
83.	statement	statement	general explanation of the data producer's knowledge about the lineage of a dataset	C / (DQ_DataQuality.scope. DQ_Scope.level = "dataset" or "series") and source and processStep not provided?	1	CharacterString	Free text
84.	<i>Role name:</i> processStep	prcStep	information about an event in the creation process for the data specified by the scope	C / statement and source not provided?	N	Association	LI_ProcessStep (B.2.4.1.1)
85.	<i>Role name:</i> source	dataSource	information about the source data used in creating the data specified by the scope	C / statement and processStep not provided?	N	Association	LI_Source (B.2.4.1.2)

#### B.2.4.1.1 Process step information

86.	LI_ProcessStep	ProcessStep	information about an event in the creation process for the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage)	Lines 86-91
87.	description	stepDesc	description of the event, including related parameters or tolerances	M	1	CharacterString	Free Text
88.	rationale	stepRat	requirement or purpose for the process step	O	1	CharacterString	Free Text
89.	dateTime	stepDateTm	date and time or range of date and time on or over which the process step occurred	O	1	Class	DateTime (B.4.2)
90.	processor	stepProc	identification of, and means of communication with, person(s) and organization(s) associated with the process step	O	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
91.	<i>Role name:</i> source	stepSrc	information about the source data used in creating the data specified by the scope	O	N	Association	LI_Source (B.2.4.1.2)

### B.2.4.1.2 Source information

92.	LI_Source	Source	information about the source data used in creating the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (LI_Lineage)	Lines 93-98
93.	description	srcDesc	detailed description of the level of the source data	C / sourceExtent not provided?	1	CharacterString	Free Text
94.	scaleDenominator	srcScale	denominator of the representative fraction on a source map	O	1	Class	MD_RepresentativeFraction <<DataType>> (B.2.2.3)
95.	sourceReferenceSystem	srcRefSys	spatial reference system used by the source data	O	1	Class	MD_ReferenceSystem (B.2.7)
96.	sourceCitation	srcCitatn	recommended reference to be used for the source data	O	1	Class	CI_Citation <<DataType>> (B.3.2)
97.	sourceExtent	srcExt	information about the spatial, vertical and temporal extent of the source data	C / description not provided?	N	Class	EX_Extent <<DataType>> (B.3.1)
98.	Role name: sourceStep	srcStep	information about an event in the creation process for the source data	O	N	Association	LI_ProcessStep (B.2.4.1.1)

### B.2.4.2 Data quality element information

99.	DQ_Element	DQElement	type of test applied to the data specified by a data quality scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (DQ_DataQuality) <<Abstract>>	Lines 100-107
100.	nameOfMeasure	measName	name of the test applied to the data	O	N	CharacterString	Free text
101.	measureIdentification	measId	code identifying a registered standard procedure	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)
102.	measureDescription	measDesc	description of the measure being determined	O	1	CharacterString	Free text
103.	evaluationMethodType	evalMethType	type of method used to evaluate quality of the dataset	O	1	Class	DQ_EvaluationMethodTypeCode <<CodeList>> (B.5.6)
104.	evaluationMethodDescription	evalMethDesc	description of the evaluation method	O	1	CharacterString	Free text
105.	evaluationProcedure	evalProc	reference to the procedure information	O	1	Class	CI_Citation <<DataType>> (B.3.2)
106.	dateTime	measDateTm	date or range of dates on which a data quality measure was applied	O	1	Class	Date Time (B.4.2)

107.	result	measResult	value (or set of values) obtained from applying a data quality measure or the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	M	2	Class	DQ_Result <<DataType>> (B.2.4.3)
108.	DQ_Completeness	DQComplete	presence and absence of features, their attributes and their relationships	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
109.	DQ_CompletenessCommission	DQCompComm	excess data present in the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	Lines 100-107
110.	DQ_CompletenessOmission	DQCompOm	data absent from the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Completeness)	Lines 100-107
111.	DQ_LogicalConsistency	DQLogConsis	degree of adherence to logical rules of data structure, attribution and relationships (data structure can be conceptual, logical or physical)	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
112.	DQ_ConceptualConsistency	DQConcConsis	adherence to rules of the conceptual schema	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
113.	DQ_DomainConsistency	DQDomConsis	adherence of values to the value domains	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
114.	DQ_FormatConsistency	DQFormConsis	degree to which data is stored in accordance with the physical structure of the dataset, as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107

115.	DQ_TopologicalConsistency	DQTopConsis	correctness of the explicitly encoded topological characteristics of the dataset as described by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_LogicalConsistency)	Lines 100-107
116.	DQ_PositionalAccuracy	DQPosAcc	accuracy of the position of features	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
117.	DQ_AbsoluteExternalPositionalAccuracy	DQAbsExtPosAcc	closeness of reported coordinate values to values accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
118.	DQ_GriddedDataPositionalAccuracy	DQGridDataPosAcc	closeness of gridded data position values to values accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
119.	DQ_RelativeInternalPositionalAccuracy	DQRelIntPosAcc	closeness of the relative positions of features in the scope to their respective relative positions accepted as or being true	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_PositionalAccuracy)	Lines 100-107
120.	DQ_TemporalAccuracy	DQTempAcc	accuracy of the temporal attributes and temporal relationships of features	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
121.	DQ_AccuracyOfATimeMeasurement	DQAccTimeMeas	correctness of the temporal references of an item (reporting of error in time measurement)	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107
122.	DQ_TemporalConsistency	DQTempConsis	correctness of ordered events or sequences, if reported	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107

123.	DQ_TemporalValidity	DQTempValid	validity of data specified by the scope with respect to time	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_TemporalAccuracy)	Lines 100-107
124.	DQ_ThematicAccuracy	DQThemAcc	accuracy of quantitative attributes and the correctness of non-quantitative attributes and of the classifications of features and their relationships	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Element) <<Abstract>>	Lines 100-107
125.	DQ_ThematicClassificationCorrectness	DQThemClassCor	comparison of the classes assigned to features or their attributes to a universe of discourse	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107
126.	DQ_NonQuantitativeAttributeAccuracy	DQNonQuantAttAcc	correctness of non-quantitative attributes	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107
127.	DQ_QuantitativeAttributeAccuracy	DQQuanAttAcc	accuracy of quantitative attributes	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_ThematicAccuracy)	Lines 100-107

#### B.2.4.3 Result information

128.	DQ_Result	Result	generalization of more specific result classes	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	
129.	DQ_ConformanceResult	ConResult	Information about the outcome of evaluating the obtained value (or set of values) against a specified acceptable conformance quality level	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	Lines 130-132

130.	specification	conSpec	citation of product specification or user requirement against which data is being evaluated	M	1	Class	CI_Citation <<DataType>> (B.3.2)
131.	explanation	conExpl	explanation of the meaning of conformance for this result	M	1	CharacterString	Free text
132.	pass	conPass	indication of the conformance result where 0 = fail and 1 = pass	M	1	Boolean	1 = yes 0 = no
133.	DQ_QuantitativeResult	QuanResult	Information about the value (or set of values) obtained from applying a data quality measure	Use obligation from referencing object	Use maximum occurrence from referencing object	Specified Class (DQ_Result)	Lines 134-137
134.	valueType	quanValType	value type for reporting a data quality result	O	1	Class	RecordType <<Metaclass>> (B.4.3)
135.	valueUnit	quanValUnit	value unit for reporting a data quality result	O	1	Class	Measure (B.4.3)
136.	errorStatistic	errStat	statistical method used to determine the value	O	1	CharacterString	Free text
137.	value	quanVal	quantitative value or values, content determined by the evaluation procedure used	M	N	Class	Record (B.4.3)

#### B.2.4.4 Scope information

138.	DQ_Scope	DQScope	description of the data specified by the scope	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 139-141
139.	level	scpLvl	hierarchical level of the data specified by the scope	M	1	Class	MD_ScopeCode <<CodeList>> (B.5.25)
140.	extent	scpExt	information about the spatial, vertical and temporal extent of the data specified by the scope	O	1	Class	EX_Extent <<DataType>> (B.3.1)
141.	levelDescription	scpLvlDesc	detailed description about the level of the data specified by the scope	C / level not equal "dataset" or "series"?	N	Class	MD_ScopeDescription <<Union>> (B.2.5.1)

## B.2.5 Maintenance information

- UML model shown in Figure A.7

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
142.	MD_MaintenanceInformation	MaintInfo	information about the scope and frequency of updating	Use obligation from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata and MD_Identification)	Lines 143-148
143.	maintenanceAndUpdateFrequency	maintFreq	frequency with which changes and additions are made to the resource after the initial resource is completed	M	1	Class	MD_MaintenanceFrequencyCode <<CodeList>> (B.5.18)
144.	dateOfNextUpdate	dateNext	scheduled revision date for resource	O	1	Class	Date (B.4.2)
145.	userDefinedMaintenanceFrequency	usrDefFreq	maintenance period other than those defined	O	1	Class	TM_PeriodDuration (B.4.5)
146.	updateScope	maintScp	scope of data to which maintenance is applied	O	N	Class	MD_ScopeCode <<CodeList>> (B.5.25)
147.	updateScopeDescription	upScpDesc	additional information about the range or extent of the resource	O	N	Class	MD_ScopeDescription <<Union>> (B.2.5.1)
148.	maintenanceNote	maintNote	information regarding specific requirements for maintaining the resource	O	N	CharacterString	Free text

### B.2.5.1 Scope description information

149.	MD_ScopeDescription	ScpDesc	description of the class of information covered by the information	Use obligation from referencing object	Use maximum occurrence from referencing object	Class <<Union>>	Lines 150-155
150.	attributes	attribSet	attributes to which the information applies	C / features, featureInstances, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_AttributeType (B.4.4)
151.	features	featSet	features to which the information applies	C / attributes, featureInstances, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_FeatureType (B.4.4)

152.	featureInstances	featIntSet	feature instances to which the information applies	C / attributes, features, attributeInstances, dataset and other not documented?	1	Set (B.4.7)	GF_FeatureType (B.4.4)
153.	attributeInstances	attribIntSet	attribute instances to which the information applies	C / attributes, features, featureInstances, dataset and other not documented?	1	Set (B.4.7)	GF_AttributeType (B.4.4)
154.	dataset	datasetSet	dataset to which the information applies	C / attributes, features, featureInstances, attributeInstances, and other not documented?	1	CharacterString	Free text
155.	other	other	class of information that does not fall into the other categories to which the information applies	C / attributes, features, featureInstances, attributeInstances, and dataset not documented?	1	CharacterString	Free text

## B.2.6 Spatial representation information (includes grid and vector representation)

- UML model shown in Figure A.8

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
156.	<i>MD_SpatialRepresentation</i>	SpatRep	digital mechanism used to represent spatial information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata) <<Abstract>>	
157.	MD_GridSpatialRepresentation	GridSpatRep	information about grid spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	Lines 158-161
158.	numberOfDimensions	numDims	number of independent spatial-temporal axes	M	1	Integer	Integer
159.	axisDimensionsProperties	axDimProps	information about spatial-temporal axis properties	M	1	Sequence (B.4.7)	MD_Dimension <<DataType>> (B.2.6.1)
160.	cellGeometry	cellGeo	identification of grid data as point or cell	M	1	Class	MD_CellGeometryCode <<CodeList>> (B.5.9)
161.	transformationParameterAvailability	tranParaAv	indication of whether or not parameters for transformation exists	M	1	Boolean	1 = yes 0 = no

162.	MD_Georectified	Georect	grid whose cells are regularly spaced in a geographic (i.e., lat / long) or map coordinate system defined in the Spatial Referencing System (SRS) so that any cell in the grid can be geolocated given its grid coordinate and the grid origin, cell spacing, and orientation	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified (MD_GridSpatialRepresentation)	Lines 163-170 and 158-161
163.	checkPointAvailability	chkPtAv	indication of whether or not geographic position points are available to test the accuracy of the georeferenced grid data	M	1	Boolean	1 = yes 0 = no
164.	checkPointDescription	chkPtDesc	description of geographic position points used to test the accuracy of the georeferenced grid data	C / checkPointAvailability equals "yes"?	1	CharacterString	Free text
165.	cornerPoints	cornerPts	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cells at opposite ends of grid coverage along two diagonals in the grid spatial dimensions. There are four corner points in a georectified grid; at least two corner points along one diagonal are required	M	1	Sequence (B.4.7)	GM_Point <<Type>> (B.4.6)
166.	centerPoint	centerPt	earth location in the coordinate system defined by the Spatial Reference System and the grid coordinate of the cell halfway between opposite ends of the grid in the spatial dimensions	O	1	Class	GM_Point <<Type>> (B.4.6)
167.	pointInPixel	ptInPixel	point in a pixel corresponding to the Earth location of the pixel	M	1	Class	MD_PixelOrientationCode <<Enumeration>> (B.5.22)
168.	transformationDimensionDescription	transDimDesc	description of the information about which grid dimensions are the spatial dimensions	O	1	CharacterString	Free text
169.	transformationDimensionMapping	transDimMap	information about which grid dimensions are the spatial dimensions	O	2	CharacterString	Free text
170.	MD_Georeferenceable	Georef	grid with cells irregularly spaced in any given geographic/map projection coordinate system, whose individual cells can be geolocated using geolocation information supplied with the data but cannot be geolocated from the grid properties alone	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_GridSpatialRepresentation)	Lines 171-175 and 158-161
171.	controlPointAvailability	ctrlPtAv	indication of whether or not control point(s) exists	M	1	Boolean	1 = yes 0 = no
172.	orientationParameterAvailability	orieParaAv	indication of whether or not orientation parameters are available	M	1	Boolean	1 = yes 0 = no
173.	orientationParameterDescription	orieParaDs	description of parameters used to describe sensor orientation	O	1	CharacterString	Free text
174.	parameters	georeffPars	terms which support grid data georeferencing	M	1	Class	Record (B.4.3)

175.	parameterCitation	paraCit	reference providing description of the parameters	O	N	Class	CI_Citation <<DataType>> (B.3.2)
176.	MD_VectorSpatialRepresentation	VectSpatRep	information about the vector spatial objects in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_SpatialRepresentation)	Lines 177-178
177.	topologyLevel	topLvl	code which identifies the degree of complexity of the spatial relationships	O	1	Class	MD_TopologyLevelCode <<CodeList>> (B.5.28)
178.	geometricObjects	geometObjs	information about the geometric objects used in the dataset	O	N	Class	MD_GeometricObjects <<DataType>> (B.2.6.2)

### B.2.6.1 Dimension information

179.	MD_Dimension	Dimen	axis properties	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 180-182
180.	dimensionName	dimName	name of the axis	M	1	Class	MD_DimensionNameTypeCode <<CodeList>> (B.5.14)
181.	dimensionSize	dimSize	number of elements along the axis	M	1	Integer	Integer
182.	resolution	dimResol	degree of detail in the grid dataset	O	1	Class	Measure (B.4.3)

### B.2.6.2 Geometric object information

183.	MD_GeometricObjects	GeometObjs	number of objects, listed by geometric object type, used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 184-185
184.	geometricObjectType	geoObjTyp	name of point and vector spatial objects used to locate zero-, one-, and two-dimensional spatial locations in the dataset	M	1	Class	MD_GeometricObjectTypeCode <<CodeList>> (B.5.15)
185.	geometricObjectCount	geoObjCnt	total number of the point or vector object type occurring in the dataset	O	1	Integer	> 0

## B.2.7 Reference system information (includes temporal, coordinate and geographic identifiers)

- UML model shown in Figure A.9

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
186.	MD_ReferenceSystem	RefSystem	information about the reference system.	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 187-188
187.	referenceSystemIdentifier	refSysID	name of reference system	C / MD_CRS.projection, MD_CRS.ellipsoid, and MD_CRS.datum not documented?	1	Class	RS_Identifier (B.2.7.2)
188.	<i>role name (derived): /Reference System</i>	derRefSys	relationship indicating that MD_ReferenceSystem (as well as its attributes and aggregates) is derived from RS_ReferenceSystem	(Not applicable)	(Not applicable)	Derived Association	RS_ReferenceSystem <<Abstract>> (B.2.7)
189.	MD_CRS	MdCoRefSys	metadata about a coordinate system in which attributes have been derived from SC_CRS as defined in ISO 19111 – Spatial referencing by coordinates	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ReferenceSystem)	Lines 190-194 and 187-188
190.	projection	projection	identity of the projection used	O	1	Class	RS_Identifier (B.2.7.2)
191.	ellipsoid	ellipsoid	identity of the ellipsoid used	O	1	Class	RS_Identifier (B.2.7.2)
192.	datum	datum	Identity of the datum used	O	1	Class	RS_Identifier (B.2.7.2)
193.	<i>role name:</i> ellipsoidParameters	ellParas	set of parameters that describe the ellipsoid	O	1	Association	MD_EllipsoidParameters (B.2.7.1)
194.	<i>role name:</i> projectionParameters	projParas	set of parameters that describe the projection	O	1	Association	MD_ProjectionParameters (B.2.7.5)
195.	<i>RS_ReferenceSystem</i>	RefSys	description of the spatial and temporal reference systems used in the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Abstract>>	Lines 196-197
196.	name	refSysName	name of reference system used	M	1	Class	RS_Identifier (B.2.7.2)
197.	domainOfValidity	domOValid	range which is valid for the reference system	O	N	Class	EX_Extent <<DataType>> (B.3.1)

198.	TM_ReferenceSystem	TMRefSys	documented in ISO 19108 – Temporal schema	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem)	Lines 196-197
199.	SI_SpatialReferenceSystemUsingGeographicIdentifiers	SISRefSys	documented in ISO 19112 – Spatial referencing by geographic identifiers	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem)	Lines 196-197
200.	SC_CRS	SCRefSys	documented in ISO 19111 – Spatial referencing by coordinates	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (RS_ReferenceSystem) <<Abstract>>	Lines 196-197

### B.2.7.1 Ellipsoid parameter information

201.	MD_EllipsoidParameters	EllParas	set of parameters that describe the ellipsoid	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CRS)	Lines 202-204
202.	semiMajorAxis	semiMajAx	radius of the equatorial axis of the ellipsoid	M	1	Real	> 0.0
203.	axisUnits	axisUnits	units of the semi-major axis	M	1	Class	UomLength (B.4.3)
204.	denominatorOfFlatteningRatio	denFlatRatio	ratio of the difference between the equatorial and polar radii of the ellipsoid to the equatorial radius when the numerator is set to 1	C / not a spheroid?	1	Real	> 0.0

### B.2.7.2 Identifier information

205.	MD_Identifier	MdIdent	value uniquely identifying an object within a namespace	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class	Lines 206-207
206.	authority	identAuth	person or party responsible for maintenance of the namespace	O	1	Class	CI_Citation <<Data Type>> (B.3.2)
207.	code	identCode	alphanumeric value identifying an instance in the namespace	M	1	CharacterString	Free text
208.	RS_Identifier	RsIdent	identifier used for reference systems	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_Identifier)	Lines 206-207

### B.2.7.3 Oblique line azimuth information

209.	MD_ObliqueLineAzimuth	ObLineAzi	method used to describe the line along which an oblique mercator map projection is centred using the map projection origin and an azimuth	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ProjectionParameters)	Lines 210-211
210.	azimuthAngle	aziAngle	angle measured clockwise from north, and expressed in degrees	M	1	Real	Real
211.	azimuthMeasurePointLongitude	aziPTLong	longitude of the map projection origin	M	1	Real	Real

### B.2.7.4 Oblique line point information

212.	MD_ObliqueLinePoint	ObLinePt	method used to describe the line along which an oblique mercator map projection is centred using two points near the limits of the mapped region that define the centre line	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ProjectionParameters)	Lines 213-214
213.	obliqueLineLatitude	obLineLat	latitude of a point defining the oblique line	M	1	Real	Real
214.	obliqueLineLongitude	obLineLong	longitude of a point defining the oblique line	M	1	Real	Real

### B.2.7.5 Projection parameter information

215.	MD_ProjectionParameters	ProjParas	set of parameters that describe the projection	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CRS)	Lines 216-231
216.	zone	zone	unique identifier for 100.000 metre grid zone	○	1	Integer	Integer
217.	standardParallel	stanParal	line of constant latitude at which the surface of the Earth and the plane or developable surface intersect	○	2	Real	Real
218.	longitudeOfCentralMeridian	longCntMer	line of longitude at the centre of a map projection generally used as the basis for constructing the projection	○	1	Real	Real
219.	latitudeOfProjectionOrigin	latProjOri	latitude chosen as the origin of rectangular coordinates for a map projection	○	1	Real	Real
220.	falseEasting	falEastng	value added to all "x" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units	○	1	Real	Real
221.	falseNorthing	falNorthng	value added to all "y" values in the rectangular coordinates for a map projection. This value frequently is assigned to eliminate negative numbers. Expressed in the unit of measure identified in Planar Coordinate Units	○	1	Real	Real
222.	falseEastingNorthingUnits	falENUUnits	units of false northing and false easting	○	1	Class	UomLength (B.4.3)
223.	scaleFactorAtEquator	sclFacEqu	ratio between physical distance and corresponding map distance, along the equator	○	1	Real	> 0,0
224.	heightOfProspectivePointAboveSurface	hgtProsPt	height of viewpoint above the Earth, expressed in metres	○	1	Real	>0,0
225.	longitudeOfProjectionCenter	longProjCnt	longitude of the point of projection for azimuthal projections	○	1	Real	Real
226.	latitudeOfProjectionCenter	latProjCnt	latitude of the point of projection for azimuthal projections	○	1	Real	Real
227.	scaleFactorAtCenterLine	sclFacCnt	ratio between physical distance and corresponding map distance, along the centre line	○	1	Real	Real
228.	straightVerticalLongitudeFromPole	stVrLongPl	longitude to be oriented straight up from the North or South Pole	○	1	Real	Real

229.	scaleFactorAtProjectionOrigin	sclFacPrOr	multiplier for reducing a distance obtained from a map by computation or scaling to the actual distance at the projection origin	O	1	Real	Real
230.	<i>role name:</i> obliqueLineAzimuthParameter	obLnAziPars	parameters describing the oblique line azimuth	O	1	Association	MD_ObliqueLineAzimuth (B.2.7.3)
231.	<i>role name:</i> obliqueLinePointParameter	obLnPtPars	parameters describing the oblique line point	O	2	Association	MD_ObliqueLinePoint (B.2.7.4)

## B.2.8 Content information (includes Feature catalogue and Coverage descriptions)

- UML model shown in Figure A.10

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
232.	MD_ContentInformation	ContInfo	description of the content of a dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	
233.	MD_FeatureCatalogueDescription	FetCatDesc	information identifying the feature catalogue	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	Lines 234-238
234.	complianceCode	compCode	indication of whether or not the cited feature catalogue complies with ISO 19110	O	1	Boolean	0=not compliant 1=compliant
235.	language	catLang	language(s) used within the catalogue	O	N	CharacterString	ISO 639-2, other parts can be used
236.	includedWithDataset	incWithDS	indication of whether or not the feature catalogue is included with the dataset	M	1	Boolean	0=no 1=yes
237.	featureTypes	catFetTyps	subset of feature types from cited feature catalogue occurring in dataset	O	N	Class	GenericName (B.4.8)
238.	featureCatalogueCitation	catCitation	complete bibliographic reference to one or more external feature catalogues	M	N	Class	CI_Citation <<Data Type>> (B.3.2)
239.	MD_CoverageDescription	CovDesc	information about the content of a grid data cell	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_ContentInformation)	Lines 240-242

240.	attributeDescription	attDesc	description of the attribute described by the measurement value	M	1	Class	RecordType <<Metaclass>> (B.4.3)
241.	contentType	contentTyp	type of information represented by the cell value	M	1	Class	MD_CoverageContentTypeCode <<CodeList>> (B.5.12)
242.	<i>Role name:</i> dimension	covDim	information on the dimensions of the cell measurement value	O	N	Class	MD_RangeDimension (B.2.8.1)
243.	MD_ImageDescription	ImgDesc	information about an image's suitability for use	O	Use maximum occurrence from referencing object	Specified Class (MD_CoverageDescription)	Lines 244-255 and 241-242
244.	illuminationElevationAngle	illElevAng	illumination elevation measured in degrees clockwise from the target plane at intersection of the optical line of sight with the Earth's surface. For images from a scanning device, refer to the centre pixel of the image	O	1	Real	-90 – 90
245.	illuminationAzimuthAngle	illAziAng	illumination azimuth measured in degrees clockwise from true north at the time the image is taken. For images from a scanning device, refer to the centre pixel of the image	O	1	Real	0,00 – 360
246.	imagingCondition	imagCond	conditions affected the image	O	1	Class	MD_ImagingConditionCode <<CodeList>> (B.5.16)
247.	imageQualityCode	imagQuCode	specifies the image quality	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)
248.	cloudCoverPercentage	cloudCovPer	area of the dataset obscured by clouds, expressed as a percentage of the spatial extent	O	1	Real	0,0 – 100,0
249.	processingLevelCode	prcTypCde	image distributor's code that identifies the level of radiometric and geometric processing that has been applied	O	1	Class	MD_Identifier <<DataType>> (B.2.7.2)
250.	compressionGenerationQuantity	cmpGenQuan	count of the number the number of lossy compression cycles performed on the image	O	1	Integer	Integer
251.	triangulationIndicator	trianInd	indication of whether or not triangulation has been performed upon the image	O	1	Boolean	0-no 1-yes
252.	radiometricCalibrationDataAvailability	radCalDatAv	indication of whether or not the radiometric calibration information for generating the radiometrically calibrated standard data product is available	O	1	Boolean	0-no 1-yes
253.	cameraCalibrationInformationAvailability	camCallnAv	indication of whether or not constants are available which allow for camera calibration corrections	O	1	Boolean	0-no 1-yes
254.	filmDistortionInformationAvailability	filmDistlnAv	indication of whether or not Calibration Reseau information is available	O	1	Boolean	0-no 1-yes
255.	lensDistortionInformationAvailability	lensDistlnAv	indication of whether or not lens aberration correction information is available	O	1	Boolean	0-no 1-yes

### B.2.8.1 Range dimension information (includes Band information)

256.	MD_RangeDimension	RangeDim	information on the range of each dimension of a cell measurement value	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_CoverageDescription)	Lines 257-258
257.	sequenceIdentifier	seqID	number that uniquely identifies instances of bands of wavelengths on which a sensor operates	O	1	Class	MemberName (B.4.8)
258.	descriptor	dimDescrp	description of the range of a cell measurement value	O	1	CharacterString	Free text
259.	MD_Band	Band	range of wavelengths in the electromagnetic spectrum	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (MD_RangeDimension)	Lines 260-267 and 257-258
260.	maxValue	maxVal	longest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	Real
261.	minValue	minVal	shortest wavelength that the sensor is capable of collecting within a designated band	O	1	Real	Real
262.	units	valUnit	units in which sensor wavelengths are expressed	C / minValue or maxValue provided?	1	Class	UomLength (B.4.3)
263.	peakResponse	pkResp	wavelength at which the response is the highest	O	1	Real	Real
264.	bitsPerValue	bitsPerVal	maximum number of significant bits in the uncompressed representation for the value in each band of each pixel	O	1	Integer	Integer
265.	toneGradation	toneGrad	number of discrete numerical values in the grid data	O	1	Integer	Integer
266.	scaleFactor	sclFac	scale factor which has been applied to the cell value	O	1	Real	Real
267.	offset	offset	the physical value corresponding to a cell value of zero	O	1	Real	Real

### B.2.9 Portrayal catalogue information

- UML model shown in Figure A.11

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
268.	MD_PortrayalCatalogueReference	PortCatRef	information identifying the portrayal catalogue used	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Line 269
269.	portrayalCatalogueCitation	portCatCit	bibliographic reference to the portrayal catalogue cited	M	N	Class	CI_Citation <<Data Type>> (B.3.2)

### B.2.10 Distribution information

- UML model shown in Figure A.12

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
270.	MD_Distribution	Distrib	information about the distributor of and options for obtaining the resource	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 271-273
271.	<i>Role name:</i> distributionFormat	distFormat	provides a description of the format of the data to be distributed	C / MD_Distributor.distributorFormat not documented?	N	Association	MD_Format (B.2.10.3)
272.	<i>Role name:</i> distributor	distributor	provides information about the distributor	O	N	Association	MD_Distributor (B.2.10.2)
273.	<i>Role name:</i> transferOptions	distTranOps	provides information about technical means and media by which a resource is obtained from the distributor	O	N	Association	MD_DigitalTransferOptions (B.2.10.1)

### B.2.10.1 Digital transfer options information

274.	MD_DigitalTransferOptions	DigTranOps	technical means and media by which a resource is obtained from the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Distributor)	Lines 275-278
275.	unitsOfDistribution	unitsODist	tiles, layers, geographic areas, etc., in which data is available	O	1	CharacterString	Free text
276.	transferSize	transSize	estimated size of a unit in the specified transfer format, expressed in megabytes. The transfer size is > 0.0	O	1	Real	> 0,0
277.	onLine	onLineSrc	information about online sources from which the resource can be obtained	O	N	Class	CI_OnLineResource <<DataType>> (B.3.2.4)
278.	offLine	offLineMed	information about offline media on which the resource can be obtained	O	1	Class	MD_Medium <<DataType>> (B.2.10.4)

### B.2.10.2 Distributor information

279.	MD_Distributor	Distributor	information about the distributor	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution)	Lines 280-283
280.	distributorContact	distorCont	party from whom the resource may be obtained. This list need not be exhaustive	M	1	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
281.	<i>Role name:</i> distributionOrderProcess	distorOrdPrc	provides information about how the resource may be obtained, and related instructions and fee information	O	N	Association	MD_StandardOrderProcess (B.2.10.5)
282.	<i>Role name:</i> distributorFormat	distorFormat	provides information about the format used by the distributor	C / MD_Distribution.distributionFormat not documented?	N	Association	MD_Format (B.2.10.3)
283.	<i>Role name:</i> distributorTransferOptions	distorTran	provides information about the technical means and media used by the distributor	O	N	Association	MD_DigitalTransferOptions (B.2.10.1)

### B.2.10.3 Format information

284.	MD_Format	Format	description of the computer language construct that specifies the representation of data objects in a record, file, message, storage device or transmission channel	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distribution and MD_Identification)	Lines 285-290
285.	name	formatName	name of the data transfer format(s)	M	1	CharacterString	Free text
286.	version	formatVer	version of the format (date, number, etc.)	M	1	CharacterString	Free text
287.	amendmentNumber	formatAmdNum	amendment number of the format version	O	1	CharacterString	Free text
288.	specification	formatSpec	name of a subset, profile, or product specification of the format	O	1	CharacterString	Free text
289.	fileDecompressionTechnique	fileDecmTechnique	recommendations of algorithms or processes that can be applied to read or expand resources to which compression techniques have been applied	O	1	CharacterString	Free text
290.	<i>Role name:</i> formatDistributor	formatDist	provides information about the distributor's format	O	N	Association	MD_Distributor (B.2.10.2)

### B.2.10.4 Medium information

291.	MD_Medium	Medium	information about the media on which the resource can be distributed	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 292-297
292.	name	medName	name of the medium on which the resource can be received	O	1	Class	MD_MediumNameCode <<CodeList>> (B.5.20)
293.	density	medDensity	density at which the data is recorded	O	N	Real	> 0,0
294.	densityUnits	medDenUnits	units of measure for the recording density	C / density documented?	1	CharacterString	Free text
295.	volumes	medVol	number of items in the media identified	O	1	Integer	> 0,0
296.	mediumFormat	medFormat	method used to write to the medium	O	N	Class	MD_MediumFormatCode <<CodeList>> (B.5.19)
297.	mediumNote	medNote	description of other limitations or requirements for using the medium	O	1	CharacterString	Free text

### B.2.10.5 Standard order process information

298.	MD_StandardOrderProcesses	StanOrdProc	common ways in which the resource may be obtained or received, and related instructions and fee information	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Distributor)	Lines 299-302
299.	fees	resFees	fees and terms for retrieving the resource. Include monetary units (as specified in ISO 4217)	O	1	CharacterString	Free text
300.	plannedAvailableDateTime	planAvDtTm	date and time when the dataset will be available	O	1	Class	DateTime (B.4.2)
301.	orderingInstructions	ordInstr	general instructions, terms and services provided by the distributor	O	1	CharacterString	Free text
302.	turnaround	ordTurn	typical turnaround time for the filling of an order	O	1	CharacterString	Free text

### B.2.11 Metadata extension information

- UML model shown in Figure A.13

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
303.	MD_MetadataExtensionInformation	MdExtInfo	information describing metadata extensions	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 304-305
304.	extensionOnLineResource	extOnRes	information about on-line sources containing the community profile name and the extended metadata elements. Information for all new metadata elements	O	1	Class	CI_OnLineResource <<DataType>> (B.3.2.4)
305.	<i>Role name:</i> extendedElementInformation	extEleInfo	provides information about a new metadata element, not found in ISO 19115, which is required to describe geographic data	O	N	Association	MD_ExtendedElementInformation (B.2.11.1)

### B.2.11.1 Extended element information

306.	MD_ExtendedElementInformation	ExtEleInfo	new metadata element, not found in ISO 19115, which is required to describe geographic data	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_MetadataExtensionInformation)	Lines 307-319
307.	name	extEleName	name of the extended metadata element.	M	1	CharacterString	Free text
308.	shortName	extShortName	short form suitable for use in an implementation method such as XML or SGML. NOTE other methods may be used	C / dataType notEqual "codelistElement"?	1	CharacterString	Free text
309.	domainCode	extDomCode	three digit code assigned to the extended element	C / is dataType "codelistElement"?	1	Integer	Integer
310.	definition	extEleDef	definition of the extended element	M	1	CharacterString	Free text
311.	obligation	extEleOb	obligation of the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	Class	MD_ObligationCode <<enumeration>> (B.5.21)
312.	condition	extEleCond	condition under which the extended element is mandatory	C / obligation = "Conditional"?	1	CharacterString	Free text
313.	dataType	eleDataType	code which identifies the kind of value provided in the extended element	M	1	Class	MD_DatatypeCode <<CodeList>> (B.5.13)
314.	maximumOccurrence	extEleMxOc	maximum occurrence of the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	CharacterString	N or any integer
315.	domainValue	extEleDomVal	valid values that can be assigned to the extended element	C / dataType not "codelist", "enumeration" or "codelistElement"?	1	CharacterString	Free text
316.	parentEntity	extEleParEnt	name of the metadata entity(s) under which this extended metadata element may appear. The name(s) may be standard metadata element(s) or other extended metadata element(s).	M	N	CharacterString	Free text
317.	rule	extEleRule	specifies how the extended element relates to other existing elements and entities	M	1	CharacterString	Free text
318.	rationale	extEleRat	reason for creating the extended element	O	N	CharacterString	Free text
319.	source	extEleSrc	name of the person or organization creating the extended element	M	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)

## B.2.12 Application schema information

- UML model shown in Figure A.14

	Name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
320.	MD_ApplicationSchemaInformation	AppSchInfo	information about the application schema used to build the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_Metadata)	Lines 321-328
321.	name	asName	name of the application schema used	M	1	Class	CI_Citation <<DataType>> (B.3.2)
322.	schemaLanguage	asSchLang	identification of the schema language used	M	1	CharacterString	Free text
323.	constraintLanguage	asCstLang	formal language used in Application Schema	M	1	CharacterString	Free text
324.	schemaAscii	asAscii	full application schema given as an ASCII file	O	1	CharacterString	Free text
325.	graphicsFile	asGraFile	full application schema given as a graphics file	O	1	CharacterString	Free text
326.	softwareDevelopmentFile	asSwDevFile	full application schema given as a software development file	O	1	Binary	Binary
327.	softwareDevelopmentFileFormat	asSwDevFIF	software dependent format used for the application schema software dependent file	O	1	CharacterString	Free text
328.	<i>Role name:</i> featureCatalogueSupplement	featCatSup	information about the spatial attributes in the application schema for the feature types	O	1	Association	MD_SpatialAttributeSupplement (B.2.12.2)

### B.2.12.1 Feature type list information

329.	MD_FeatureTypeList	FeatTypList	list of names of feature types with the same spatial representation (same as spatial attributes)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_SpatialAttributeSupplement)	Lines 330-331
330.	spatialObject	spatObj	instance of a type defined in the spatial schema	M	1	CharacterString	Free text
331.	spatialSchemaName	spatSchName	name of the spatial schema used	M	1	CharacterString	Free text

### B.2.12.2 Spatial attribute supplement information

332.	MD_SpatialAttributeSupplement	SpatAttSup	spatial attributes in the application schema for the feature types	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (MD_ApplicationSchemaInfo)	Line 333
333.	<i>Role name:</i> theFeatureTypeList	featTypeList	provides information about the list of feature types with the same spatial representation	M	N	Association	MD_FeatureTypeList (B.2.12.1)

## B.3 Data type information

### B.3.1 Extent information

- UML model shown in Figure A.15

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
334.	EX_Extent	Extent	information about spatial, vertical, and temporal extent	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 335-338
335.	description	exDesc	spatial and temporal extent for the referring object	C / geographicElement and temporalElement and verticalElement not documented?	1	CharacterString	Free text
336.	<i>Role name:</i> geographicElement	geoEle	provides geographic component of the extent of the referring object	C / description and temporalElement and verticalElement not documented?	N	Association	EX_GeographicExtent <<Abstract>> (B.3.1.1)
337.	<i>Role name:</i> temporalElement	tempEle	provides temporal component of the extent of the referring object	C / description and geographicElement and verticalElement not documented?	N	Association	EX_TemporalExtent (B.3.1.2)
338.	<i>Role name:</i> verticalElement	vertEle	provides vertical component of the extent of the referring object	C / description and geographicElement and temporalElement not documented?	N	Association	EX_VerticalExtent (B.3.1.3)

### B.3.1.1 Geographic extent information

339.	EX_GeographicExtent	GeoExtent	geographic area of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent and EX_SpatialTemporalExtent) <<Abstract>>	Line 340
340.	extentTypeCode	exTypeCode	indication of whether the bounding polygon encompasses an area covered by the data or an area where data is not present	O	1	Boolean	0 – exclusion 1 – inclusion
341.	EX_BoundingPolygon	BoundPoly	boundary enclosing the dataset, expressed as the closed set of (x,y) coordinates of the polygon (last point replicates first point)	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Line 342 and 340
342.	polygon	polygon	sets of points defining the bounding polygon	M	N	GM_Object (B.4.6)	-90 to 90 latitude -180 to 180 longitude
343.	EX_GeographicBoundingBox	GeoBndBox	geographic position of the dataset NOTE This is only an approximate reference so specifying the co-ordinate system is unnecessary	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Lines 344-347 and 340
344.	westBoundLongitude	westBL	western-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Angle (B.4.3)	-180,0 <= West Bounding Longitude Value <= 180,0
345.	eastBoundLongitude	eastBL	eastern-most coordinate of the limit of the dataset extent, expressed in longitude in decimal degrees (positive east)	M	1	Angle (B.4.3)	-180,0 <= East Bounding Longitude Value <= 180,0
346.	southBoundLatitude	southBL	southern-most coordinate of the limit of the dataset extent, expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90,0 <= South Bounding Latitude Value <= 90,0; South Bounding Latitude Value <= North bounding Latitude Value
347.	northBoundLatitude	northBL	northern-most, coordinate of the limit of the dataset extent expressed in latitude in decimal degrees (positive north)	M	1	Angle (B.4.3)	-90,0 <= North Bounding Latitude Value <= 90,0; North Bounding Latitude Value >= South Bounding Latitude Value
348.	EX_GeographicDescription	GeoDesc	Description of the geographic area using identifiers	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_GeographicExtent)	Line 349 and 340
349.	geographicIdentifier	geold	identifier used to represent a geographic area	M	1	Class	MD_Identifier (B.2.7.2)

### B.3.1.2 Temporal extent information

350.	EX_TemporalExtent	TempExtent	time period covered by the content of the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	Line 351
351.	extent	exTemp	date and time for the content of the dataset	M	1	Class	TM_Primitive (B.4.5)
352.	EX_SpatialTemporalExtent	SpatTempExt	extent with respect to date/time and spatial boundaries	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Specified Class (EX_TemporalExtent)	Line 353 and 351
353.	<i>role name:</i> spatialExtent	exSpat	spatial extent component of composite spatial and temporal extent	M	N	Association	EX_GeographicExtent <<Abstract>> (B.3.1.1)

### B.3.1.3 Vertical extent information

354.	EX_VerticalExtent	VertExtent	vertical domain of dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Aggregated Class (EX_Extent)	Lines 355-358
355.	minimumValue	vertMinVal	lowest vertical extent contained in the dataset	M	1	Real	Real
356.	maximumValue	vertMaxVal	highest vertical extent contained in the dataset	M	1	Real	Real
357.	unitOfMeasure	vertUoM	vertical units used for vertical extent information Examples: metres, feet, millimetres, hectopascals	M	1	CharacterString	UomLength (B.4.3)
358.	<i>role name:</i> verticalDatum	vertDatum	provides information about the origin from which the maximum and minimum elevation values are measured	M	1	Association	SC_VerticalDatum (B.4.9)

### B.3.2 Citation and responsible party information

- UML model shown in Figure A.16

	Name / Role name	Short Name	Definition	Obligation / Condition	Maximum occurrence	Data type	Domain
359.	CI_Citation	Citation	standardized resource reference	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 360-373
360.	title	resTitle	name by which the cited resource is known	M	1	CharacterString	Free text
361.	alternateTitle	resAltTitle	short name or other language name by which the cited information is known. Example: "DCW" as an alternative title for "Digital Chart of the World"	O	N	CharacterString	Free text
362.	date	resRefDate	reference date for the cited resource	M	N	Class	CI_Date (B.3.2.3) <<DataType>>
363.	edition	resEd	version of the cited resource	O	1	CharacterString	Free text
364.	editionDate	resEdDate	date of the edition	O	1	Class	Date (B.4.2)
365.	identifier	citId	unique identifier for the resource EXAMPLE: Universal Product Code (UPC), National Stock Number (NSN)	O	N	CharacterString	Free text
366.	identifierType	citIdType	reference form of the unique identifier (ID) Example: Universal Product Code (UPC), National Stock Number (NSN)	O	N	CharacterString	Free text
367.	citedResponsibleParty	citRespParty	name and position information for an individual or organization that is responsible for the resource	O	N	Class	CI_ResponsibleParty <<DataType>> (B.3.2)
368.	presentationForm	presForm	mode in which the resource is represented	O	N	Class	CI_PresentationFormCode <<CodeList>> (B.5.4)
369.	series	datasetSeries	information about the series, or aggregate dataset, of which the dataset is a part	O	1	Class	CI_Series <<DataType>> (B.3.2.5)
370.	otherCitationDetails	otherCitDet	other information required to complete the citation that is not recorded elsewhere	O	1	CharacterString	Free text
371.	collectiveTitle	collTitle	common title with holdings note NOTE title identifies elements of a series collectively, combined with information about what volumes are available at the source cited	O	1	CharacterString	Free text
372.	ISBN	isbn	international Standard Book Number	O	1	CharacterString	Free text
373.	ISSN	issn	international Standard Serial Number	O	1	CharacterString	Free text

374.	CI_ResponsibleParty	RespParty	identification of, and means of communication with, person(s) and organizations associated with the dataset	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 375-379
375.	individualName	rpIndName	name of the responsible person- surname, given name, title separated by a delimiter	C / organisationName and positionName not documented?	1	CharacterString	Free text
376.	organisationName	rpOrgName	name of the responsible organization	C / individualName and positionName not documented?	1	CharacterString	Free text
377.	positionName	rpPosName	role or position of the responsible person	C / individualName and organisationName not documented?	1	CharacterString	Free text
378.	contactInfo	rpCntInfo	address of the responsible party	O	1	Class	CI_Contact <<Data Type>> (B.3.2.2)
379.	role	role	function performed by the responsible party	M	1	Class	CI_RoleCode <<CodeList>> (B.5.5)

### B.3.2.1 Address information

380.	CI_Address	Address	location of the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 381-386
381.	deliveryPoint	delPoint	address line for the location (as described in ISO 11180, annex A)	O	N	CharacterString	Free text
382.	city	city	city of the location	O	1	CharacterString	Free text
383.	administrativeArea	adminArea	state, province of the location	O	1	CharacterString	Free text
384.	postalCode	postCode	ZIP or other postal code	O	1	CharacterString	Free text
385.	country	country	country of the physical address	O	1	CharacterString	ISO 3166-3, other parts may be used
386.	electronicMailAddress	eMailAdd	address of the electronic mailbox of the responsible organization or individual	O	N	CharacterString	Free text

### B.3.2.2 Contact information

387.	CI_Contact	Contact	information required to enable contact with the responsible person and/or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 388-392
388.	phone	cntPhone	telephone numbers at which the organization or individual may be contacted	O	1	Class	CI_Telephone <<DataType>> (B.3.2.6)
389.	address	cntAddress	physical and email address at which the organization or individual may be contacted	O	1	Class	CI_Address <<DataType>> (B.3.2.1)
390.	onLineResource	cntOnlineRes	on-line information that can be used to contact the individual or organization	O	1	Class	CI_OnLineResource <<DataType>> (B.3.2.4)
391.	hoursOfService	cntHours	time period (including time zone) when individuals can contact the organization or individual	O	1	CharacterString	Free text
392.	contactInstructions	cntInstr	supplemental instructions on how or when to contact the individual or organization	O	1	CharacterString	Free text

### B.3.2.3 Date information

393.	CI_Date	DateRef	reference date and event used to describe it	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<DataType>>	Lines 394-395
394.	date	refDate	reference date for the cited resource	M	1	Class	Date (B.4.2)
395.	dateType	refDateType	event used for reference date	M	1	Class	CI_DateTypeCode <<CodeList>> (B.5.2)

### B.3.2.4 OnLine resource information

396.	CI_OnLineResource	OnlineRes	information about on-line sources from which the dataset, specification, or community profile name and extended metadata elements can be obtained	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 397-402
397.	linkage	linkage	location (address) for on-line access using a Uniform Resource Locator address or similar addressing scheme such as <a href="http://www.statkart.no/isotc211">http://www.statkart.no/isotc211</a>	M	1	Class	URL (IETF RFC1738 IETF RFC 2056)
398.	protocol	protocol	connection protocol to be used	O	1	CharacterString	Free text
399.	applicationProfile	appProfile	name of an application profile that can be used with the online resource	O	1	CharacterString	Free text
400.	name	orName	name of the online resource	O	1	CharacterString	Free text
401.	description	orDesc	detailed text description of what the online resource is/does	O	1	CharacterString	Free text
402.	function	orFunct	code for function performed by the online resource	O	1	Class	CI_OnLineFunctionCode <<CodeList>> (B.5.3)

### B.3.2.5 Series information

403.	CI_Series	DatasetSeries	information about the series, or aggregate dataset, to which a dataset belongs	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 404-406
404.	name	seriesName	name of the series, or aggregate dataset, of which the dataset is a part	O	1	CharacterString	Free text
405.	issueIdentification	issId	information identifying the issue of the series	O	1	CharacterString	Free text
406.	page	artPage	details on which pages of the publication the article was published	O	1	CharacterString	Free text

### B.3.2.6 Telephone information

407.	CI_Telephone	Telephone	telephone numbers for contacting the responsible individual or organization	Use obligation/condition from referencing object	Use maximum occurrence from referencing object	Class <<Data Type>>	Lines 408-409
408.	voice	voiceNum	telephone number by which individuals can speak to the responsible organization or individual	O	N	CharacterString	Free text
409.	facsimile	faxNum	telephone number of a facsimile machine for the responsible organization or individual	O	N	CharacterString	Free text

## Appendix 4.2.3: Example Metadata Set using ISO 19115:2003

### J.2 Example 1 – Exploration Licences for Minerals

This example is provided in a tabbed-outline format. Element values are underlined and role names are denoted with a "+".

```
MD_Metadata
fileIdentifier: ANZSA1000001233
language: en
characterSet: 001
contact:
  CI_ResponsibleParty
  organisationName: Department of Primary Industries and Resources SA
  role: 002
dateStamp: 20000803
metadataStandardName: ISO 19115
metadataStandardVersion: DIS
+referenceSystemInfo
  MD_ReferenceSystem
  referencySystemIdentifier:
    .RS_Identifier
    .code: GDA 94
+identificationInfo
  MD_DataIdentification
  citation:
    .CI_Citation
    .title: Exploration Licences for Minerals
    .date:
      . CI_Date
      . date: 193001
      . dateType: 001
  abstract: Location of all current mineral Exploration Licences issued under the Mining Act, 1971. Exploration Licences provide exclusive tenure rights to explore for mineral resources for up to a maximum of 5 years. Comment is sought on applications for Exploration Licences from numerous sources before granting. Exploration programs are subject to strict environmental and heritage conditions. Exploitation of identified resources must be made under separate mineral production leases.
  purpose: The dataset was developed to record information necessary for the administration of the Mining Act.
  status: 004
  pointOfContact:
    .CI_RespParty
```

.organisationName: Department of Primary Industries and Resources SA  
..positionName: GIS Coordinator  
..contactInfo:  
.. CI\_Contact  
.. phone:  
.. ..CI\_Telephone  
.. ..voice: 61 8 8463 3306  
.. ..facsimile: 61 8 8463 3268  
.. address:  
.. ..CI\_Address  
.. ..deliveryPoint: GPO Box 167  
.. ..city: Adelaide  
.. ..administrativeArea: South Australia  
.. ..postalCode: 5001  
.. ..country: Australia  
.. ..electronicMailAddress: pirsa.spatial@saugov.sa.gov.au  
.. onlineResource:  
.. ..CI\_OnlineResource  
.. ..linkage: <http://www.pir.sa.gov.au>  
.. ..role: 007  
spatialRepresentationType: 001  
spatialResolution:  
..MD\_Resolution  
..equivalentScale:  
.. MD\_RepresentativeFraction  
.. denominator: 50000  
language: en  
characterSet: 001  
topicCategory: 003  
topicCategory: 008  
geographicBox:  
..EX\_GeoBoundingBox  
..westBoundLongitude: 129.0  
..eastBoundLongitude: 141.0  
..southBoundLatitude: -26.0  
..northBoundLatitude: -38.5  
geographicDescription: South Australia

```

+resourceMaintenance
..MD_MaintenanceInformation
..maintenanceAndUpdateFrequency: 002
+resourceFormat
..MD_Format
..name: ArcInfo Export
..version: 8.0.2
+resourceFormat
..MD_Format
..name: MapInfo
..version: 6.0
+resourceFormat
..MD_Format
..name: DXF
..version: 14
+resourceFormat
..MD_Format
..name: Plotted Maps
..version: Not applicable
+descriptiveKeywords
..MD_Keywords
..keyword: BOUNDARIES Administrative
..keyword: INDUSTRY Mining Exploration
..keyword: MINERALS Exploration
..thesaurusName:
..CI_Citation

..title: ANZLIC Search Words
..date:
..CI_Date
..date: 199607
..dateType: 002
+resourceSpecificUsage
..MD_Usage
..specificUsage: Used to supply government, industry and the general public with an up-to-date status and extent of mineral exploration activities throughout the State.
..userContactInfo:
..CI_ResponsibleParty
..positionName: GIS Coordinator
..role: 007
+resourceConstraints
..MD_Constraints
..useLimitation: The data should not be used at a scale larger than 1:50 000.
+dataQualityInformation
DQ_DataQuality
scope:
..DQ_Scope
..level: dataset
+lineage
..LI_Lineage
..statement: Source Data History: Exploration Licence boundaries were sourced from the official Mining Register licence documents. Licence boundaries are legally defined to follow lines of latitude and longitude. The register has existed since 1930. Processing Steps: Coordinates entered by keyboard from licence documents. Linework cleaned to remove duplicate arcs. Data adjusted for accurate state border and coastline. Where appropriate, cadastral parcels removed from licence polygons. Associated attribute data also captured from licence documents.

```

```
+report
.DQ_Completeness
.result:
.   DQ_QuantitativeResult
.   value: Spatial data is 100% complete. Associated attribute data is 100% complete.
.DQ_TopologicalConsistency
.result:
.   DQ_QuantitativeResult
.   value: The dataset contains no overshoots, undershoots or duplicate lines. All polygons representing licences contain only one label.
.DQ_PositionalAccuracy
.result:
.   DQ_ConformanceResult
.   explanation: Most boundary locations are constructed from lines of latitude and longitude, hence are scale independent. The accuracy of other boundaries is dependent upon the source, eg. state border, coastline, cadastre.
.   pass: 1
.DQ_ThematicAccuracy
.result:
.   DQ_QuantitativeResult
.   value: Validation checks are performed periodically, resulting in an estimated 99% accuracy. These checks include comparisons between reports from the spatial dataset and the digital Mining Register.
```

#### Appendix 4.2.4: Comparison of Metadata Standards

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
<b>Dataset identification</b>	M	<b>Identification</b>			<b>Identification Information</b>	
Dataset title	M	Title	M	1	Citation Information	M
Alternative title	O					
Abbreviated title	O					
Version	O	Edition	O	1		
		Series name	O	1	Series Name	
		Issue identification	O	1	Issue identification	
		Metadata file identifier	O	1	Metadata online linkage	M
		Metadata parent identifier	O	1		
		<i>Initiative identification information</i>	O	1		
		Initiative type	O	1		
		Initiative name	M	1		
<b>Dataset overview</b>	M					
Summary	M	Abstract	M	1	Abstract	M
Producer organization name	M					

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
Spatial schema type	M				Direct spatial reference method	M
User-defined spatial schema description	C					
Dataset language	M	Language of dataset	M	1		
Dataset character set		Dataset character code set	C	1		
Purpose of production	O	Purpose	O	1	Purpose	M
Intended application scale	O	Resolution level code ?	O	1		
Potential usage	O					
Document reference(s)	O					
Sample	O	Browse graphic			Browse graphic file name	O
Related dataset	O					
Description of the organization	O					
Type of raster data	O	Raster spatial representation information	C	2	Raster Object Info	C
Description of the	O					

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
raster data						
<b>Dataset quality elements</b>	M	<b>Data quality</b>				
Lineage	C	Lineage statement	O	1	Lineage	M
Quality parameters	C					
Usage	C					
Homogeneity	C					
Updatedness	C	Progress code	O	1	Progress	M
Quality text	O	Qualitative narrative report	O	1	Logical consistency report + completeness report	M
<b>Metadata reference</b>	M	<b>Metadata reference</b>				
Entry date	M	Metadata date	M	1	Metadata date	M
Last check date	C				Metadata review date	O
Last update date	C					
Future review date	O					
Spatial reference system of Metadata	O					
		Language of Metadata	M	1		
		Metadata character	C	1		

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
		code set				
		Level of conformance code	M	1		
<b>Spatial reference system</b>	O	Spatial reference system type code	O	1	Spatial Reference Information	
<i>Indirect positioning system</i>	C					
Name of indirect positioning system	C	Spatial representation type code	O	1	Indirect Spatial Reference	
Location classes names	C					
Reference date	O	Reference date	M	1		
Administrator of the indirect positioning system	O					
<i>Direct spatial reference system</i>	C				Direct Spatial Reference Method	
Identifier of the direct positioning system	C	Spatial representation type code	O	1		
Name of the direct positioning system	O	Coordinate reference system ?	M	2		
Name of geodetic datum	O	Datum citation	C	2	Horizontal Datum Name	C

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
Name of geodetic ellipsoid	C	Ellipsoid citation	C	2	Ellipsoid Name	M
Name of map projection	O				Map projection	M
Name of vertical datum	O				Vertical Coordinate System Definition	C
<b>Extent</b>	M	<b>Dataset extent</b>	M	1		
<i>Currency of extent data and completeness of dataset</i>	M					
Extent status	M					
Extent date	M					
<i>Planar extent</i>	O				Spatial Domain	M
Bounding quadrangle	C	Geographic extent coordinates	C	1	Bounding coordinates	M
		West bounding co-ordinate	M	1	West bounding co-ordinate	M
		South bounding co-ordinate	M	1	South bounding co-ordinate	M
		East bounding co-ordinate	M	1	East bounding co-ordinate	M
		North bounding	M	1	North	M

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
		co-ordinate			bounding co-ordinate	
Bounding area	C					
Geographic area	C	Geographic extent name reference	O	1		
Name of the area covered by the geographic dataset	C	Geographic extent name	C	1	Place Keyword	O
Name of the geographic identifiers name	O					
Code of the geographic area	O					
Coverage of the geographic area	O					
<i>Vertical extent</i>	O					
Minimum height value	C	Minimum elevation value	O	1		
Maximum height value	C	Maximum elevation value	O	1		
<i>Temporal extent</i>	O				Time Period of Content	M
Description of temporal extent	C	Temporal extent date/time	O	1	Time Period Information	M
Period range details	C					
Period start date	C				Beginning date	C

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
Period end date	C				End date	C
Period range date qualifier	O				Currentness reference	C
<b>Data definition</b>	O					
<i>Overview textual description</i>	C				Entity an attribute info	M
<i>Application schema description</i>	C					
Application schema id	C					
Application schema text	C					
<i>Object type</i>	O					
Object type name	C					
Object type definition	C					
Attribute types	O					
Supertype of	O					
Thesaurus element	O					
Related to	O					
Related from	O					
Subtype of	O					
<i>Attribute type</i>	O					
Attribute type	C					

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
name						
Attribute type definition	C					
Thesaurus element	O					
<i>Relationship type</i>	O					
Relationship type name	C					
Relationship type inverse name	C					
Relates from	O					
Relates to	O					
Relationship type definition	O					
Relationship type inverse definition	O					
Thesaurus element	O					
<b>Classification</b>	O					
<i>Thesaurus</i>	O					
Name of thesaurus	O	Keyword thesaurus name	O	1		
Thesaurus administrator	O					
Thesaurus reference	O					
Date of release	O					

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
Version	O					
<i>Thesaurus elements</i>	C	<i>Keyword information</i>	O			
Term	C	Keyword(s)	O	1	Theme Keyword	O
		Keyword type code	O	1		
Definition	C					
Synonym	O					
Related term	O					
Broader term	O	Category	M	1		
		Theme code	M	1		
Narrower term	O					
Picture	O					
<b>Administrative Metadata</b>	O	<b>Responsible party information</b>	M	1	Metadata reference info	
<i>Organization and organization role</i>	O					
Organization name	C	Responsible party organization name	C	1	Contact Organization Primary	M
Abbreviated organization name	C					
Organization address	C	Postal address	O	1	Contact Address	M

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
		City	O	1	Contact Address City	M
		Administrative area	O	1	Contact Address State or Province	M
		Postal code	O	1	Contact Address Postal Code	M
		Country	M	1	Contact Address Country	O
Organization role	C	Responsible party role code	M	1		
Visiting address	O					
Alternative organization name	O					
		Voice telephone	O	1	Contact Voice Telephone	M
Organization www home page	O	On-line resource linkage	O	1		
		Electronic mail address	O	1	Contact Electronic Mail Address	
<i>Point of contact and point of contact role</i>	O					
Point of contact	C	Responsible party individual			Contact Person	M

CEN element	Constraint	ISO element	Constraint	ISO level	FGDC Element	Constraint
name		name			Primary	
Point of contact address	C					
Point of contact role	C					
Visiting address	O					
<i>Distribution</i>	O	<b>Distribution</b>				
Restrictions on use	C	Use constraints	O	1	Use constraints	M
Copyright owners	C	Access constraints	O	1	Access constraints	M
Unit of distribution	C					
Price information	O				Fees	
Data media	O	Distribution media	O	1		
Formats	O	Distribution format name	O	1	Format Name	
On-line access	O	Distribution on line resource linkage	O	1	Digital Form	
Procurement	O				Standard Order Process	
Support services	O					

#### Appendix 4.4.1: CEGIS Metadata model for NWRD

SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
1	Language of dataset code	10.01	Language(s) used in the dataset	M	N	string	ISO 639
2	Title	10.08.01	Name by which the dataset is known	M	1	string	free text
3	Abstract	10.03	Brief narrative summary of the data set	M	1	string	free text
4	Purpose	10.04	Summery of the intention with which the dataset was developed	O	1	string	free text
5	Progress code	10.11.01	Status of the dataset	O	1	integer	1-completed 2-in work 3-planned 4-required 5-ongoing 6-historical archive 7-obsolete
6	Access constraints	10.18.02.01	Access constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on obtaining the dataset.	O	1	string	free text
7	Use constraints	10.18.02.02	constraints applied to assure the protection of privacy or intellectual property, and any special restrictions or limitations on using the dataset.	O	1	string	free text
8	Lineage statement	30.02.04.01	Additional lineage information	O	1	string	free text
9	Qualitative narrative report	20.01.04.02.01	Descriptive quality information for the qualitative report type	O	1	string	free text
10	Distribution identifier	70.01.02	identifier by which distributor knows the dataset	O	N	string	free text
11	Distribution format name	70.01.06.01	Name of the data transfer format such as ArcInfo	O	N	string	free text

SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
12	Distribution media	70.01.06.09.02	Name of the media on which dataset can be received	O	N	string	free text
13	Level of conformance	80.06.03	Conformance level of metadata	M	1	integer	1 level1 2 level 2 3 level 1 w extension
14	Language of metadata	80.08.01	Language used within the metadata	M	1	string	ISO 639
15	Metadata date	80.04.01	Date that the metadata were created or last updated	M	1	date	ISO 15046-8
16	Initiative identification information	10.09	Initiative under which a dataset is compiled or produced - used as a means of identification	O	N	metadata entity	
17	Initiative name	10.09.2	Name of initiative used for identification	M	1	string	free text
18	Reference date	10.09.04	Date and time when the dataset was published or otherwise made available for release	M	1	date	ISO 15046-8
19	Responsible party information	10.08.03	Responsible party information for an individual or organization that is knowledgeable about the dataset	M	N	metadata	
20	Responsible party individual name	10.08.03.01	Person having primary responsibility for the intellectual content of the data	C/organization not identified	1	string	free text
21	Responsible party organization name	10.08.03.02	Name of the organization associated with the dataset	C/person not identified	1	string	free text
22	Responsible party role code	10.08.03.04	Function performed by the responsible party	M	1	integer	1-originator 2-publisher 3-custodian 4-principal investigator 5-content provider 6-processor 7-distributor

SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
							8-point of contact 9-metadata provider
23	Postal address	10.08.03.05.01	Address line for the address	O	N	string	free text
24	City	10.08.03.05.02	City of the address	O	1	string	free text
	Postal code	10.08.03.05.04	Postal code of the address	O	1	string	free text
25	Country	10.08.03.05.05	Country of the address	O	1	string	ISO 3166
26	Electronic mail	10.08.03.05.09	Address of the electronic mailbox of the organization or the individual	O	N	string	free text
27	Dataset extent	10.12	Horizontal and vertical extent of the data set	M	N	metadata entity	
28	Dataset extent coordinate	10.12.01	Geographic area domain of the dataset	C/geographic name not used	1	metadata entity	
29	West bounding coordinates	10.12.01.01	Western most coordinate of the limit of coverage expressed in longitude	M	1	real	-180 <=WBC< 180
30	East bounding coordinates	10.12.01.02	Eastern most coordinate of the limit of coverage expressed in longitude	M	1	real	-180 <=WBC< 180
31	North bounding coordinate	10.12.01.03	Northern most coordinate of the limit of coverage expressed in latitude	M	1	real	-90 <=WBC< 90
32	south bounding coordinate	10.12.01.04	Southern most coordinate of the limit of coverage expressed in latitude	M	1	real	-90 <=WBC< 90
33	geographic extent name	10.12.02.01	Commonly used or well known name of a place, area or region which describes a spatial domain of the dataset	O	1	string	free text
34	Temporal extent date/time	10.12.03.03.01	Date and time of the content of the dataset	O	1	date	ISO 15046-8
35	Category	10.13	Words or phrases summarizing a subject of the dataset	M	1	metadata entity	


SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
36	Theme code	10.13.01	High level non overlapping geospatial data thematic classification to assist in the grouping and search of available geospatial data sets	M	N	integer	
37	Key word information	10.13.02	Keywords their type and reference source	O	N	string	free text
38	Keywords	10.13.02.01	Common used word(s) or phrases used to describe the subject of the dataset	O	1	string	free text
39	Keyword type code	10.13.02.02	Method used to group similar keywords	O	1	integer	1 temporal 2 theme 3 place 4 stratum 5 discipline
40	Spatial representation type code	40.01	Method used to represent geographic information in the dataset	O	N	integer	1 text 2 vector 3 raster 4 image
41	Spatial reference system type code	50.02.01	Reference system used to spatially locate information in the dataset	O	2	integer	1 geographic identifiers, 2 coordinates
42	Ellipsoid identifier	50.02.03.02.08.08.01	Name or identifier of the ellipsoid for the datum	M	1	string	free text
43	Coordinate system type	50.02.03.02.09.03	Type of coordinate system	M	1	integer	1 - Cartesian 2- geodetic 3- projected 4- polar 5- gravity related
44	Map projection identifier code	50.02.03.02.09.04	Name or identifier of the map projection	C/is coordinate system projected	N	integer	1-Gauss-Krueger 2- Universal Transverse Mercator 3- Transverse Mercator 4- Mercator 5- Lambert Conformal Conic 6- Polyconic

SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
							7- Albers equal area 8- Azimuthal 9-Stereographic
45	Feature type	60.02.07	Class of real world phenomena with common properties	M	N	metadata entity	
46	Feature type name	60.02.07.01	Text string that uniquely identifies the feature type within the data sets	M	1	string	free text
47	Feature type definition	60.02.07.02	Definition of feature type in a natural language	C/definition not provided by the definition source	1	string	free text
48	Feature type code	60.02.07.04	Code that uniquely identify the feature in a dataset	O	1	integer	integer
49	Feature attribute	60.02.07.09	Characteristic of the feature type	O	N	metadata entity	
50	Feature attribute name	60.02.07.09.01	Text string that uniquely identifies the feature attribute	M	1	string	free text
51	Feature attribute definition	60.02.07.09.02	Definition of feature attribute in a natural language	C/definition not provided by the source	1	string	free text
52	Feature attribute value data type	60.02.07.09.04	Data type of the attribute value	M	1	integer	1 character 2 integer 3 real 4 binary
53	Feature attribute value domain type	60.02.07.09.06	Indicate whether or not domain for feature attribute values is enumerated	O	1	integer	0 not enumerated 1 enumerated
54	Feature attribute value domain	60.02.07.09.07	Permissible value for feature attribute	C/domain is not enumerated	1	string	free text

SI	Name	Identifier	Definition	Con.	Max. occur.	Data type	Domain
55	Feature attribute value	60.02.07.09.08	Values for enumerated attribute value domain	C/domain is enumerated	N	metadata entity	
56	Feature attribute value label	60.02.07.09.08.01	Descriptive label for qualitative attribute value	M	1	string	free text
57	Feature attribute value code	60.02.07.09.08.02	Code that uniquely identify the feature attribute a dataset	O	1	integer	integer
58	Feature attribute value definition	60.02.07.09.08.03	Definition of the attribute in a natural language	O	1	string	free text

## Appendix 5.4.1: Data dissemination form of WARPO

(i) Data estimation form

 পানি সম্পদ পরিকল্পনা সংস্থা	<b>Water Resources Planning Organization</b> <b>Ministry of Water Resources</b> Saimon Centre House No.40, Road No.22, Gulshan-1 Dhaka-1212, Bangladesh E-mail: <a href="mailto:dm_warpo@bangla.net">dm_warpo@bangla.net</a> Tel: 988 0879, Fax: +8802 988 3456			
Memo No.	Date:			
<b>Estimate Form</b>				
To	_____ [Name] _____ [Designation] _____ [Organization]			
Attn:				
Ref:				
Sub:	Estimate of <u>Tk.</u> ( <u>Taka</u> only) for the listed data below			
SL No	Data Description	Rate ( <u>Taka</u> )	Quantity	Amount ( <u>Taka</u> )
Total				
(Taka-----only)				
Please supply necessary CDs during data receipt.				
Remarks:				
Principal Scientific Officer Information & Data System Section				

(ii) Data invoice form



**Water Resources Planning Organization**  
**Ministry of Water Resources**

Saimon Centre  
House No. 4A, Road No. 22, Gulshan-1  
Dhaka-1212, Bangladesh  
E-mail: [dg\\_warpo@bangla.net](mailto:dg_warpo@bangla.net)  
Tel: 988 0879, Fax: +8802 988 3456

Memo No.

Date:

**INVOICE**

To \_\_\_\_\_ SL. No. \_\_\_\_\_

**Sub : Payment of Tk \_\_\_\_\_ for the cost of data**

Item	Data Description	Rate (Taka)	Quantity	Amount (Taka)

Total = Tk.

This payment is to be made in favor of the Director General, WARPO (NWRD).

Remarks:

Principal Scientific Officer  
Information & Data System Section

CC: 1. Director General, WARPO, Dhaka  
2. Account Officer, WARPO, Dhaka.

(iii) Data receipt form



**Water Resources Planning Organization**  
**Ministry of Water Resources**

Saimon Centre  
House No.49, Road No.22, Gulshan-1  
Dhaka-1212, Bangladesh  
E-mail: [dg\\_warpo@bangla.net](mailto:dg_warpo@bangla.net)  
Tel: 988 0879, Fax: +8802 988 3456

Memo No.

Date:

**Data Receipt Form**

Data Issued to \_\_\_\_\_ [Name]  
\_\_\_\_\_ [Designation]  
\_\_\_\_\_ [Organization]

Ref:

Data is issued by WARPO subject to the following conditions:

1. WARPO does not take responsibility for the correctness and accuracy of the data
2. The recipient warrants that no liability of whatever form shall be placed upon WARPO for inaccuracies in the data arising from the use of the data or those who make subsequent use of any information derived from the data
3. The recipient agrees to advise WARPO of any errors detected in the data
4. The recipient agrees to acknowledge the source of this data in any report or publication using the data
5. The recipient agrees not to transfer this data in whole or in part to another party without the prior permission of WARPO

SL No	Description of data	Unit	Quantity

Remark:

**Conditions above are agreed and data received:**

Name:

Designation:

Signature with date:

**Data issued by**

Name:

Designation:

Signature with date:

