

**PHILIPPINES'**  
**NATIONAL GEOGRAPHIC**  
**INFORMATION INFRASTRUCTURE**  
**FRAMEWORK PLAN**  
**(2001-2005)**

**Inter-Agency Task Force**  
**On Geographic Information**  
**October 2000**

**PHILIPPINES'**  
**NATIONAL GEOGRAPHIC INFORMATION INFRASTRUCTURE FRAMEWORK PLAN**  
**(2001-2005)**

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### **Part I. INTRODUCTION**

An information infrastructure is needed by each country to compete in the new global economy or information age. Realizing this, the Philippine government with the private sector outlined the IT21 Vision and created mechanisms for planning and implementing policies, programs and policies to attain the IT21 vision. In July 2000, the e-Commerce Bill was signed into law, hastening the process of adopting Internet technology in public transactions among others. A Government Information System Plan was also adopted (Executive Order 265) to bring the Philippine Government Online to improve public services and support the

implementation of the Medium Term Development Plan of the Government. An Information Technology and e-Commerce Council was created by Executive Order 264 fusing two separately created organizations on information technology to become the policy making body to support and guide IT initiatives in the country.

A significant part of the information infrastructure needed is geographic or locational in nature. More than 80% of information needed in the activities of government, business and individuals has to do with the location or geography of people, places, things and events. Many agencies of government and business establishments and institutions collect, process, disseminate and use geographic information. However, many of these datasets when fused or integrated are inconsistent, inaccurate, or inadequate for the intended uses of the datasets. This is because the country has not carried out a comprehensive plan to coordinate the acquisition, production, integration and dissemination to the various users in government, in business and to consumers consistent, accurate, updated geographic information that can be further analyzed and used according to the requirements of the individual and institutional users.

The development of a National Geographic Information Infrastructure (NGII) is now being carried out in many countries and their users as well as producers of the datasets are now reaping the benefits from the establishment of these NGII's. In the Philippines, the establishment of the NAMRIA in 1987 consolidated the functions of producing the basic maps and integration of resource information. As the national mapping agency of the government it was given a lead role in an Inter-Agency Task Force on Geographic Information (IATFGI) to formulate standards and plans for the development of a national geographic information infrastructure. The World Bank provided assistance in the formulation of a framework plan for the NGII of the Philippines.

This Plan is a result of the efforts of the IATFGI and the studies undertaken by the various agencies, assisted by consultants hired under the World Bank Assisted Project.

## **Part II. NGII and Rationale for its Establishment**

### **A. What is the NGII?**

The Philippines' National Geographic Information Infrastructure (NGII) is a national initiative to provide better access for all Filipinos to essential geographic information. The primary objective of the NGII is to ensure that users of geographic information, who require a national coverage, will be able to acquire complete and consistent datasets to meet their requirements, even though the data is collected and maintained by different agencies. The National Geographic Information Infrastructure helps ensure all such agencies concern themselves with the national interest, thereby maximizing government's return on investment in data collection and maintenance. The NGII will help achieve better outcomes for the nation through better economic, social and environmental decision-making.

The NGII is backed by standards, guidelines and policies on community access to that data, to support the country's economic growth, and its social and environmental concerns.

The NGII is not planned to be a central dataset, but rather a distributed network of databases, managed by individual custodians with the expertise and incentive to maintain them and who are committed to the principles of custodianship.

## **B. Components of the NGII**

The NGII is composed of four (4) linked, core components:

1. The institutional framework, which defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets,
2. Fundamental datasets which are produced within the institutional framework and fully comply with the technical standards,
3. Technical Standards and Protocols, which define the technical characteristics of the fundamental datasets, and
4. Clearinghouse Network, which is the means by which the fundamental datasets are made accessible to the community, in accordance with policy determined within the institutional framework, and to the technical standards agreed.

These components are described below.

### **Institutional Framework**

The Institutional Framework defines the policy and administrative arrangements for building, maintaining, accessing and applying the standards and datasets. It comprises several key elements:

#### **Leadership**

It is essential that an institutional structure be identified to lead the development of a national geographic information infrastructure. A National Geographic Information Council (NGIC) supported by working groups and coordinating committees will form the institutional framework for the Philippines' NGII.

The National Geographic Information Council (NGIC) shall provide the leadership necessary to secure adoption of the infrastructure concept and to convince political leaders of its importance. The NGIC will help the community of geographic information users more clearly define and describe the infrastructure as a coherent national entity and will lead the community in defining the components of the NGII, the characteristics of those components, and provide a vehicle for the determination of national priorities and custodianship.

NGIC members, as representatives of all geographic information interests in their respective sectors or areas of jurisdiction, are the means by which a national geographic information infrastructure can be defined and implemented.

NGIC responsibilities shall include:

- Identifying fundamental land and geographic datasets
- Identifying custodians for those datasets

- Establishing operating policies for geographic information custodianship and distribution
- Providing a coordination mechanism for the data production and maintenance programs of the custodians
- Defining and supporting a national directory (system) for the fundamental datasets
- Facilitating the development and implementation of technical standards
- Sponsoring multi-agency GIS/LIS demonstration and pilot projects
- Identifying education and training needs and facilitating the implementation of training programs
- Assisting each sphere of government to define and coordinate their respective areas of responsibility for fundamental datasets, and to coordinate cross-sectoral policies, standards and programs

NGIC shall have a Strategic Plan to address each of these responsibilities.

### **Sponsorship**

To ensure that the development of the national geographic information infrastructure meets the needs of the community, NGIC shall introduce the concept of national sponsors for the individual fundamental datasets. A national sponsor is defined as follows:

*A **national sponsor** of a fundamental dataset is an organization having a special interest in ensuring that the dataset is widely available to the community as part of a National Geographic Information infrastructure and has a structure and resources to enable it to:*

- *Liaise and cooperate with NGIC and other national sponsors in order to ensure that the National Geographic Information infrastructure is assembled, maintained and delivered in a nationally consistent way;*
- *Consult with the community of users to determine specifications, standards and priorities for collection and maintenance of the data;*
- *Consult with and coordinate the activities of the custodians of the individual datasets comprising the national dataset to the extent required to ensure that those datasets are collected, maintained and delivered in conformance with standards, specifications and priorities that enable a national dataset to be assembled from the component parts in accordance with the overall model for a national geographic information infrastructure.*

### **Custodianship**

A key feature of the NGII model is the emphasis on the concept of custodianship. A Custodian is defined as follows:

*A **custodian** of a fundamental dataset, or a component of that dataset, is an agency recognised by NGIC and having the responsibility to ensure that a fundamental dataset is collected and maintained according to specifications and priorities determined by consultation with the user community, and made available to the community under conditions and in a format that conform with*

*standards and policies established for the National Geographic Information Infrastructure.*

Responsibilities of custodian agencies may include some or all aspects of data acquisition, storage, maintenance, quality assurance, security, access, documentation and distribution. Custodians are also responsible for consulting with external users in the administration of their functions. These responsibilities must be well defined, particularly where a custodian chooses to delegate or contract a function to another agency, such as maintenance of a specific data item. Custodians may be identified for new datasets that have not yet been produced. Such custodians, or "data set lead agencies", would then have the additional responsibilities of defining the initial data set specifications and production priorities, in consultation with users.

In return for these responsibilities, custodians also have certain clearly defined rights. These may include the right to charge a fee for data access, to market and distribute the data to certain classes of users, and to access and use the data administered by other custodians.

Criteria, which may be considered in the allocation of data set custodianship, include statutory or legal responsibilities, operational needs, technical capability and availability of resources. Where many agencies have an interest, capability and capacity, the agency that requires the highest standards of quality may be the most appropriate custodian.

The national custodians shall be identified for those key datasets and their rights and responsibilities clearly determined.

NGIC shall not establish national custodians for every data set, although coordinating and consultation mechanisms shall be identified for developing national standards and priorities.

### **Data Distribution**

Distribution involves institutional issues of establishing directories and policies to make the data affordable. A directory contains metadata for the geographic datasets comprising the national geographic information infrastructure. Metadata is "data about the data" and includes the key technical characteristics of the data, access conditions and procedures, and how to obtain further information. A National Geographic Information infrastructure shall include such a directory, or directory system, through which all potential users can determine the availability and suitability of datasets for their purpose. The directory shall include both the fundamental datasets that are part of the infrastructure, and other datasets that are available from the public and private sectors. A "data forecasting" capability, that identifies datasets currently in planning or production, shall be part of the data directory.

NGIC shall support the establishment and maintenance of a national directory of geographic information.

Custodians with data distribution responsibilities shall administer pricing structures and licensing conditions for the access and use of data by external parties. Distribution policies are generally based on either a "public interest" or a "commercial" approach. While commercial data producers operating in the private sector will clearly adopt a commercial approach, government agencies in the public sector shall adopt any position on the continuum between public interest and commercial, depending on current government policies and the relevant laws regarding copyright and government information.

Key issues to be considered in establishing a government-wide data distribution policy therefore are:

- The basic pricing principles to be applied (public interest or commercial)
- Whether or not prices shall be varied according to the nature of the user or use
- What restrictions if any should be included in the licenses.

NGIC shall develop a draft National Agreement on the Transfer of geographic information, and in that policy document, NGIC shall support the concept that data collected in the public interest shall be made available to the community, for non-commercial purposes, at the average cost of transfer.

### **Education and Training**

In designing and developing the infrastructure, it may be determined that there is a shortage of appropriately educated and trained people and that this is an impediment to successful implementation of the infrastructure.

NGIC shall address this issue with government, funding agencies and academic institutions. NGIC shall develop a skills profile that will be matched against existing skills and thereby identify gaps where training and education are required.

### **Applications**

Multi-agency projects that build on the data integration and analysis strengths of the technology would be particularly appropriate. Such projects help develop inter-agency cooperation, provide valuable experience on which infrastructure policies and priorities can be considered, develop technical skills, and provide cost/benefit data to support funding proposals for major Geographic Information System or Land Information Systems (GIS/LIS) programs.

NGIC shall have a key role in ensuring that geographic information is effectively applied to real economic, social and environmental issues. This can be achieved through support for projects that demonstrate the application of GIS/LIS technology.

## FUNDAMENTAL DATASETS

The essential component of the national geographic information infrastructure is the Fundamental Datasets that are produced within the Institutional Framework and that fully comply with the Technical Standards. They are the datasets which are collected as primary data sources, and from which other information is derived by integration or value adding. Fundamental dataset is defined as follows:

*A **fundamental dataset**, in the context of NGIC's vision for a national geographic information infrastructure, is a dataset for which more than one government agency requires consistent national coverage in order to achieve their objectives. This demand for a consistent national coverage implies that:*

- *There is a need for coordination between custodians to ensure that components of that dataset are collected to consistent standards;*
- *The community of users must be adequately consulted to determine specifications and priorities;*
- *Access to the data is provided in accordance with policies determined for the national geographic information infrastructure; and*
- *It conforms to a set of standards that ensures that it can be combined with other components of the national geographic information infrastructure to create value-added products.*

There are two principal issues associated with the provision of Fundamental Datasets:

### **Identification and Priorities**

A key activity in defining the National Geographic Information Infrastructure is to identify the national land and geographic data priorities - what are the Fundamental Datasets that should be produced by the government and what are the funding priorities? Individual agencies will have very strong views on needs and priorities, based on their own programs.

Datasets that might be included in the infrastructure are aerial and satellite imagery, the cadastre, census results, land use and land cover, place names, administrative areas, transportation networks, utility networks, coastline, rivers and lakes, elevation, soils, vegetation, fauna, geology, climate, pollution, hazardous sites, and areas of environmental significance.

NGIC shall facilitate the determination of a national geographic information infrastructure that rises above the narrower interests of individual agencies and jurisdictions. The Council shall identify the Fundamental datasets comprising that infrastructure, to identify custodians of those data and to facilitate the development of national priorities and standards for those data.

The technical characteristics of those datasets shall include the spatial accuracy, associated attributes, attribute accuracy and currency. The level of government (national, provincial, local) responsible for production and

maintenance, and any variations in characteristics according to geographic location, shall be specified.

A draft list of fundamental datasets and tables of characteristics and locational classifications that might be applied to each fundamental dataset is shown in the Appendix , Table 6-B.1. This is to be further refined after receiving inputs from the whole geographic information community, both data providers and data users. An extensive process of consultation will be undertaken to refine the lists.

### **Production and Integration**

After the Fundamental Datasets have been identified and prioritized, the issues of data set custodians and funding of production and maintenance programs shall be addressed. Cooperative arrangements will be needed to ensure that the Fundamental Datasets can be spatially integrated. That is, where a real world entity such as a road centerline is represented in two or more datasets, such as the transportation network and census boundaries, the spatial representations shall be coincident.

Coordination and consultation mechanisms shall be needed to ensure that standards and priorities are determined for the greatest benefit of the community as a whole. The NGIC shall offer its broadly based coordination structures to assist in this process but will look to custodians and special interest user groups to take a lead in developing standards and priorities.

## **TECHNICAL STANDARDS**

In the context of a national geographic information infrastructure, Technical Standards define the technical characteristics of the fundamental datasets.

### **Standardization Processes**

A National Geographic Information Infrastructure requires standards in each of the following areas: reference systems, data models, data dictionaries, data quality, data transfer, and metadata.

The International Standards Organization (ISO) has recently established a committee structure (ISO TC/211) for geographic information standardization as a new field of technical activity. This ISO work will provide the framework for both international and national geographic information standardization. NGIC and DTI's \_\_\_\_\_ shall provide the institutional framework for development and support of technical standards for GIS/LIS data in the country, and actively participate in the work of ISO TC/211.

Some work has been done by the IATFGI and other countries in the development of standards and that it may be neither necessary nor appropriate to develop completely new standards. Time and effort may be saved by adapting existing standards to national needs, with the added advantage of support by the major GIS/LIS vendors. The essential thing that

shall be done is to identify areas where standardization is required, to identify or develop appropriate standards, and to encourage the adoption of those standards.

The NGIC shall strongly support work for the development and adoption of standards because compliance with a single set of integrated national standards shall be more efficient for industry than having to comply with the divergent standards of individual agencies. NGIC shall ensure that national geographic information standards shall be independent of the system standards developed by GIS/LIS vendors. This is to ensure that geographic information can be utilized on any system, and that systems can be upgraded and replaced without loss of data.

### **Reference Systems**

The geographic reference system, or geodetic datum, is a fundamental standard to enable integration of geographic information. The availability of Global Positioning System (GPS) technology has greatly improved geodetic knowledge at the national, regional and global levels, enabling computation of a precise geocentric datum. Within a national geographic information infrastructure, the two key requirements are for the fundamental datasets to be stored on a single accurate national reference system, and for the relationship between the national and geocentric reference systems to be well defined (if they are not the same).

The development and maintenance of a national geographic reference system, in the era of satellite positioning systems, requires a technological infrastructure of its own. The core of this geodetic infrastructure is a "fiducial network" of GPS stations, linked to the national and preferably also the regional and global geodetic systems. In addition to the fundamental datasets, this geodetic infrastructure also supports the geoscientific and navigational users of satellite positioning technology.

The NGII shall use the new Philippine Reference System (PRS) as its geographic reference system making it compatible with modern satellite-based positioning systems. NGIC shall endorse the work of the NAMRIA in its efforts to further densify the geodetic controls for survey and mapping activities in the country.

### **Data Models**

There are two levels to a data model standard - the conceptual data model and the logical data model (or data structure). A third level, the physical data model or file structure is implemented in the data transfer standard. The conceptual model provides a schema for the representation of the real world in the form of geographic information. The schema provides a semantic structure for the spatial and attribute components of the fundamental datasets and for the relationships between the various datasets. The conceptual level is then mapped into one or more logical data models, which specify how the

relationships are to be defined. This is the level at which, for example, a topological or raster data structure would be specified.

NGIC shall identify the requirements for standard data models in a variety of land and geographic areas.

### **Data Dictionaries**

The data dictionary standard is built on the conceptual data model. It provides standard definitions for the spatial and attribute components of the fundamental datasets. For example, the feature 'road' may have a range of attributes such as 'class', 'surface' and 'width', and the attribute 'class' may have a range of values such as 'principal', 'secondary' and 'minor'. All these terms must be unambiguously defined in a data dictionary to enable accurate interpretation and efficient integration of data in GIS/LIS applications. Data dictionaries must be developed for each fundamental dataset, and cross-referenced to ensure consistency.

As more and more data is produced and the applications and communications technologies becomes more efficient, the lack of semantic standards such as data dictionaries has become a larger impediment to GIS/LIS success than the lack of technology-related standards such as data transfer.

The IATFGI is coordinating the development of data dictionaries. There are groups currently working on data dictionaries for topography, cadastre, utilities, street addresses, geosciences, etc. These groups are: land and surveys, socio-economic, infrastructure and utilities, agriculture and environment

NGIC shall continue to identify the requirements for data dictionaries in a variety of land and geographic areas.

### **Data Quality**

Geographic data quality standards may be descriptive, prescriptive, or both. A descriptive standard is based on the concept of 'truth in labeling', requiring data producers to report what is known about the quality of the data. This enables data users to make an informed judgment about the 'fitness for purpose' of the data. A descriptive data quality standard may require producers to provide information on the following five key characteristics: lineage, positional accuracy, attribute accuracy, logical consistency, and completeness. A prescriptive standard would define quality parameters for each characteristic, for a particular application.

NGIC shall develop descriptive quality standards. A quality statement is a key element in the metadata standard, because it enables potential users of data to assess whether the data held is fit for the purpose to which they intend to use it. However, for fundamental datasets, prescriptive standards may be required and that wide community consultation is required to determine those

standards. Quality standards shall be addressed in the community consultation on fundamental datasets.

### **Data Transfer**

Transfer standards provide an intermediate format for the transfer of data between different computing environments. They comprise a set of rules for encoding data into fields, records and files for transfer via a specified media. A data model is a prerequisite to development of the encoding rules. The intermediate nature of transfer standards is an important characteristic - they are not intended to be product or database structures. Transfer standards are optimized to achieve effective communication of all data and metadata, whereas product and database structures may be optimized for efficiency of storage, application or maintenance.

The transfer standard provides a GIS/LIS vendor-independent target for encoding data for output, and for decoding data for input. Vendor-independence enables production and application agencies to utilize whichever hardware and software systems are the most cost-effective for their needs, without compromising 'corporate government' principles.

It is hoped that the ISO activity will result in an international geographic information transfer standard, which, with government agency and GIS/LIS vendor support, will facilitate effective data communications within and between nations. The Philippines shall actively participate in the work of ISO TC/211 to try to ensure that any international standard adopted is compatible with the Philippines'.

NGIC shall support the adoption of the US Geographic information Transfer Standard (SDTS). It shall be subjected to the usual process of community consultation. Comments shall be accommodated in the draft and the final standard shall be published as a Philippine Standard. This standard will, in due course, replace existing standards but recognizing that the old standard has been implemented in many systems, it will remain a standard for another five years, after which it will be withdrawn.

### **Metadata**

A metadata standard will specify how data is described in the national directory and in data transfers. Characteristics to be described may include the data set name, content, coverage, quality and structure, and information on access procedures and restrictions. The metadata standard can be viewed as a microcosm of the other data standards, requiring (meta) data model, dictionary, quality and transfer specifications of its own.

The NGIC shall support the concept of a national directory of geographic information and shall develop a metadata standard which will be supported by all agencies and all levels of government. The NGIC shall adopt protocols aimed at encouraging all agencies to consistently record their datasets on the national directory system and to freely share metadata.

## **CLEARING HOUSE NETWORK**

The Clearing House Network is the final component of the national geographic information infrastructure and is the means by which the Fundamental Datasets are made accessible to the community, in accordance with policies determined within the Institutional Framework, and to the Technical Standards agreed. There are two issues to consider:

### **Technological Framework**

The Clearing House Network is the technological framework established to give the community access to the Fundamental Datasets. The model does not propose a single central database. Rather, the model anticipates that the respective custodians will hold datasets on a number of independently maintained systems, and that they will be linked by common standards and policies. Physical linkages between those systems will be through a range of mechanisms including dedicated telephone lines, local area networks, wide area networks and integrated-services networks.

### **Data Directory System**

The national geographic information clearing house network will be a part of the developing, more general national infrastructure for information distribution and access. The key element of the network is the data directory system that should be freely accessible and contain highly accurate metadata for the Fundamental Datasets, including advice on gaining access to the data.

NGIC's aim in developing the Clearing House Network is to foster the integration of Fundamental Datasets into the network and to coordinate with other infrastructure coordinating bodies to develop a national consensus. The Clearing House Network is not something that NGIC can address on its own, as it is part of the broader information distribution problem. However, NGIC will encourage the adoption of standard data transfer protocols and national policies for access and pricing, and will ensure that the particular needs of the national geographic information infrastructure are taken into consideration when data distribution networks are being designed.

### **C. Why Do We Need a National Geographic Information Infrastructure?**

The concept of national infrastructures is not new in the Philippines. National roads and telecommunications networks, basic health and education facilities are national infrastructures that have been funded by the government (and lately with the participation of private sector investments) in the national interest, to promote economic development. These infrastructures are developed to provide a common, consistent infrastructure upon which a variety of government, private sector and community activities can take place.

Geographic information is just as much an infrastructure as roads, communications, school buildings, health facilities with the same rationale and characteristics. A National Geographic Information Infrastructure, backed by national standards, guidelines, and policies on community access to that data, is needed to support the country's socio-economic development and maintenance of ecological balance.

### ***Uses and Applications of Geographic Information***

A significant proportion of our nations' economic development and social and environmental well-being is heavily dependent upon land or location related activities. Examples are mining, farming, forestry, transport, tourism, fisheries and the planning of public services, to name a few. Much of what we want to do in these areas can only be achieved with good, consistent land and geographic information being available and readily accessible to the private and public sectors as well as the community at large. This not only refers to present activities but it is especially important when we are planning for our future.

There are few areas of the economy, which do not rely either directly or indirectly on geographic information for planning, maintaining, monitoring or rationalizing activities.

Without geographic information, we cannot address, let alone resolve, national issues such as urban renewal, forest management, land title administration, coastal zone management, defense, drought and flood relief, and land management.

Similarly issues such as soil salinity, river water quality, watersheds management, land development and transport planning as well as location of hospitals, police stations, fire stations and other community facilities all require good, consistent geographic information. Local issues such as farm planning, coastal development, town and property planning, provincial physical framework planning, air quality, local transportation infrastructure is also heavily dependent upon geographic information.

Geographic information can be used for a variety of purposes. Soils information not only supports farmers in managing their farms and SAFDZs but also is useful to local authorities in identifying suitable areas of road construction material. Geological information not only supports the mining and petroleum exploration industries, but also helps identify suitable underground water for our cities and towns. Census information assists in the development of government policies on a whole range of issues as well as supporting the most appropriate positioning of community infrastructure such as health centers, fire stations, public deep wells and schools. Government agencies rely on geographic information in the provision of services (agricultural, planning, emergency and disaster) and the management (transport, forests and property information) and development (resource development, mining and petroleum) of the country. Much of this information has multiple uses.

Property information provides a basis for asset management, utilities, valuation services, town planning and emergency response.

The above list will expand in the years ahead, as data is adapted for use in new areas, such as real time monitoring of vehicle speed and location, monitoring of traffic density patterns, determining accident and crime locations, monitoring environmental and ecological trends, and providing location services on mobile phones.

### ***Benefits from a National Geographic Information Infrastructure***

#### **Reduction in duplication of efforts and data inconsistencies**

The precision or scale of geographic information used for national applications will not be suitable for regional or local applications. For instance a national vegetation study which produces a broad, generalized dataset will not provide much useful information for a city land use planning group which needs site specific datasets with a lot of detail.

Everyone could collect the geographic information that they need at the national, regional and local level, but this leads to costly duplication of data and inconsistency. It also results in data that cannot be integrated with other data and used as a basis for spatial modeling and analysis to produce value added information. In other words, excessive costs, inefficiencies, confusion and decision-making based on poor information can be the results.

The Philippines does not have the resources to waste on such duplicated efforts. It is believed that the community should reach agreement on what fundamental datasets are required in the national interest, to what standards they should be collected and maintained, which agencies should have custodianship of those data, and what the national priorities are for collection of those data.

#### **Multipurpose nature of geographic information**

Using data that has been collected for one purpose (geology for minerals exploration) in another application (geology for water supplies) is cost efficient. However to take full advantage of this principle the information must be consistent, to acceptable standards, its existence widely known and it must be accessible.

#### **Economic Returns from Geographic Information Investments**

The country can benefit from better management of its geographic information by taking a perspective that starts from the national level and works down to the local level. The Price Waterhouse Benefit Study done for the Australian and New Zealand Land Information Council (NGIC) revealed a benefit: -cost ratio for data usage over the last five years of approximately 4:1. This shows that for every dollar invested in Australia and New Zealand for producing geographic information, \$4 of benefit was generated within the economy. For

the period 1989 - 1994 these benefits were in the order of \$4.5 billion. Benefits were distributed across the broad spectrum of economic activities ranging from the operation of electricity, gas, and water utilities to projects involving agriculture, and mining and environmental management. The benefit-cost experience in Australia and New Zealand may even be of higher ratio in the Philippines as Geographic Information production and use are to be undertaken in the information/Internet age.

By everyone adopting this national perspective the Philippines will not only avoid wasting resources on data collection, storage and integration but it can gain some impressive advantages as well. Users can be provided with consistent, repeatable data that can be used on issues such as reducing land use conflict, completing the land reform program, improving the agriculture sector, resolving environmental issues and improving our ability to locate mineral deposits. In doing so we also improve business competitiveness and hence the ability of our private sector to compete on the international market.

### **Cost Savings for Users**

The Price Waterhouse Benefit Study conducted for the ANZLIC also showed that the existing infrastructure for supplying geographic information has provided information to users at a cost far lower than alternative methods. If the existing infrastructure had not been in place and users had been forced to meet their data requirements from other sources, their costs would have been approximately six times higher. Over the past five years alone, establishing infrastructure has saved users in ANZ over \$5 billion.

In the Philippines, government and private sector investment in the computerization of key government information-based public services such as civil registration, issuance of drivers licenses, land titles registration, passport issuance, roads inventory, precinct mapping and voter registration, land administration, national police, population census, etc. reinforces the concept of building a single, consistent, accessible, geographic information infrastructure to provide the geographical perspective in the use of the databases for value-adding services by private and government sector users. Other data infrastructure initiatives include: the NAMRIA mapping program, the DENR mapping of the final forest line, NIPAP, NEDA's regional and provincial physical framework planning, the city and municipality land use and comprehensive development planning, the DENR's Land Administration and Management Project, the Bureau of Agriculture Statistics and NSO's Census of Agriculture and Fisheries, the inventory of establishments by the NSO, the profiling of volcanic areas by Phivolcs, the Weather Forecasting initiatives of the PAG-ASA, the revision of property valuations conducted by LGU assessors, etc.

All these efforts will result in geographic information that, if done based on policies that will allow integration, fusion in a spatial context, can be used in business and government for many other uses- thus more than doubling the value of the benefits from these data acquisition efforts.

#### **D. International Trends in the Area of National Geographic Information Infrastructure**

Governments throughout the world are coming to recognize that information is one of the most critical elements underpinning decision making for economic and social development, and the need to assign resources to establishing an effective information infrastructure.

For example, in April 1994 the President United States of America issued an Executive Order that implemented a National Spatial Data Infrastructure. The European Community has developed detailed policies and strategies for a European Geographic Information Infrastructure. Similar steps are being taken in South Korea, Japan, Indonesia and other countries in our region. As of April 2000, about 30 countries have established their NGII's or NSDIs while more were reported to be in the planning stage such as the Philippines.

In October 1996, the Permanent Committee for GIS Infrastructure for Asia and the Pacific held its inaugural plenary meeting in Sydney to address the needs and strategies for a regional Geographic Information infrastructure.

#### **E. Emerging Applications for a National Geographic Information Infrastructure**

There are certain emerging national user needs which require a consistent dataset across the nation, based on the integration and availability of datasets produced by different agencies.

**Population Census** - The national population census requires an up-to-date, consistent topographic/cadastral map base for delineating enumeration area (census tracts) units. It is important that in the counting of the population, the barangay boundaries are accurate and sufficient landmarks details are delineated in maps because many other government agency programs depend on the population distribution information for allocating resources and planning programs and projects. The Internal Revenue Allotments of Local Government Units depend on population as well as area of the LGUs. Conflicts in boundaries and the population count based on wrong boundaries lead to conflicts on resource allocations.

**Defense** - National defense services and agencies (army, navy, marine, airforce, intelligence, DND, etc.) need data routinely collected and maintained by national agencies, to build a consistent database to support national security purposes.

**Land Titles Registration** - Land ownership and tenure maps are needed to identify fake and fraudulent titling as well as irregular and inaccurate surveys of land and water bodies. Because the quality of surveys are suspect, an orthophoto map database can serve the purpose of providing a control map to

overlay titled properties to and determine those parcels of alienable and disposable lands that remain untitled.

**Comprehensive Agrarian Reform Program** – The CARP requires the metes and bounds of properties in the private and public domains that are to be either covered and not to be covered under the CARP. It requires topographical and other thematic maps for planning the support services for agrarian reform communities. There is land reform in the alienable and disposable lands and in the public domain. There are many contentious issues in the Program the resolution of which could be facilitated with the existence of a consistent data set on land parcels and tenure, as well as soil suitability and topographical data.

**Voter Registration and Precinct Mapping** - The perennial problem of ghost barangays, flying voters, disenfranchised legitimate voters, and the fairly recent "dagdag – bawas" anomalies are being addressed through issuance of secure Ids as well as through the mapping of legitimate voters on a precinct basis. The importance of accurate political boundaries in the exercise cannot be over-emphasized because of disputes that will arise during the vote counting. The need for accurate, updated and unique building addresses is important for successful implementation of this activity by the COMELEC to modernize the electoral system.

**Vehicle Navigation** - The emergence of vehicle navigation systems will require a nationally consistent, regularly maintained digital road network dataset, upon which system providers can base their value-added network. There are currently a few sources of data for roads information. The DPWH RIMSS Project would be a key data source on national roads. Mobile mapping of secondary and tertiary roads will be possible with a national roads database to connect to. However, a planimetric or topographical basemap will still be necessary to serve as basemap for applications such as this.

**Integrated Area Development** – LLDA, PDA, Davao Gulf, MARILAQUE, CALABARZON, NLT, and similar development planning areas require consistent datasets for planning and operations. Socio-economic and physical profiling of the planning areas are standard activities that require consistent and updated geographic information.

**Emergency Management** – The Philippines is a disaster-prone country, regularly subjected to natural calamities, and some man-made ones. It has built a national disaster management coordination mechanism with the NDCC and OCD at the central level, the RDCC at the Regional Level, the PDCC at the provincial level, the City DCCs at the city/municipal level, and BDCCs at the barangay level. In every aspect of planning and operations of these councils and the member agencies and volunteers that comprise them, geographic information is vital and essential. Fundamental datasets such as topography, roads, population centers and distribution, hazard maps, climate map, infrastructure data such as schools buildings, water facilities, electric facilities, etc. are important data sets for planning for emergencies,

responding to emergencies, damage assessment, rescue, relief and rehabilitation activities.

In all of the above cases, considerable effort is required to integrate the separate datasets from the various agencies to produce a consistent dataset. This is because the datasets have been produced for the specific needs of each producer or clients of producer with a lack of common standards. This narrow focus can also occur within departments, where different government agencies collect data in an uncoordinated manner to meet their specific needs. Such datasets are difficult to integrate with other similar datasets, leading to multiple datasets covering the same phenomena but to different criteria e.g. vegetation data.

### **Part III. SITUATIONER**

- A. Data
- B. Applications
- C. Technology
  - a. Hardware, Software and Networks
- D. Organization and Human Resources
  - a. Draft of EO on the Creation of NGIC
- E. Funding
- F. Policies and Standards
  - a. Manual on Standard GIS Data Definitions, Classifications and Codes

(text to follow based on interviews and surveys)

### **Part IV. VISION**

The vision for the National Geographic information Infrastructure (NGII) is for Philippine society making full use of geographic information resources for sustainable socio-economic and physical development through improvements in the availability, usability, consistency, compatibility, and affordability of geographic datasets produced by various sources. Geographic information will be available through networks to any user. The optimal usage of geographic information in Philippine society will be insured by a variety of available services from government and business made possible by the NGII. This should result in decrease in overlapping data collection and maintenance and an increase in value add uses of geographic information not attainable without a well thought out National Geographic information Infrastructure.

Here are some examples of different situations where geographic information will be used with the NGII in place.

- A real estate buyer connects to the NGII clearinghouse node on land parcels to search for property that is for sale in town A in Barangay X giving search

parameters such as distance to the city/municipal hall or church, within the Central District, along a national road, etc. and finds out the market value of that property, assessed value of that property, owner, and other legal documents on ownership and survey documentation. He also finds out the neighborhood where that parcel is located, and is given a contact name and number for next action in the buy/sell process.

- An online product seller dispatches the delivery truck to their destinations following the best and most cost effective route having been planned earlier using an Internet Mapping Service in the National Clearinghouse Network.
- A utility service provider is able to determine the location of a service complaint as given by a caller, is able to determine the possible causes, and issues work order and dispatches the crew to service the complaints, all in speed faster than conventional means since all information are accessible through the Web.
- An Elementary school student is able to learn about Philippine geography and about his hometown by zooming in and out of maps and getting information about any object on the map in understandable forms. They are able to learn about population, climate, water quality, economic activities, etc.
- A farm manager is able to assess the potential damage to crops as a result of a strong typhoon that is nearing his site at Typhoon Signal Number 3 using precision agriculture methods in the documentation of farm inputs to plots within his farm.
- As numbers of casualties in an earthquake stricken area are reported on broadcast media, a map of the location of the victims and the buildings involved are identified and color coded to show the extent of damage to the areas affected. TV viewers and decision makers having access to the information have a visual understanding of the situation and are able to make the appropriate emergency response.
- A Balikbayan family who has not visited the Philippines for 10 years and planning to tour unknown tourist destinations from their homebase in the USA are able to plug to the Internet and determine the best program and plan a two week holiday including a visit to their hometown.
- A Municipal Land Use Planner is able to regularly update the municipal socio-economic and physical profile of his town in a visual way by being able to link transactional and statistical data to maps of the municipality that is available in the NGII clearinghouse.
- A Budget review and allocation officer is able to visualize the allocation of government funds in relation to needs of the localities and discovers areas that are underserved and localities that have more resources needed, subsequently making adjustments to resource allocations.
- A COMELEC election review team is able to quickly assess on a precinct by precinct basis problem areas where incidence of statistical anomalies in voter registration are occurring as well as statistical anomalies as counts are coming in or during the municipal canvassing process.
- A visual inventory and assessment of national roads and bridges is accessible to planners, maintenance personnel, and auditors, improving the process of allocating and using funds for national roads.
- Cadastral records of the DENR are completely inventoried and can be visualized and matched with the Land Titles Records of the Land Registration Authority, making possible the speedy review and examination of land transactions. The same records are accessed by LGU Assessors to update their tax maps.
- Simple queries are possible such as who owns the lands beside a Seven-eleven Store near corner Kamias St. and EDSA.

- A Call Center operator receives a call for Pizza Hut delivery and by knowing the phone number of the caller and/or the address given is able to view the location of the caller and is able to transmit the order to the Pizza Hut Delivery Store nearest to the caller's address.
- An Agriculture Extension Worker is able to provide advise to farmer customers on best crops to plant in a season, after accessing the agriculture information database that provides a visualization of technical information related to farm lots in his service area, as well as market conditions around the country.
- The location of a 10 wheeler van carrying millions of pesos worth of cargo can be traced from a command center as it moves from warehouse to its destination, as part of a security system of the company.
- The total value of agriculture and other property losses are estimated faster after a strong typhoon and flooding event in a rural district as geographic information on farms and properties are integrated and fused with Pag-asa information on the typhoon, facilitating faster relief and rehabilitation activities and resource provisioning.
- Terrorist positions are better analyzed in unknown terrain, facilitating tactical planning of the armed forces teams.
- A WAP user is able to use a browser to find out the neighborhood he got lost in and determines the best route to get back to the direction of the place he should be going to.
- Based on traffic condition reports accessible from the dashboard of a modern car, a car user is advised of alternate routes to avoid the traffic in his route.
- Right of Way data of government agencies are organized geographically and facilitates the survey and resolution of right of way issues in infrastructure projects involving private and public lands.
- Environmental impact analysis of the biggest dam project in the country is more comprehensive with the visualization and spatial analysis tools applied to geographic information about the environmental elements that will be impacted by the project. The analysts have visualization tools in public foras to discuss findings and mitigation measures, helping reduce tensions between affected parties.
- The mobile phone network planner optimizes the nodes and the number of transmitters in respect to the network capacity by using the digital terrain model and information about the settlements and traffic flows.
- The environmental authority checks the land ownership concerned with the preparation of the environmental protection decision of a coastline. The authority retrieves the information with a single query saving a week of work with the archives.
- The head of civil defense can simulate a catastrophe situation to test and design the rescue and evacuation capacities to a safe level.
- And more.....

## **Part V. Goals and Objectives**

The goals and objectives of the NGII are:

- To ensure that users of geographic information will be able to acquire consistent datasets to meet their requirements, even though the data is collected and maintained by different agencies.
- To maximize government's return on investments in data collection and maintenance of the national fundamental datasets.

- To reduce waste from unnecessary duplication of efforts in data creation and updating, and from use of inconsistent or poor quality data in planning and operations of programs and projects.
- To help improve planning and decision-making in government and business that are impacted by the location of people, places, things and events.
- To promote value add activities, products and services from the fundamental datasets.
- To promote private industry development in geographic information acquisition, development and provisioning to local and global markets.

## **PART VI –A. INSTITUTIONAL FRAMEWORK DEVELOPMENT PLAN**

The Institutional Framework Development Plan consists of programs, projects and activities to build and operationalize the policy and organizational arrangements for building, maintaining and applying the technical standards and datasets of the NGII.

### **1. Organization and Administrative Arrangements**

A National Geographic Information Council (NGIC) shall be organized by Executive Order to spearhead and lead the development of the national geographic information infrastructure (NGII), to secure adoption of the infrastructure concept and to convince political leaders in the executive and legislative branches of its importance. The NGIC will help the community of geographic information users more clearly define and describe the infrastructure as a coherent national entity and will lead the community in defining the components of the NGII, the characteristics of those components, and provide a vehicle for the determination of national priorities and custodianship.

The mandates and functions of the NGIC are to:

- Identify fundamental geographic datasets
- Identify and designate custodians for those datasets
- Establish operating policies for geographic information custodianship and distribution
- Provide a coordination mechanism for the data production and maintenance programs of the custodians
- Define and support a national directory (system) for the fundamental datasets
- Facilitate the development and implementation of technical standards
- Sponsor multi-agency GIS/LIS demonstration and pilot projects
- Identify education and training needs and facilitate the implementation of training programs
- Assist each sector and level of government to define and coordinate their respective areas of responsibility for fundamental datasets, and coordinate cross-sectoral policies, standards and programs
- Prepare a Strategic Plan to accomplish above mandates.

The member agencies forming the National Geographic Information Council (NGIC) shall include:

- Department of Environment and Natural Resources (DENR)
- Department of Science and Technology (DOST)
- Department of Agriculture (DA)
- Department of Public Works and Highways (DPWH)
- Department of Transportation and Communications (DOTC)
- Department of Defense (DOD)
- Department of Justice (DOJ)
- National Economic and Development Authority (NEDA)
- Department of Finance (DOF)
- Department of Agrarian Reform (DAR)
- Department of Interior and Local Government (DILG)
- National Mapping and Resource Information Authority (NAMRIA)
- Land Registration Administration (LRA)
- National Statistics Coordination Board (NSCB)
- Housing and Land Use Regulatory Board (HLURB)
- League of Leagues of Local Government Units (check the right name)

In addition the private GIS industry shall be represented in the Council by a nominee from a representative organization.

The Council shall be Chaired by the Secretary of the DENR. The NAMRIA shall act as the Secretariat of the Council and shall in addition to its current functions, undertake coordinative and support activities for the NGIC to implement its mandate and responsibilities. A permanent organization with full time staff shall be set up within the NAMRIA to support the NGIC.

The NGIC shall create such technical working groups (TWGs) and committees as may be necessary to accomplish its mandate of leading the development of the NGII. Working Groups shall include those that would focus on: the Fundamental Data Sets, the National Clearinghouse Network, Metadabase Guidelines, Custodianship Guidelines, Data Distribution Guidelines, and such other areas of coordination and policy and program development. The NGIC shall encourage the participation of private industry in the development of technical standards and protocols as well as in the build up and distribution of fundamental datasets including value add information products. Likewise, the academic sector will be encouraged to participate in the development of the NGII particularly in research and development, education and training.

The NGIC, through the NAMRIA, shall operate and maintain the hub or web portal of the National Geographic Information Clearinghouse Network and shall be responsible for the National Geographic Information Directory System.

The Nodes of the National Geographic Information Clearinghouse Network shall be the designated custodians of fundamental datasets, although these custodians may designate another data custodian or the NAMRIA to host their site. Each node (data custodian and/or national sponsor) shall have the responsibilities described in section 2.1 (custodianship) and 2.2 (data distribution). It will be necessary for the Nodes to establish the appropriate structure and staffing to support its functions as data custodian of a

fundamental dataset and provider of metadata concerning the fundamental datasets under its custodianship in the national directory system. NGIC will support efforts of the Network nodes to develop capability and capacity as data clearinghouse network node.

## **2. Policy Development**

### **2.1 Custodianship**

The NGIC shall formulate and adopt data custodianship guidelines to be adopted by agencies that form part of the NGII. A Draft Data Custodianship Guidelines is attached in the Appendix of this Plan for review and finalization of a Working Group on Data Custodianship and the NGIC Secretariat for consideration of the NGIC.

### **2.2 Data Distribution**

The NGIC shall formulate and institute such policies to address institutional issues of establishing directories and policies to make the data accessible and affordable. The NGIC shall lead the development of a national geographic information directory system through which all potential users can determine the availability and suitability of datasets for their purpose. The NGIC shall revisit resolutions of the IATFGI as well as draft policies and standards on data sharing, marketing of geographic information, data classification schemes and definitions, standard for map scales and map projections. These draft policies and guidelines can be found in the Appendix of this Plan.

Some models concerning data distribution policies and institutional arrangements can be reviewed in the web pages of several NGII's and NSDIs which can be adopted and customized for use in the Philippines' NGII.

## **3. Change Management**

The community of geographic information producers and users in the Philippines are still learning new concepts as well as technology concerning geographic data acquisition and production, utilization, data custodianship and data distribution as may now be practiced in more advanced countries. Furthermore, the concept of joint undertakings by agencies in geographic data acquisition and production still has to be appreciated. Each agency (and even private companies) still prefer not to work with other agencies for their mapping requirements or to undertake joint undertakings to co-build geographic information databases that can be shared by the participants and consequently result in cost reductions and avoidance of duplicative efforts.

In this case, there is a need to build confidence among the agencies by undertaking pilot GIS/LIS applications that involve several agencies cooperating and working together to build value add data by acquiring, fusing, integrating and further processing their respective data sets for the same geographical area. The NGIC shall support the implementation of multi-

agency pilot projects on GIS/LIS involving the fusion of several fundamental datasets. This Project will serve as a means for changing attitudes or perceptions about geographic data sharing and demonstrating benefits of cooperation and data sharing.

Another area for change management has to do with concepts and practices concerning ownership of data and how data may be made accessible in less bureaucratic ways to the various potential users. As policies are adopted, NGIC must target persons assigned by data custodians to attend NGIC sponsored seminars on how to be customer-friendly and provide data and information based on guidelines issued by the NGIC.

There is need to increase awareness in government of the concept that geographic information are resources of government that need to be managed and that greater value can be derived from making the data available in digital form so that these can be used by the producer/owner of the data as well as others in business, governance and for individual purposes. Demonstration projects showing how national agencies can leverage their geographic information holdings to make the local government units better partners in the development of the data producer's sector are recommended to be undertaken. For example, the DENR Regional Office (or PENRO/CENRO) can work with City/Municipal and Provincial Assessors and Registers of Deeds to account for all lands in a given administrative/political jurisdiction by jointly building their respective parcel databases which can be linked and integrated to visualize the reality about land tenure in the pilot city or municipality. There are many opportunities for multi-agency projects involving geographic information that can provide benefits for all participants and reduce project operating costs compared to a single agency implementation of the same project. The methodology, results and benefits from these projects should be adequately documented as a demonstration of the benefits each participant got from the joint undertakings. Change management workshops should then be held to report the results and to determine other areas of cooperation between the agencies.

#### **4. Education and Training**

Building the NGII requires better-trained professionals in the information and communication technologies as well as spatial technologies. As more agencies realize the importance of geographic information in mainstream business and government computer applications, and appreciate the technical requirements for building and distributing digital fundamental datasets, the more the need for trained people who can implement the various functions involved in acquiring, building, maintaining, processing and disseminating geographic information.

The NGIC shall anticipate and monitor the market requirements for professionals knowledgeable about the various spatial technologies and information and communication technologies and work with the academe and other training resources for the development of curricula and training

programs that address the needs of the geographic information community. It shall help promote the disciplines vital to the industry as well as to the user community and work with the appropriate agencies for support and other assistance in building the needed manpower.

NGIC members may also host practicum programs involving thesis students to increase student awareness about careers in the GIS and related industries.

The building of the NGII shall involve the conversion of many paper based records in government which are presently managed by staff who have not been trained yet on managing geographic information using ICT and network technologies. It would therefore be necessary for the NGIC to address the requirements for retraining of existing government personnel who may be involved in the planning and implementation of programs, projects and activities identified in this Plan. Geographic information creation, updating and maintenance are a specialized function but in recent years, the technology has been more user friendly and flexible.

## **5. Programs and Projects Development**

The NGIC and member agencies, including its Secretariat, shall undertake project development activities particularly for the listed data acquisition and management projects identified in Part VI.B of this Plan. Some of the projects can be incorporated in their regular budget plans, which the Department of the Budget and Management reviews and submits to Congress. Most projects, however, require detailed studies and plans and potentially can be implemented with official development assistance (grants and loans) or with private sector investment under the BOT Law.

It must be emphasized here that geographic information acquisition and management projects must support programs and projects identified in the medium term development program of the government, at the same time must be marketed to pipeline and proposed programs and projects which can benefit from the availability of consistent fundamental datasets. In many instances, budgets for survey, mapping and planning are not well thought out and particularly have no provisions for data management and utilization beyond the initial use it was conceived to support.

## **6. Information, Education and Communication**

One of the NGIC tasks is to promote and facilitate the development and implementation of standards for the NGII, the production and integration of consistent fundamental datasets, and the means by which all users of geographic information may search and access the geographic databases through a national geographic information directory system or clearinghouse network.

To sustain a national effort for building and maintaining the NGII, which will depend a lot on the cooperation of designated data custodians and sponsors, it would be necessary for the NGIC to implement an information, education and communication (IEC) program to address not only the participants in building the NGII but also the necessary support organizations and offices, including the political leadership, oversight agencies and funding institutions, and even counterpart organizations in other countries. This will be undertaken by developing and maintaining websites that have rich content, and reports on what is going on as the NGIC leads in the building of the Philippines' NGII. It will publish primers on standards and policies even as they are being formulated and developed in order that public discussion is facilitated and enhancements are proposed leading to the finalization of standards and policies. In addition to the maintenance of websites, the NGIC shall conduct workshops and seminars to inform, educate and otherwise communicate to its various publics about any aspect of the NGII including the adoption of standards, policies and the means by which data can be accessed and used. Particularly important is a campaign to get political and administrative support for member agencies to undertake programs and projects to build and maintain the fundamental datasets assigned to them for custodianship.

The above activities will form the action agenda of the NGIC in the first two years of its existence. Figure VI-A in the Appendix shows an implementation schedule for this action agenda.

## **PART VI. B. FUNDAMENTAL AND FRAMEWORK DATASETS: DATA ACQUISITION AND MANAGEMENT PROGRAM**

### **1. Introduction and Rationale**

**Fundamental datasets** are the datasets for which several government agencies and/or industry groups require a consistent national coverage in order to achieve their corporate objectives and responsibilities. Fundamental datasets are the building blocks of the National Geographic Information Infrastructure. The proposed fundamental datasets (and the fundamental framework datasets) are defined and described in Appendix Table 6.b.1. The inadequacy of the existing fundamental geographic information resources of the Philippines in terms of availability, accuracy, consistency, currency, comprehensiveness and accessibility requires the formulation of a data acquisition and management program as part of the National Geographic Information Infrastructure Framework Plan. Without fundamental geographic information, there is no information to share and manage in a NGII.

### **2. Objectives**

The objectives of this Program are:

- a. to provide updated, consistent, digital fundamental datasets with national coverage to meet requirements of users
- b. to fill the gaps in available fundamental datasets
- c. to provide a basis for adjusting or correcting existing fundamental data sets to facilitate the building of a complete national coverage for fundamental framework datasets.
- d. to facilitate search and access to the datasets.

### **3. Components**

The components of the Program are as follows:

#### **4.1 Data Acquisition, Production and Integration**

**4.1.1 Enhancement of the Philippine Reference System (PRS 92)**– This Project will establish 42 beacons that will provide surveyors with data for differential GPS processing anytime without the need to look for geodetic control monuments. This will support survey and navigation activities involving the use of global positioning systems. This Project will facilitate a lot of new survey activities and the production of high quality geographic information, including some of the projects listed below.

**4.1.2 Updating of the Topographic Map Series 1:50,000** – This National Topographic Mapping Project will update the 1950's Topographic Map Series built by the US Government and will contain the following fundamental framework datasets: land surface (elevation, slope, aspect), coastline, surface hydrology (rivers and inland water bodies), river catchment/drainage areas, roads, railroads, vegetation cover, populated places, and cultural features. The new series will consist of three basic products: digital elevation models, rectified ortho-images, and topographic line maps. Compilation of the digital topographic information shall be at 1:25,000 scale, however hard copy maps shall be made available at the 1:50,000 scale. The national sponsor of this Project is the DENR's National Mapping and Resource Information Authority.

**4.1.3 Topographic Mapping of Population Centers (1:10,000)** – This Project will map the country's population centers which will include central business districts, suburbs and expansion areas identified in the land use plans of local government units. The Project will output: digital elevation models, rectified orthophotos or orthoimages, and topographic line maps. The national sponsor of this Project is the DENR's National Mapping and Resource Information Authority. Local government units may undertake topographic mapping projects based on a standard to be prescribed by the NGIC, through the NAMRIA, for this scale.

**4.1.4 Land Administration and Management Project (LAMP)** – This Project will consolidate all land tenure information covering 30 million hectares of lands of the Philippines archipelago, by acquiring and integrating primary

and secondary sources of information involving the various land transacting agencies as well as survey and mapping agencies. Land parcel information from survey activities shall be a principal output of this Project. The national sponsor of this Project is the Department of Environment and Natural Resources. Various custodians will be involved to form a complete coverage for the whole country, including DAR, LRA, DOE, DENR, DOT, DPWH, and LGUs.

**4.1.5 Roads Information and Management Support System Project (RIMSS)** – This Project, which is funded by the World Bank, will supply the fundamental dataset on national roads (about 28,000 kms) at submeter accuracy, with a rich source of road attributes. This data set can serve as the control dataset for the acquisition and or updating of provincial, city/municipal and barangay roads information, where the latter datasets can be linked to the former to form the total road network of the country. The results of the roads information project will be integrated with the topographic mapping projects (1:50,000 and 1:10,000) for consistency. The national sponsor of this dataset is the Department of Public Works and Highways (DPWH). Custodians of roads information will provide information to produce a complete road network database for the whole country.

**4.1.6 Political Boundary Survey and Mapping Project** – This Proposed Project will provide a complete, updated database of the boundaries of barangays, cities, municipalities, and provinces. This will involve (a) an inventory and mapping of all existing political boundary information, (b) the integration of land classification information with cadastral survey data, political boundary survey data, including all geodetic control points used, and other relevant data; (c) assessment of barangay maps used by the various agencies and instrumentalities of the government; (d) legal research on all basis for political boundaries; (e) analysis of situation on boundary conflicts among jurisdictions, (f) resolution of conflicts, including new surveys and maps, and (g) policy and legal instruments to adopt the political boundary maps and areas. This Project will require the integration of topographic information containing fundamental datasets which can serve as backdrop in the visualization of boundaries. An inventory of all existing political boundary conflicts will be helpful in the geographic prioritization of project activities. The proposed national sponsor of this Project is the Department of Environment and Natural Resources with the DILG as a co-sponsor.

**4.1.7 Address Mapping Project** – This Proposed Project will provide a complete and updated address database of all building structures linked to land parcels and will be implemented by local government units who are required under the Local Government Code to assign address numbers to all buildings within their respective jurisdiction. This Project can be implemented jointly by the National Statistics Office (NSO), PhilPost, and Local Government Units. This will require an integrated approach and the use of a basemap, which may be updated tax maps of LGU Assessors as well as

roads and buildings maps. The LGUs will also have to provide street signs and building address numbers. A national standard for addressing has to be devised, under the auspices of the NGIC. The proposed national sponsor for this Project is the National Statistics Office, with the LGUs serving as custodians of the dataset for their respective jurisdiction, and with the NSO being provided with a complete dataset for its census operations. The Philpost, under its corporate structure, may commercialize access to the complete dataset, under some agreement with the data sources. It may also revise its Zip Coding System to facilitate the location of addresses in rural and urban areas. The address maps shall eventually be consistent with the topographic maps and the land parcels maps.

**4.1.8 Soils Survey and Mapping Project** – Many parts of the country have only reconnaissance level soil survey and classification. This Proposed Project will complete the soil survey program to provide more detailed soil classification information that can be integrated to the topographic base maps of the country at 1:50,000 scale. A national standard for soil classification will be needed for use by soils scientists/surveyors in any location in the country. The spatial database shall use the updated topographic map as basemap layer. A system of integrating geo-technical information that are provided in infrastructure and building construction projects as well as exploration projects shall be established and institutionalized as a rich source of soil and ground water source information. A database of soil survey information will be established. The national sponsor shall be the Bureau of Soils and Water Management of the Department of Agriculture.

**4.1.9 Bathymetric Survey and Mapping Project** - This Project will supply the topographic database of the seabeds/oceans around us within our 200 mile economic zone. Much of this area is unknown and still to be discovered for its wealth as well as geological history. The government has recently purchased a well-equipped hydrographic vessel to undertake surveys of the waters within the Philippine archipelago and 200 mile economic zone. The NAMRIA shall be the implementor of this Project.

**4.1.10 Environment Forecasting System Project** – This Proposed Project will provide the capability to the country to monitor and analyze climatological changes as well as to forecast more accurately weather conditions anywhere in the country that can be delivered at the micro-level to farmers and other users whose activities are affected or dependent on weather conditions. The national sponsor of this Project shall be the PAGASA. The fusion of weather satellite data with the fundamental datasets (topography and administrative boundaries, vegetation cover, population and cultural features) will be the eventual output of this system.

**4.1.11 Updating of Nautical Charts and Aids to Navigation** – This Project will update the old nautical charts of the NAMRIA and the accompanying Aids

to Navigation, particularly for the sealanes used for commercial shipping and transportation. This database will be in the quality suited for navigation purposes and meet international quality requirements. Coastline information from the topographic map will be a necessary input to this Project as well as offshore survey data.

#### **4.1.12 Remote Sensing Data Transmission and Processing Project** –

This Proposed Project will provide the country with the capability to acquire satellite information from various sources, on demand basis, and to pre-process the data for its various users. This will allow the country to benefit more from the technological progress in the acquisition and processing of earth surface and meteorological information, particularly for the use of the GIS community. However, instead of establishing our own ground receiving station, the country will avail of services of ground receiving stations around us (i.e. Taiwan, Thailand, Malaysia, Singapore) and use Philcomsat facilities for real time transmission of satellite data received through the ground receiving stations. A remote sensing center will pre-process the data using image processing facilities and output various information products for use of the GIS community.

**4.1.13 Land Registration Administration Computerization Project** - This Project, to be implemented through the Build-Operate-Transfer (BOT) scheme, will produce a system that can account for all titled properties, provide digital records for each of registered property, and an index to all the titled land parcels. Metro Manila and selected areas with high rates of growth in land titling and transfer transactions are the priority targets of the computerization project. The datasets of titled properties shall be eventually integrated with datasets of public domain land parcels under the LAMP to account for all lands. The national sponsor of this Project is the Department of Justice's Land Registration Administration.

**4.1.14 Geographic Names Inventory and Updating Project** - This Project is a necessary input to all the mapping projects and must be undertaken alongside the fundamental framework datasets acquisition Projects. All annotations of all features on the maps will depend on the information to be provided by this Project. This Project will require the re-mobilization of the Committee on Geographical Names, which used to be under the NAMRIA (or its former agencies). Local knowledge (through LGU participation) will enrich the database and help ensure data quality, consistency, and accuracy. The proposed national sponsor for this Project can be the National Library or National Historical Institute or the NGIC/NAMRIA.

**4.1.15 Tax Mapping Project** – This Project will build on the availability of land parcel survey data and the LRA Computerization Project, administrative boundaries, and fundamental datasets on the built environment for an improved, updated, and technically accurate graphical inventory of real

property on a municipality or city basis with barangay details. This will improve the real property valuation activities of LGU Assessors and consequently lead to a discovery of undeclared, undervalued real property. The national sponsor of this Project will be the Department of Finance (Bureau of Local Government Finance) and custodians of datasets will be the Assessor Office of LGUs.

**4.1.16 Land Use and Vegetation Cover Mapping Project** – This Project builds on the availability of new fundamental data sets (topography, roads, administrative boundaries, vegetation), supported by ground truthing. Satellite data supplements the analysis, particularly for areas without recent coverage.

**4.1.17 Data Conversion of the Topographic BaseMap 1:50,000.** – The old 1:50,000 topographic map series of 1950's are important datasets for temporal analysis of land use changes as well as a source of basic information for areas that have not been recently mapped. Many map sheets have been converted, however, no quality assurance has been undertaken by the government to assure consistency of the digitized datasets. Many map sheets also remain to be converted to digital form. This Project will therefore aim to build a complete set of digitized topographic maps by working out a means of having all existing digitized sets evaluated for consistency and accuracy based on the source document, and to complete the conversion of the paper-based map sheets. The national sponsor for this Project shall be the NAMRIA.

**4.1.18 Geological Mapping Project** – Gaps in existing geological survey maps will be addressed by the Project. The Project will build on the topographic basemap, including digital elevation model of the topographic maps, ortho-images and orthophotos. Field information will supplant those extracted from the topographic maps. The geological maps will be produced by the Mines and Geoscience Bureau of the DENR.

**4.1.19 Census Tracts Mapping Project** - This Project will be a joint Project of the NAMRIA and the NSO to build a census tracts database which can be used for household-based surveys. This Project will build on the topographic basemap, the administrative boundary maps, the road network map, as well as the database on the built environment. Address maps and attributes will be interfaced for a complete inventory of addresses on a census tract basis. A plan for the continuous updating of the Census Tracts database with the address database will be part of the Project.

**4.1.20 Mapping of the Census 2000 Data** – This Project will be possible with the availability of new topographic maps, road maps, political boundary maps, address maps and census tracts (enumeration area) maps. The enumeration area maps sketched during the Census 2000 operations will be

converted to more accurate forms using the census tracts. Consequently, population statistics at sub-barangay level can be generated and analyzed through overlay analysis. The census tract maps will serve as the base map for the Census 2005 and provide the basemap for subsequent surveys.

**4.1.21 Inventory of Agriculture Areas** – This Project will build on the land parcel dataset, tax maps, topographical map and digital elevation model, and vegetation cover to provide a database to support programs and projects for the modernization of the country's agriculture, including the collection of production statistics and other surveys involving farms and cropping systems.

**4.1.22 Forest Resource Inventory** – This Project will build on topographical database land tenure, and land use/vegetation cover database, along with remote sensing data, ground surveys/ground truthing, and secondary information resulting from projects and regulatory processes, including land classification and other land surveys, to provide basic information on the forest line and the forest resources within the public forest and/or public domain.

**4.1.23 Precinct Boundary Mapping** – This Project will convert the sketch maps produced by the Commission on Elections into accurate maps that can be integrated with the fundamental data sets of the national geographic information infrastructure. These sketch maps are products of the Precinct Mapping Project of the Commission being undertaken in time for the 2001 elections. There is need to fuse the population census data, the administrative boundary data, and the roads information to facilitate the continuous cleaning of the voters registration database. The Project can start with locations that have more recent and accurate geographic information on city/municipal/barangay boundaries, expanding exponentially as new topographic maps and administrative boundary maps are available to produce accurate precinct maps.

## **4.2 Data Management**

This Program component covers the data management of the fundamental datasets. It covers policies, projects and activities for efficient and effective management of datasets even if they are produced and managed by different agencies or instrumentalities (such as contractors of BOT Projects).

**4.2.1 Data Dictionary** – The management of the NGII fundamental datasets require a common data dictionary that is accessible, used and maintained by data custodians. The NGIC will be the forum for the development and maintenance of the NGII data dictionaries. It will draw on models built by other NGIIs and customize for Philippine conditions. This will be published via the WWW for public access and use. Only registered custodians will have the

right to update the data dictionary following a set of procedures and guidelines for data maintenance.

**4.2.2 Metadatabase Development** – Under the sponsorship of the NGIC, a Working Group will focus on the development of the metadatabase ("data about data") for the NGII fundamental and related data sets. The NGIC will study the applicability of the metadatabase design of the "Global Spatial Data Infrastructure" – multi-national project involving representatives from various NSDIs – and customize or adopt it for use of data custodians in building the metadatabase. It will be made the responsibility of national sponsors and data custodians to update and maintain the NGII metadatabase, which shall be freely available to users. Every dataset that is made part of the NGII shall be described in the metadatabase to assist users assess the data for their own purposes, including making the decision to access and use the described data. The National Geographic Information ClearingHouse Network will provide access to the metadatabase and the data itself.

**4.2.3 Geographic Information Clearinghouse Network** (Data Directory System) – This Project, led by the NGIC, through its Secretariat, consists of distributed databases of the fundamental datasets, with the metadatabase of each data set in the collection, and the policies, systems and procedures for making the data accessible to users.

## **5. Implementation Strategy**

### **5.1 Phasing of Data Acquisition Projects by Priority Area and Market Forces**

Data acquisition projects will be carried out based on priority requirements of programs and projects identified in the Medium Term Plan of the Government as well as the need of the business and other institutional users. Obviously the framework data sets will have to be given priority as they are needed to build the other fundamental datasets. On a geographical basis, priority for the framework datasets will be areas without any recent coverage but have been targeted for major programs and projects of the government. An area that has larger scale and fairly recent topographic and orthophoto datasets shall have low priority in the build up of the topographic dataset at 1:50,000 scale, but are candidates for the build up of other fundamental datasets. Geographical areas of interest to many agencies in a given period shall be given higher priority over areas of interest to one or few agencies. Geographical areas of interest to many users in the private sector willing to share costs of data build up will also be given priority over areas where only a few users are interested.

A simple market survey of demand for geographic information will be a necessary activity to pinpoint areas where the immediate availability of maps will help create value add products that can further be used in the production chain contributing to increase in the country's gross domestic product.

### **5.1.1 Technology**

#### **Remote Sensing and DGPS**

New data acquisition, production, integration, and management technologies are in place or will be in place during the planning and implementation of this Program. New generation satellites can speedily provide highly accurate and digital geographic information that used to be acquired in months and years. Satellites able to provide one-meter resolution data have been launched and more of these are expected to be in place in the first half of this decade. Interferometric radar mapping systems, both on satellites and airborne, will particularly be valuable for the country not only for the high resolution of the data but also because it will enable data acquisition on any weather and cloud condition, facilitating the completion of data acquisition projects within a predetermined work schedule. Differential global positioning systems (GPS) will also be a basic technology for ground truthing as well as ground surveys needed to enrich airborne or satellite borne data.

**Digital or SoftCopy Photogrammetry and Radargrammetry** – Digital processing of data acquired through various remote sensing means is now the standard approach to making maps, resulting in the generation of digital elevation models, orthophotos or orthoimages and topographic line maps, including 3-D outputs. Data acquisition scale is based on the capacity of the processing tools for cost effective data production projects.

**Digital Cartographic Systems** – These are tools for the production of publication ready maps, incorporating art and science, and working with softcopy photogrammetry or radargrammetry systems. These systems help improve productivity of cartographers and at the same time help produce basic and derived maps that are user-focused and designed for the intended use/s of the geographic information products.

#### **Geographic Information System -**

#### **Internet, Intranet, Extranet –**

#### **E-Commerce -**

### **5.1.2 Program Management**

The planning and implementation of the projects that comprise this Program shall be coordinated and monitored by the NGIC through its Secretariat. Each agency designated as sponsor and/or custodian for the dataset shall be responsible for following a planning, budgeting and implementation process that is in accordance with laws and guidelines applicable to information technology and database infrastructure. The guidelines that may be issued by the Information Technology and E-commerce Council (ITECC) shall be considered in program implementation. The BOT law and implementing rules and regulations applicable to the projects shall likewise be applied as appropriate. For multi-agency implementation of projects, guidelines shall be

issued by the NGIC, for cost effective implementation through cost sharing and coordinated non-duplicating efforts.

The necessary organization and support infrastructure for the planning and implementation of projects shall be the responsibility of the project sponsor, including the negotiation for project funding. Oversight agencies shall provide such services as necessary for efficient and effective resolution of policy issues concerning procurement of products and services as well as the financing of projects.

### **5.1.3 Financing**

There are many funding sources for the projects identified under this program. The Project outputs have similar characteristics as physical infrastructures like roads, bridges, school buildings, health centers, dams, irrigation systems. Geographic information enable others to be more productive and produce value add products and services. Geographic information belongs to the so-called information infrastructure that are being built by governments all over the world for their constituencies to be able to successfully compete in the information economy. It is part of the content of the information highway.

Acknowledging this principle, funding institutions that give grants and loans are now more inclined and have in fact opened windows for projects of the nature described above. The World Bank, the Asian Development Bank, the International Finance Corporation, venture capitalists and others are part of the bandwagon that is driving more investment projects involving information and communication technology and the build up of content.

The approved Government Information Systems Plan (GISP) of the national government (EO265) has also identified various financing schemes for the implementation of government information Systems in addition to the usual government appropriations derived from government revenues and borrowings. This includes private financing under the BOT law for projects that have a continuous revenue stream with returns that are acceptable to investors. Loans and grants are other sources of financing. The implementing agencies may also internally finance projects if in fact they can recover part of the cost of production and dissemination through sale of products and services.

The common service that will be maintained for the NGII shall be the national directory system, the web portal that will enable data users to access the metadatabase to learn about the information holdings that can be accessed through the system. The NGIC as operator of the system shall charge fees to the agencies based on an agreed upon system and set of policies in order that the service can be sustained. It is also possible for the NGIC to enroll in global services such as [geographynetwork.com](http://geographynetwork.com) so that the set-up of the information infrastructure need not be procured in the scale needed if the hosting were done directly by the NGIC.

## **PART VI – C. Technical Standards and Protocols Development Plan**

**This Plan component is about establishing technical standards and protocols for the building, maintenance, sharing, transfer of the NGII fundamental datasets. NGIC shall carry out a plan of action in the near term for the development and adoption of technical standards as described below.**

### **1. Reference Systems**

**(insert text)**

### **2. Data Dictionaries**

**(insert text)**

### **3. Data Quality**

**(insert text)**

### **4. Data Transfer**

**(insert text)**

### **5. Metadata**

**(insert text)**

## **PART VI- D. NATIONAL GEOGRAPHIC DATA CLEARINGHOUSE NETWORK DEVELOPMENT PLAN**

The Clearing House Network is the means by which the Fundamental Datasets are made accessible to the community of users, in accordance with policies determined within the NGII Institutional Framework, and to the Technical Standards and protocols agreed. The Clearinghouse network model for the NGII consists of distributed databases held by NGIC-designated data custodians in independently maintained systems but linked by common standards and policies. Physical linkages between these systems are through a range of mechanisms including dedicated telephone lines, local area networks, wide area networks and integrated-services networks. This NGI clearinghouse network is part of the national information infrastructure for distribution and access that is targeted under the IT21 Vision. The key

element of the network is the data directory system that shall be freely accessible and contain highly accurate metadata for the Fundamental Datasets, including advice on gaining access to the data.

NGIC will develop a web portal to all the nodes of the clearinghouse network and will operate the national directory system. The NGIC will coordinate and work with the ITECC and all organizations participating in the establishment of the national information infrastructure so that the requirements for the NGII are part of the design of the National Information Infrastructure. NGIC's aim in developing the Clearing House Network is to foster the integration of Fundamental Datasets into the network and to coordinate with other infrastructure coordinating bodies to develop a national consensus. The Clearing House Network is not something that NGIC can address on its own, as it is part of the broader information distribution problem. However, NGIC will encourage the adoption of standard data transfer protocols and national policies for access and pricing, and will ensure that the particular needs of the national geographic information infrastructure are taken into consideration when data distribution networks are being designed.

A revised conceptual framework of a national geographic information clearinghouse network is attached in the Appendix. A Technical Working Group for the Data ClearingHouse will be created by the NGIC to finalize and promote the concept and plan to establish the clearinghouse network.

**APPENDIX**

**TABLE VI.B. 1 PROPOSED Fundamental & Framework Datasets for the Philippines' NGII**

<b>Theme</b>	<b>Description</b>	<b>F</b>	<b>Proposed National Sponsor (Custodian)</b>
<b>TOPIC/CLASS PRIMARY REFERENCE</b>			
<b>Geodetic Control Network</b>		*	NAMRIA
National Geodetic Database	Geodetic Survey Marks (horizontal stations) and Bench Marks (vertical elevation)	*	NAMRIA; DENR-LMB
Philippine Height Datum	Definition of vertical datum surface	*	NAMRIA
National Geoid Model	Geoid-ellipsoid separations (N values) to convert from GPS observations to PHD heights	*	NAMRIA
<b>Aerial Photography (Orthophoto/Orthoimage)</b>			NAMRIA (Other users, producers)
<b>Satellite Imagery (Orthoimage)</b>			NAMRIA (Other users, producers)
<b>TOPIC/CLASS ADMINISTRATION</b>			
<b>Land Parcels/Cadastre</b>	A consistent framework of land parcel boundaries defined for land tenure purposes, referenced to a common datum and including road casements	*	DENR-LMB (with LRA; Registers of Deeds; LGU Assessors; DPWH)
<b>Land Tenure</b>	Current, proposed and historical details of tenures; details of ownership, etc.	*	DENR, (with DOJ-LRA, DOE, DAR)

<b>Land Classification</b>	Boundaries of land as classified into alienable and disposable land or public forest	*	DENR-NAMRIA
<b>Street Address</b>	Unique street address of parcels/property		Phil Post and LGU Assessors
<b>Mining, Petroleum and Energy Lease Boundaries and Tenure</b>	Boundaries of mining, petroleum and energy claims/rights (production or exploration, surveyed or unsurveyed and conditions of ownership: e.g. Environmental and Statutory		DENR-MGB; DOE
<b>Administrative Boundaries</b>  - International, National, Regional, Provincial, City, Municipal and Barangay Boundaries  - Electoral Boundaries  - Zip Code	Jurisdictional Boundaries  -Precinct Boundaries, Congressional Districts  - Post Code Boundaries		DENR-LMB (with NAMRIA; NSO; LGUs; other Agencies)  COMELEC; (with NSO; DENR-LMB)  Philpost
<b>Constraining or Major Interests in Land</b>	Heritage sites – polygon or point locations and details of significance  Indigenous Peoples Sites – Polygon or point locations and details of significance  Restricted Sites – Boundaries of other restricted areas for example contaminated		DOT, National Historical Institute  NIPC (with DENR)  DENR  NIPC (with DENR)

	<p>sites</p> <p>Ancestral Lands/Domain: Title Applications/Determinations – boundaries of applications and/or areas claimed/determined</p> <p>Indigenous Land Use Agreements – boundaries of registered agreements</p>		DENR
<b>Populated Places</b>	Settlements in cities, towns, villages, barangays		NSO (with LGUs)
<b>Feature Names/Place Names</b>	Official and local names of cultural and geographic features (including roads)		NAMRIA (with National Historical Institute and LGUs)
<b>TOPIC/CLASS NATURAL ENVIRONMENT</b>			
<b>Earth's Land Surface</b>	Vertical distance from the earth's surface to a base defined by Philippine Height Datum	*	NAMRIA
<b>Coastline</b>	The limit of land features usually at mean high water level	*	NAMRIA
<b>River Catchments/Drainage Areas</b>	- Boundaries of catchments/drainage areas	*	NAMRIA (with DENR-FMB)
<b>Streamlines and Inland Water bodies</b>	-Location of water courses and all inland water bodies	*	NAMRIA (with DENR and NWRB)
<b>Bathymetry</b>	- Vertical distance of earth's land surface from base defined by Lowest Astronomical Tide		NAMRIA
<b>Geology</b>	Boundaries and classification of geological		DENR-MGB (with Phivolcs)

	units, both terrestrial and marine		
<b>Mineral Resources</b>	Boundaries and classification of mineral occurrence, both terrestrial and marine		DENR-MGB
<b>Hydrogeology</b>	Boundaries and classification of aquifers		DENR-MGB (with Academe and Research Organizations; NWRB)
<b>Oceanography</b>	Boundaries of physical and chemical characteristics of parts of the ocean		NAMRIA (with MSI)
<b>Climatology</b>	Macro climate for a specific region		PAG-ASA
<b>Soils Classification</b>	Boundaries and classification of terrestrial soil resources		DA-BSWM (with DENR-FMB)
<b>Biodiversity Regions</b>	Interim biogeographic regionalization of the Philippines (terrestrial, marine, coastal)		DENR-PAWB
<b>Vegetation Classification (Flora)</b>	Boundaries and areas of vegetation and associated entity description of dominant life form (terrestrial/marine)		NAMRIA (with DENR-FMB, DA, CRMP)
<b>Animals (Fauna)</b>	Classification and location of native and introduced animals (fauna-terrestrial/marine)		DENR-PAWB
<b>Marine benthic substrate Classification</b>	- Boundaries and classification marine benthic substrates		DA- BFAR
<b>Land and marine systems</b>	Areas or groups of like topology, soils and vegetation (often modeled), throughout which can be recognized a recurring pattern		DENR- NAMRIA (with BSWM)

<b>Areas subject to natural hazard</b>	Spatial definition of such area with attribute data on periodic level of probability (include permanent danger zones)		NDCC- OCD (with Phivolcs, DENR-MGB, PAG-ASA)
<b>TOPIC/CLASS SOCIO-ECONOMIC</b>			
<b>Census Collection Districts or Statistical Boundaries</b>	Boundaries of areas defined for collection of demographic census information (i.e. enumeration areas)		NSO
<b>Demography</b>	Population statistics linked to statistical areas		NSO
<b>Planning Zones</b>	Boundaries of areas of permitted land use defined by planning authorities		HLURB (with DILG, LGUs; NEDA-RDCS, MARINA, DENR)
<b>Rural and Urban Land Use</b>	Rural and urban actual land use activities		HLURB (with DILG, LGUs, NAMRIA, DENR Regional Offices, NSO)
<b>TOPIC/CLASS BUILT ENVIRONMENT</b>			
<b>Cultural Features</b>	Location of built environment, buildings, structures and other cultural features		NAMRIA (with, NSO, LGUs)
<b>Aviation Features</b>	Location of airports and navigation aids		ATO-DOTC (with NAMRIA)
<b>Maritime Transport</b>	Ports, harbors, wharfs, shipping routes		PPA-DOTC (with MARINA)
<b>Road Centerlines</b>	Centerline of physical roads and carriageways with attribute data	*	DPWH (with NAMRIA; LGUs)
• <b>Rail Centerlines</b>	Location of trunk rail centerlines with attribute data	*	PNR-DOTC
<b>Water supply, waste water,</b>	Location of trunk networks and major		NIA, Water Districts, MWSS, MWS; Maynilad

<b>irrigation and drainage networks</b>	assets with attributes of classification and ownership		Water, LGU Waterworks, LWUA, NWRB
<b>Electricity and Gas Networks</b>	Location of trunk networks and major assets with attributes of classification and ownership		NEA, Electric Coops, PePoa, Shell Explo, DOE, NPC
<b>Telecommunication Network</b>	Location of trunk networks and major assets with attributes of classification and ownership		DOTC –NTC (with PLDT, other private telecoms firms)

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