The Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan in the Republic of the Philippines

Final Report Volume 2 Main Report March 2008

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Japan International Cooperation Agency (JICA)

National Mapping and Resources Information Authority (NAMRIA)

No.

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Final Report
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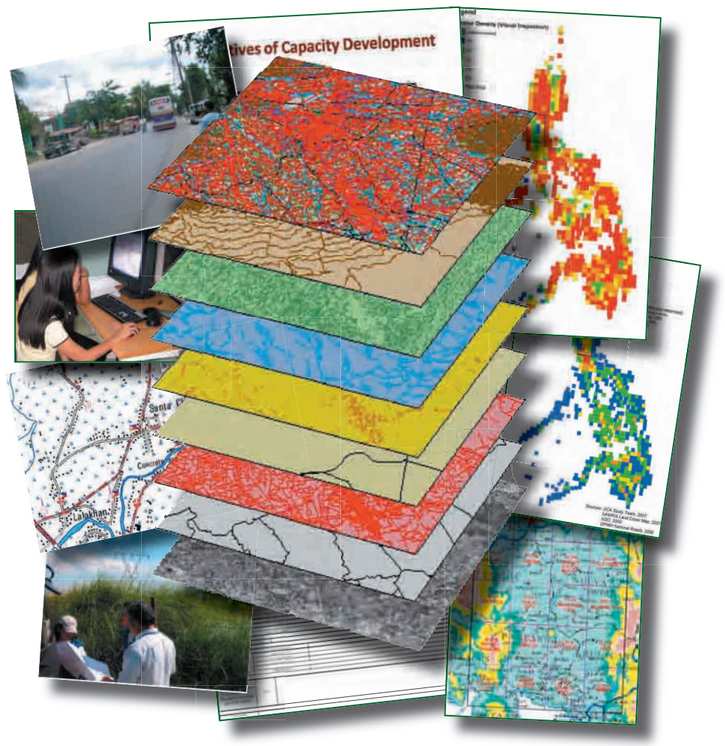

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PREFACE

In response to a request from the Government of Philippine, the Government of Japan decided to conduct a study on Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yutaka KOKUFU of PASCO Corporation and consists of PASCO Corporation and Nomura Research Institute, Ltd. between February, 2006 and March, 2008.

The team held discussions with the officials concerned of the Government of Philippine, and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Philippine for their close cooperation extended to the study.

March 2008

Eiji HASHIMOTO,
Deputy Vice President
Japan International Cooperation Agency

Letter of Transmittal

Mr. Eiji HASHIMOTO
Deputy Vice President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Hashimoto

We are pleased to submit herewith the final report—the Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan in the Republic of the Philippines.

This report compiles results of the study which was undertaken in the Republic of the Philippines from February 2006 until March 2008 by the Study Team composed of Pasco Corporation and Nomura Research Institute, Ltd. under the contract with the JICA.

The Final Report is composed of: Summary Report; Main Report; Specifications; and Manuals.

The Study covered: capacity development for topographic mapping at scale of 1: 50,000 of National Mapping & Resource Information Authority (NAMRIA); and pilot projects. The pilot projects included technical verification of mapping methods and technology transfer. Based on the results of the study components, recommendations of the nationwide development plan and action programs were prepared. The topographic mapping at scale of 1:50,000 for technical verification and technology transfer was conducted in the area of the Pampanga watershed using digital mapping methodologies. In addition, the technical specifications, human resource development plan and capacity development plan for nationwide deployment plan were prepared. We believe that these results and transferred technique will support not only the Integrated National Development Plan but also land use planning, environmental management and regional development in the Philippines.

We would like to express our sincere gratitude and appreciation to: your agency; the Ministry of Foreign Affairs; Embassy of Japan in the Philippines; and JICA Philippine Office. We would also like to send our appreciation to all those extended their kind assistance and cooperation to the Study Team, in particular—officials of National Mapping & Resource Information Authority, Philippines—the counterpart agencies.

Yours Faithfully,

March 2008

Yutaka KOKUFU
Team Leader
The Study for Mapping Policy and Topographic Mapping for
Integrated National Development Plan in the
Republic of the Philippines

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List of Abbreviations and Acronyms

BCGS	Bureau of Coast and Geodetic Survey
BSWM	Bureau of Soils and Water Management
BTSM	Board of Technical Surveys and Mapping
CARP	Comprehensive Agrarian Reform Program
CGSD	Coast and Geodetic Surveys Department
CIS	Communal Irrigation System
CLUP	Comprehensive Land Use Plan
CPDO	City Planning and Development Office
CPO	City Planning Officer
CSC	Civil Service Commission
CSC BVP	Civil Service Commission Bulletin of Vacant Position
DA	Department of Agriculture
DAR	Department of Agrarian Reform
DEM	Digital Elevation Models
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Governments
DOJ	Department of Justice
DOST	Department of Science and Technology
DOTC	Department of Transportation and Communication
DPSB	Department Promotion & Selection Board
DPWH	Department of Public Works and Highways
GIS	Geographic Information System
GPS	Global Positioning System
HLURB	Housing and Land Use Regulatory Board
HRD	Human Resource Development
IATFGI	Inter Agency Task Force on Geographic Information
IMD	Information Management Department
JAFTA	Japan Forest Technical Association
JICA	Japan International Cooperation Agency
LGU	Local Government Unit
LIS	Land Management System
LMB	Land Management Bureau
LRMIS	Land Records Management Information System
LVP	List of Vacant Position
MD	Mapping Department
MGB	Mines and Geosciences Bureau
NAMRIA	National Mapping and Resources Information Authority
NBI	National Bureau of Investigation
NCA	National Cartography Authority
NCC	National Computer Office NEDA National Economic and Development Authority
NIA	National Irrigation Authority
NIS	National Irrigation System
NMTS	National Topographic Map Series
NPC	National Power Corporation
NRMC	National Resources Management Center
NSCB	National Statistical Cooperation Board
NSO	National Statistic Office
ODA	Official Development Assistance
OIC	Officer in Charge
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration

PDO	Project Development Officer
PDS	Personal Data Sheet
PENRO	Provincial Environment and Natural Resources Office
PHP	Philippine Peso(s)
PIVOLCS	Philippine Institute of Volcanology and Seismology
PMS	Personnel Management Section
PPDO	Provincial Planning and Development Office
PRS	Philippine Reference System
PSD	Promotion Selection Board
RIMSS	Roads Information and Management System
RSRDAD	Remote Sensing and Resources Data Analysis Department

CHAPTER 1 INTRODUCTION

In response to the request of the Government of the Republic of Philippines (hereinafter referred to as "GOP"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct the "Study for Mapping Policy and Topographic Mapping for Integrated National Development Plan in the Republic of Philippines (hereinafter referred to as "the Study").

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programs of the GOJ, undertook the Study in accordance with the relevant laws and regulations enforced in Japan.

On the part of the GOP, National Mapping & Resource Information Authority (hereinafter referred to as "NAMRIA"), acted as the counterpart agency to the JICA Study Team (hereinafter referred to as "the Study Team") and also the coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

1-1 Background of the Study

In the Philippines, topographic maps at a scale of 1:50,000 prepared in the 1950s, except for some areas updated by NAMRIA, are used even now, as base data for the national development policy plans, regional development project planning, and infrastructure development planning. However, the present conditions are largely different from those of 50 years ago mainly due to various degrees of development activities. It became an urgent policy issue to update the topographic maps. In the Philippines, the National Mapping and Resource Information Authority (NAMRIA) undertakes the duty to perform preparation, updating and providing maps. Although the potential of executing such duties exists in NAMRIA, implementation is in a difficult state due to insufficient financial and human resources.

To cope with this situation, the GOP requested the GOJ to conduct a study to strengthen organizations for maintaining and managing geographic information by NAMRIA. By preparing the "Specifications for Topographic Mapping at Scale of 1:50,000" which would strengthen NAMRIA financially and technically, it was expected that NAMRIA develops capability to prepare topographic maps at a scale of 1:50,000 covering the entire area of the Philippines. JICA thereafter dispatched the Preliminary Study Mission headed by Mr. Akira Nakamura to the Philippines to investigate mapping policies and scope of conducting the Topographic Mapping for Integrated National Development Plan in September 2005. The Mission discussed the scope of work including the study area, scope, and requirements of NAMRIA. The Minutes of Meeting (M/M) was signed by the Mission and NAMRIA on September 13, 2005 and the Implementation Arrangement (I/A) was signed on December 2, 2005. The study was carried out based on the I/A.

The mapping methods for accuracy inspection are: aerial photography; single-satellite imagery; and stereo-satellite imagery as agreed in the preliminary study between the JICA SW (Scope of Work) Mission and NAMRIA.

1-2 Scope of the Study

1-2-1 Objectives of the Study

The objective of the Study is "the formulation of an implementation plan for NAMRIA to promote nationwide deployment of topographic maps at a scale of 1:50,000 based on the result of the study." It requires institutional improvement and organizational development. To achieve this objective, the following six project components were conducted.

(1) Formulation of Capacity Development Plan

The Study Team assesses the vitality of organizations of entire NAMRIA. The target of organizational development is selected from the assessment. Based on the assessment "Specifications for Topographic Mapping at Scale of 1:50,000" and "Human Resource Development Program" mainly for Mapping Division should be prepared.

(2) Establishment of "Specifications for Topographic Mapping at Scale of 1:50,000"

Allowing for map production systems in NAMRIA, the "Specifications for Topographic Mapping at Scale of 1:50,000" has to be prepared for economical and practical production of topographic maps at a scale of 1:50,000. Pilot Projects will be conducted. The "Specifications for Topographic Mapping at Scale of 1:50,000" will be improving and deepening its contents based on trial and error practices in the Pilot Project.

(3) Formulation of Human Resource Development Program and Implementation of Technical Training

The "Human Resource Development Program" will be prepared including a technical training program which will enable sustainable operation of topographic mapping at a scale of 1:50,000. This program will be prepared mainly for the Mapping Division, but the Study Team may recommend programs for others based on the result of organizational assessment conducted in the initial stage.

(4) Implementation of Pilot Projects and Technology Transfer

For the purpose of technical verification on the processes of survey and mapping and for technology transfer, On-the-Job Training (hereinafter referred to as "OJT"), the Pilot Projects will be conducted.

The technical verification will include three fundamental source materials: aerial photographs, satellite images without stereo-pairs, and satellite images with stereo-pairs. Methods, costs, time schedule required, and accuracy will be compared and methods for the future operation will be evaluated.

(5) Formation of Promotion Mechanism for Topographic Mapping at Scale of 1:50,000 and Associated Products

Working with the Coordinating Committee, the Study Team will prepare a plan to promote uses of maps and associated products among members in the government sector and 0in the private sector.

(6) Preparation of Action Program for Nationwide Topographic Mapping at Scale of 1:50,000

Action programs for nationwide topographic mapping at a scale of 1:50,000 will be formulated with the technical verification results from the Pilot Projects, national development plans, and needs from the users.

1-2-2 Scope

The Study area will cover the entire NAMRIA and the Pilot Project area.

The Study involves the following organizational units of NAMRIA on the organizational development scheme.

Table 1-1 Organizations Involved in the Study

Work Component	Target Organization Unit	Level of Involvement
(1) Organization Assessment	Entire NAMRIA	Initiated by administrative units
(2) Organizational Development Analysis	Entire NAMRIA	Dissemination by administrative units. A workshop held by Administrator.
(3) Specifications for Topographic Mapping at Scale of 1:50,000	Mapping Department and other technical departments	Mainly, the Mapping Department, but other departments which prepare, save, maintain and sell topographic maps at scale 1:50,000 will be involved.
(4) Human Resource Development Program	Mainly for Mapping Department	

The area of the Pilot Projects is the area of the Pampanga watershed including a part of Agno River down-stream region which has about 17,520km^2 equivalent to 24 topographic map sheets at scale 1:50,000.

1-2-3 Study Organizations

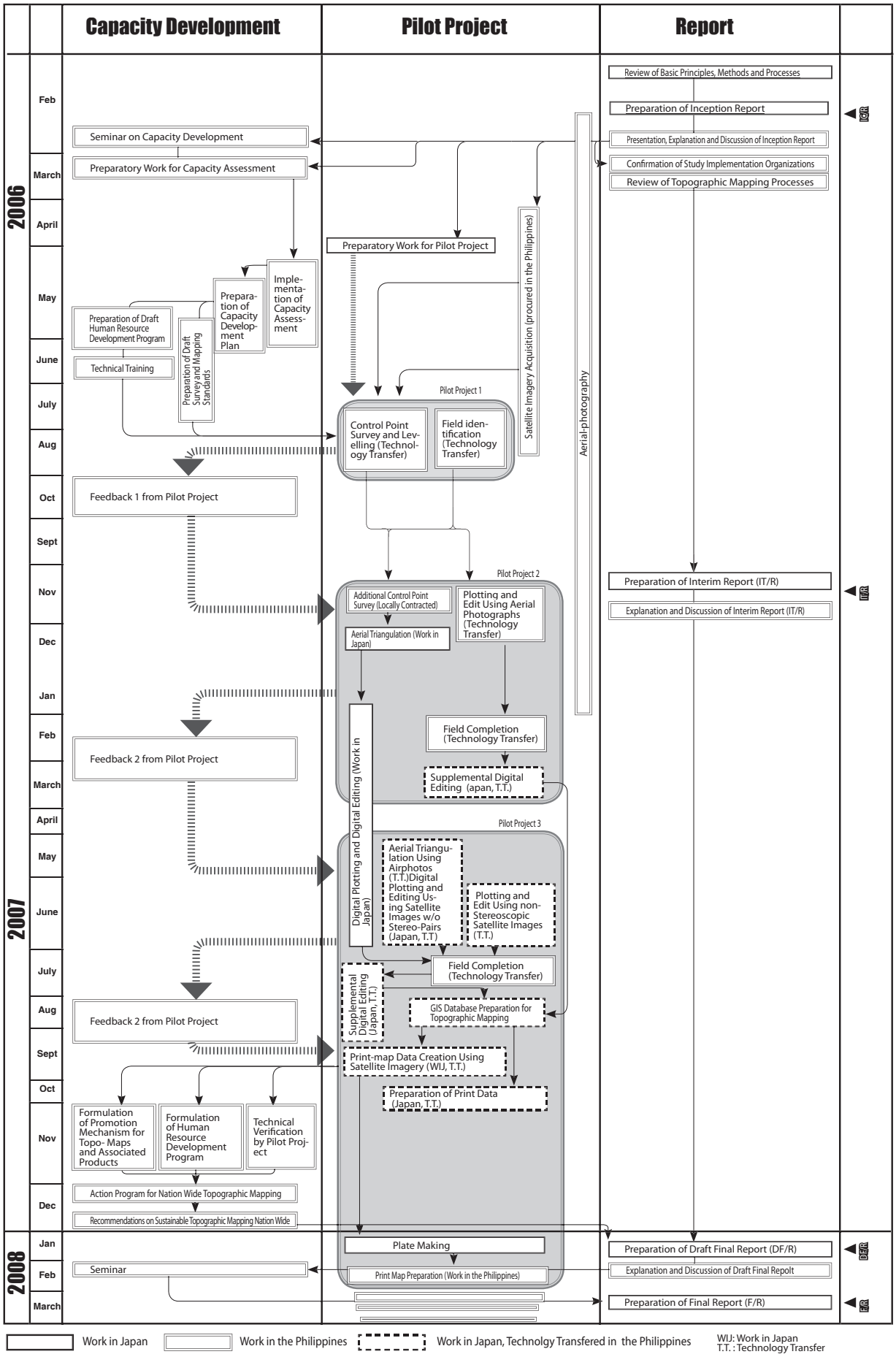
(1) Study Team Members

Table 1-2 Composition of the Japanese Study Team

Study Team

KOKUFU, Yutaka	Team Leader/ Survey Operation Standards
TAKANO, Masashi	Deputy Team Leader /Organization Analysis /Capacity Development
MORI Hisashi	Human Resource Development /Technology Transfer
KAMIMURA, Kazunobu	Human Resource Development II
KOSEKI, Junichi	Survey Operation Standards (Feb., 2006 – June, 2006)
TAMARI, Kiyofumi	Aerial Photography /Field Identification /Field Completion /Digital Completion
USUDA, Kentaro	Control Point Survey
HATORI, Tomohiko	Leveling
YAMAYA, Kozo	Map Symbolization
KIMURA, Kensuke	Coordination (May, 2006 and Sept., 2006)
MORI, Hisashi	Coordination

Figure 1-1 Study Work Flow



(2) JICA In-charge

Table 1-3 Composition of JICA

Members from JICA

NAKAMURA, Akira	Group Director, Group II, Social Development Department
SUGANO, Yuichi	Team Director, Urban and Regional Development / Peace Building Team II, Group II, Social Development Department
ISHIDA, Yukio	Deputy Resident Representative, JICA Philippine Office (Feb., 2006 – May, 2006)
IWAKAMI, Kenzo	Deputy Resident Representative, JICA Philippine Office (May, 2006 - March, 2008)
TSURUOKA, Noriyuki	Urban and Regional Development / Peace Building Team II, Group II, Social Development Department (Feb., 2006 – May, 2007)
SUHARA, Yasuhiro	Urban and Regional Development / Peace Building Team II, Group II, Social Development Department (June, 2007 – March, 2008)
KANOME, Takeshi	Assistant Resident Representative, Program Operation Section, JICA Philippine Office
Mae Salvanette D. Leyson	Program Assistant, JICA Philippine Office (Feb., 2006 – July, 2007)

JICA Technical Advisors

YOSHIMURA, Yoshimitsu	Director of 5th Research Department, Infrastructure Development Institute, Japan (Feb.,2006 – March, 2006)
CHUJO, Kenji	Senior counselor, 5th Research Department, Infrastructure Development Institute, Japan (April, 2006 – March, 2007)
TANAKA, Tsuneo	Senior counselor, 5th Research Department, Infrastructure Development Institute, Japan (April,2007 – March, 2008)

JICA Expert, NAMRIA

SUZUKI, Akira	JICA Expert (NAMRIA), Geospatial Data Administration

(3) Counterpart Personnel

Table 1-4 Technical Working Group

No.	Name	Position	Department / Division
1	Randolf S. Vicente	Assistant Director	Mapping
2	Enrique S. Macaspac	Assistant Director	Coast & Geodetic Survey
3	Ofelia s. Castro	Division Chief	Photogrammetry - Mapping
4	Joaquin B. Borja, Jr.	OIC -Division Chief	Cartography - Mapping
5	Nicandro Parayno	OIC - Division Chief	Aerial & Spatial - Mapping
6	Reynaldo Manuel	OIC - Division Chief	Printing & Reprography - Mapping
7	Alma Arquero	Division Chief	GIS - Remote Sensing and Resource Data Analysis
8	Bobby Crisostomo	Division Chief	Database - Information Management
9	Tita Cruz	Division Chief	Hydrography - Coast & Geodetic Survey
10	Romeo I. Ho	OIC - Division Chief	Geodesy & Geophysics - Coast & Geodetic Survey
11	Joselito Reasol	Engineer	Development Study & Standard Office
12	Trinidad Garbo	Engineer	Director's Office - Mapping
13	Brian Dela Cruz	Engineer	Photogrammetry - Mapping

Table 1-5 Technical Coordinating Committee

No.	Name	Position	Office / Department
1	Sofio Quintana	Director	Forest Management Services – Region 3
2	Leonardo Z. Aggabao, Jr.	Director	Land Management Services – Region 3
3	Angel Bravo	Director	Mines and Geosciences Bureau – Region 3
4	Alfredo G. Tolentino	Director	DPWH – Region 3
5	Remigio A. Mercado	Director	NEDA – Region 3
6	Lynette Bautista	Asst. Director	NEDA – Region 3
7	Leonardo Quintos, Jr.	Director	NEDA – Region 1
8	Mark Allen Sison	City Administrator	CPDO – Angeles City
9	Angel Tolention	City Planning & Development Officer	CPDO – Angeles City
10	Arch. Tony Kar M. Balde, III	City Planning & Development Officer	CPDO – Olongapo City
11	Engineer. Fernando Lambitco	City Administrator	CPDO – San Fernando City
12	Ludivina Banzon	Project Development Officer	PPDO - Bataan
13	Arlene G. Pascual	Project Development Officer	PPDO - Bulacan
14	Gemilliano Ferrer	Project Development Officer	PPDO – Nueva Ecija
15	Fernando Y. Henson	Project Development Officer	PPDO - Pampanga
16	Norma Untalan	Project Development Officer	PPDO - Pangasinan
17	Engineer. Roberto P. Ventura	Project Development Officer	PPDO - Tarlac
18	Lawag S. Bada	OIC – Project Development Officer	PPDO - Zambales
19	Moises H. Butic	Director	DENR – PENRO, Region 3

(4) Study Organization

Figure 1-2 Study Organization

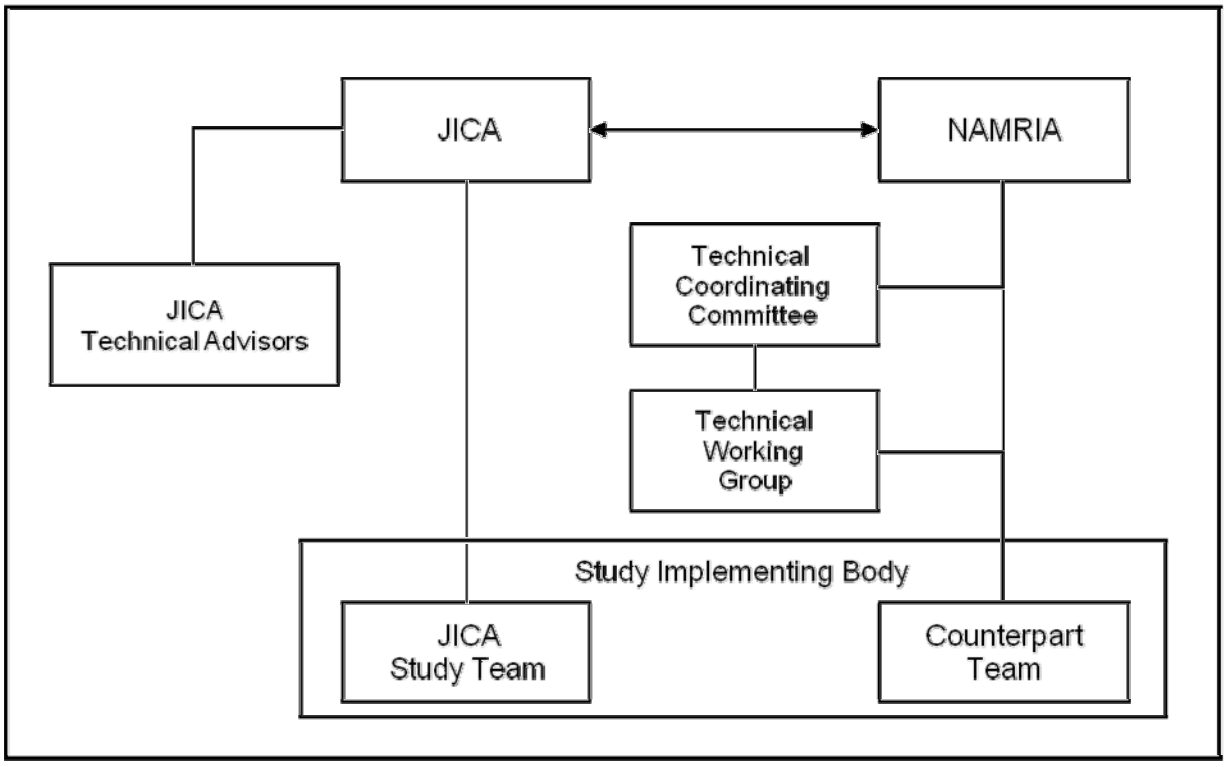


Table 1-6 Major Activities

Year	Date	Components
FY2005	Feb. 19, 2006	Starting the Field Activities in the Philippines
	Feb. 22, 2006	Distribution of Inception Report (Director's Office, NAMRIA)
	March 1, 2006	Explanation and Discussion of Inception Report (Director's Office, NAMRIA)
	March 10, 2006	Meeting on Preparations for the Seminar (Director's Office, NAMRIA)
	March 14, 2006	Holding the Seminar（EDSA Shangri-la）
	March 16, 2006	Meeting on Inception Report (Administrator's Office, NAMRIA)
	March 17, 2006	Holding the Technical Coordinating Committee （Clark Holiday Inn）
	July 5, 2006	Regional Seminar on Pilot Project for Technical Coordinating Committee (NEDA Region 3 Office)
	Sept. 13, 2006	Meeting on DCC and PCM results (Director's Office, NAMRIA)
	Sept. 26, 2006	Meeting on Survey Standard Operation, Result of Pilot Projects (Interim report) (Director's Office, NAMRIA)
FY2006	Nov. 20, 2006	Distribution of Interim Report and Meeting on Training on Photo-grammetry and Satellite Imagery and Additional Control Points for Field Verification Survey (Director's Office, NAMRIA)
	Nov. 28, 2006	Meeting on Interim Report (Lecture Hall in NAMRIA)
	Feb. 19, 2007	Discussion on the next steps of the Study (Director's Office, NAMRIA)
	Feb. 26, 2007	Meeting on the proposed presentation of the Study progress (Director's Office in NAMRIA)
	March 5, 2007	Meeting on Clarification of the Technical Specifications of the Digital Photogrammetry Systems and Drawing and Printing System for NAMRIA Study (Director's Office, NAMRIA)
	March 6, 2007	Discussion on the result of Spot Image and Mapping Schedule (Photogrammetry Department, NAMRIA)
FY2007	June 6, 2007	Discussion on Training Schedule (Director's Office, NAMRIA)
	June 20, 2007	Meeting on Project Progress, Request and Arrangement of "Map Specification and Standards" and "Human Resource Development", Schedule of Field Completion, Progress Report of OJT and Report of Map Database (Director's Office, NAMRIA)
	July 13, 2007	Meeting on Project Progress, Marginal Information Style and Legend, BM Field Reconnaissance, Contour lines data and so on (Director's Office, NAMRIA)
	Aug. 15, 2007	Holding the Technical Coordinating Committee（Poinsettia Hall, Pampanga）
	Sept. 27, 2007	Meeting on Project Progress, Specification of Extraction rules, Symbolization and Marginal information (Director's Office, NAMRIA)
	Sept. 28, 2007	Holding the Technical Coordinating Committee（Hotel Consuelo Resort and Chinese Restaurant, Pangasinan）
	Nov. 6, 2007	Meeting on Project Progress, Specification of Topographic mapping, Symbolization, Magnetic north and so on (Director's Office, NAMRIA)
	Nov. 26, 2007	Meeting on Project Progress, Arrangements reached during the previous meeting, Progress and Schedule and Remaining Activities (Director's Office, NAMRIA)
	Dec. 13, 2007	Meeting on Technical Specifications for 1:50,000 Topographic Mapping for the JICA Project (Meeting Room, NAMRIA)
	Dec. 28, 2007	Meeting on Schedule of the Project for 2007 and 2008 and Progress Status of the Final Report (Director's Office, NAMRIA)
	Feb. 29, 2008	Distribution, Explanation and Discussion of the Draft Final Report (Director's Office, NAMRIA)
	March 5, 2008	Holding the Seminar （EDSA Shangri-la）
	March 7, 2008	Discussion of the Draft Final Report (Director's Office, NAMRIA)

1-3 Modifications in Scope of the Study

The following items were revised during the presentation and discussion of the Inception Report (draft) on February 22, 2006 and March 1 2006 and agreed on March 16, 2006 as attached in the Annex ”Minutes of Discussions on March 16,2006”.

(1) The phrase “Capacity Development” was changed to “Organizational Development.”
(2) Organizational development on institutional and legal organizational development shall not include external positioning or sectors of institutions. (The reason is that NAMRIA has been discussing its rationalization plan with the Executive Office of the President in accordance with the Executive Order No. 366, as an organization under DENR.)
(3) The target organization for organizational development will be the Mapping Department.
(4) The capacity assessment will cover the entire NAMRIA.
(5) The scope of human resource development planning for the Mapping Department will be extended to other department depending on the results of the capacity assessment.
(6) Organizational development at an individual level shall not be treated officially in the Study.

Director Isada and Team Leader Kokufu have discussed the changed item (1); both agreed that the concept of capacity development had been understood by both parties, and the term capacity development was decided to be used again in the final report.

CHAPTER 2 CURRENT SITUATIONS AND ANALYSES

2-1 Institutional Capacity

2-1-1 Map Related Policies

(1) Medium-term Philippine Development Plan

The Philippine government prepared the Medium-term Philippine Development Plan, 2004-2010 (MTPDP) in 2004 adopting proposals of President Ayorro including the following development issues: (1) Creation of six to ten million jobs; (2) Education for all; (3) Balancing the national budget in view of the country's debilitating deficit woes; (4) decentralization of progress and development across the country; (5) provision of power and water supply to all barangays; (6) decongestion of Metro Manila by forming new cores of government and housing centers in Luzon, Visayas and Mindanao; (7) development of Clark and Subic as the logistics center in Asia; (8) Automation of the electoral process; (9) peace agreements with rebel groups; and (10) "Closure of wounds" caused by divisions due to EDSA 1, 2 and 3.

With the objective of "Reducing the level of population under poverty to less than 20 percent of the total population," four policy issue areas were defined: (1) sustainable economic development and restructuring of governments, (2) security by a peace agreement with the insurgent groups; (3) higher salary and employment levels of people in poverty; and (4) raising education and living standards of people in poverty. The government is taking various measures including requesting supports from donor organizations.

For planning and implementing various poverty reduction measures based on MTPDP, the role and significance of providing geographic information to the central and local governments are very large. The potential of executing the responsibility does exist in NAMRIA, DENR, which is responsible for preparing, updating and providing maps in the Philippines; however, actual implementation is difficult because of lack of financial and human resources.

(2) Philippine National Spatial Data Infrastructure Framework Plan

The Philippines' National Spatial Data Infrastructure (NSDI) is a national initiative to provide better access for all Filipinos to essential geographic information.[1] The NSDI has four components: the Institutional Framework; Fundamental Datasets; Technical Standards and Protocols; and Clearinghouse Network. The total cost of the financial estimates for data acquisition, production, and management is US$ 904 million. The plan, however, has not been committed.

(3) Geo-Hazard Mapping Project

The Geo-Hazard Mapping Project was commenced in accordance with the order of the National Disaster Coordinating Council. The implementing agency is composed of NAMRIA, MGB, PIVOLGS, and PAGASA. The seventeen month project was initiated by the Cartography Division started the work in February 2006. The source data of the geo-hazard mapping was the images from the SPOT5. The work involves in satellite ortho-image creation, digitizing contour lines, roads and water bodies from the existing topographic maps. Using the satellite ortho-images and the digitized data, the digital-satellite-ortho maps had to be created and submitted to MGB. The thirty-three SPOT

[1] Inter-Agency Task Force on Geographic Information/Information management Department, National Mapping and Resource Information Agency. Philippines' NSDI Framework Plan. p.2.

scenes were acquired, and the images were rectified and features were extracted. At the same time, the edge-enhancement and editing was conducted. The work was scheduled to end at the end of July 2007; as of December 2007, about half has been completed.

The objective of the Study is the "formulation of an implementation plan for NAMRIA to promote nationwide deployment of topographic maps at a scale of 1:50,000 based on the result of the study" as stated in the Minutes of Meeting dated on September 13, 2005 between JICA and the NAMRIA side and as agreed on December 2, 2005 as the Implementing Arrangement.

The Geo-hazard project and the Study have the same scale of 1:50,000; however, the objective of the Geo-hazard Mapping is creation of ortho-photo maps at scale of 1:50,000 that are one kind of thematic maps. The technical specifications are different from the 1:50,000 topographic maps created in the Pilot Projects. The Study Team recognized the Geo-hazard Project as a completely different projects from the Study.

(4) Philippine Reference System of 1992 (PRS92) Program

PRS 92 was established by NAMRIA and adopted as Philippine's Standard Reference System by Executive Order No.45. Manual of Land Survey Regulations of 1980 was officially revised, taking dynamic advancement of surveying science into account, as Revised Manual of Land Surveying Regulations in The Philippines by DENR AO No.98-12, in 1998. It can be said that the standards of land survey in the Philippines are well organized and operative now, although the main application of this Manual is cadastral maps or land tax maps which are large scale maps prepared by land survey.

The components of the program being implemented are:

- Geodetic Network Establishment (Geodetic Control Points Survey, Geodetic Leveling and Gravity Survey);
- Data Integration of Maps into PRS 92;
- Geodetic Network Information System Development; and
- Support Activities (Technical Training and Tri-media Campaign).

The program targets the entire land area (all the islands) in the Philippines.

(5) Legal Aspects of Survey and Mapping

The present institutional system of mapping organization and activities was established by an integrated government reorganization of 1987 with the following legal orders.

1) EXECUTIVE ORDER NO.192 (1987)

This is the order providing for reorganization of the Department of Environment, Energy and Natural Resources, renaming it as the Department of Environment and Natural Resources (DENR) and for other purposes. Section 22 (a) of EO No.192 legislated the creation of the National Mapping and Resources Information Authority (NAMRIA) under DENR as the central mapping agency of the Philippines.

2) DENR ADMINISTRATIVE ORDER NO.31 (1988)

This is the order to describe the guidelines implementing Executive Order No.192 dated 10 June 1987 with respect to the creation of the National Mapping and Resource Information Authority (NAMRIA). Section 1 and Section 2 of DENR Administrative Order No.31 legislated Mandate, Responsibility, Powers and Function of NAMRIA.

3) EXECUTIVE ORDER NO.45 (1993)

This is the order adopting the Philippine Reference System of 1992 (PRS 92) as the Standard Reference System for surveying and mapping activities in the Philippines. Sec-

tion 1 and Section 2 of EO No.45 legislated the adoption of PRS 92 as the standard reference for all surveying and mapping activities of the country.

Note: The geodetic control network of control points is a key and basic factor to keep the accuracy and standardization of survey and mapping in any country. The original control network, which was established by the US Coast and Geodetic Survey, covered mostly along the coasts and the network of inland was not feasible because of Philippines' physical configuration and conventional surveying techniques. New Philippine Reference System of 1992 (PRS 92) was established with extensive uses of modern GPS (Global Positioning System) technology by NAMRIA.

4) DENR ADMINISTRATIVE ORDER NO.22 (1994)

This order is the guideline of the adoption of PRS 92 for land survey in the Philippines.

5) DENR ADMINISTRATIVE ORDER NO.98-12 (1998)

This order is to revise MANUAL OF LAND SURVEYING REGULATIONS IN THE PHILIPPINES issued in 1980.

6) NSCB MEMORANDUM ORDER NO.01-93 (1993)

This order is to create Inter Agency Task Force on Geographic Information (IATFGI) to promote and coordinate the efficient development, management and utilization of geographic information in the country with NAMRIA as the Chairman.

IATFGI shall have the following activities:

i) Review current policies, directions, thrusts, programs and projects related to the management of geographic information system (GIS);
ii) Determine the issues and problems affecting the GIS development in the country and recommend measures to enhance its development;
iii) Recommend appropriate mechanism for coordinating the various agencies involved in geographic information and their eventual institutionalization;
iv) Conduct an inventory of geographic information holdings and projects;
v) Develop and recommend minimum standards for GIS interchange, standard methodologies and concepts and definitions for universal adoption by all government agencies in the generation of geographic information; and
vi) Create technical working groups (TWGs) as may be needed for specific purposes subject to the approval by the Secretary General of the National Statistical Coordination Board (NSCB).

7) DENR ADMINISTRATIVE ORDER NO.54 (2000)

This order amending the Section 10: Transitory Provisions of Administrative Order No.31 series of 1988. This is known as Guidelines Implementing Executive Order No.192 with respect to the creation of NAMRIA. Section 10.2 is to provide continuity in the judicious conduct of hydrographic, oceanographic and geodetic surveys, the Commissioned and Enlisted Services of the BCGS shall be transferred to the NAMRIA. The Officers' Corps shall continue to be governed by extant laws, rules and regulations on Commissioned Officers, embodied by RA 2057, RA 5534 and RA 5976, which shall continue to have operative effect until amended, modified or repealed. The enlisted personnel shall continue to be governed under the Exempt Service.

8) EXECUTIVE ORDER NO. 280

As it was foreseen that full implementation of PRS 92 by year 2000 as indicated in Executive Order No. 45 was impossible to achieve, the Section 2 of Executive Order No. 45 was amended to extend the transition period to year 2005. After that the PRS 92 shall be recognized as the standard for reference system for all surveys and maps in the country.

9) DENR ADIMINISTRATIVE ORDER NO. 2005 13

This order prescribes the guidelines for the full implementation of PRS 92. Its aim is to provide the guidelines for integrating old surveys and maps into the new network, and provide guidelines for the maintenance and completion of national geodetic work.

10) SPECIAL ORDER NO. 018 SERIES 2003

This is an order for a creation of task groups on PRS 92. The Order also writes down the functions and responsibilities of each task group. The created task groups were to include:

Task Group 1: Field Surveys and Data Management

Task Group 2: Research, Development and extension

Task Group 3: Project Management and Policy

Task Group 4: Information, Communication, and Education

11) EXECUTIVE ORDER NO. 321 (2006)

This is the order amending further Executive Order No.45, series of 1993, which prescribes the adoption of the Philippine Reference System of 1992 as the Standard Reference System of Surveys in the Philippines. The transition period for the integration of old surveys into PRS 92 is further extended up to the end of the year 2010.

2-1-2 Institutional Environment

(1) Public Sector

1) General

When maps with very high accuracy and with scales larger than 1:5,000 are required for detailed design of infrastructure such as--dam construction, bridge construction and irrigation system development for specific areas--surveying and mapping works must be newly conducted. Such works are generally conducted by private surveying and mapping companies on project by project basis through tendering and contracting procedures.

Mapping activities of most of government agencies are mainly to make thematic maps for their own applications, and topographic maps of NAMRIA such as 1:250,000, 1:50,000 and 1:10,000 are often used as the base maps. Each agency must extract data or layers needed for their applications from NAMRIA topographic maps and it means digitalization works of NAMRIA topographic maps are duplicated or repeated by various agencies. Once NAMRIA digital topographic map database is prepared and published, such duplication of mapping efforts or double investments will be avoided.

Three private survey and mapping companies have technologies, equipment and manpower for ground surveying, aerial photo survey, photogrammetry mapping and GIS data generation with limited production capacity. Because there is no official standard specification of topographic mapping in the Philippines and private companies must develop own surveying and mapping processes by themselves. Quality and accuracy of survey and maps by these private companies are not stable.

Through this baseline survey, quite a few foreign assistances to the Philippines on mapping and GIS sector were noticed and they are summarized as follows:

Table 2-1 International Cooperation Projects

Year	Agency in Philippines	Assisting Agency/ Country	Project
1981-86 1987-92	NCA NAMRIA	FRGIGTZ	National Cartography Center Project to supply and install various mapping equipment with technical training
1983-85	BCGS (NAMRIA)	JICA	NCR project, Mapping of 1:10,000 scale Maps for Metropolitan Manila
1990-91	NAMRIA	Australia	National Resources Management Information System (NRMIS) to supply Satellite data GIS and training
1990	DA	JICA	Soil and Water Research Center Project included supply and installation of GIS hardware and software
1992	DAR NAMRIA	SAITEC Sweden	Satellite-based topographic mapping project for Comprehensive Agrarian Reform
1992	NAMRIA	Australia	Establishment of Philippine Reference System 92 with GPS
1993	DPWH	ADB	Philippine Road Classification Study included development of GIS Database of Natural Capital Region
1994	DPWH	JICA	Eastern Pinatubo flood control project included aerial photos and 1:10,000 mapping
1997	DPWH	JICA	The Laoag River Basin Flood Control project included aerial photos and 1:10,000 mapping
1998	IATFGI	SIDA	Technical assistance for Geographic Information Management Framework Plan (An expert was assigned.)
1998-01	DAR	SIDA	Geographic-based Information system for CARP-- Cadastre mapping land registration information system
1999	LGUs NAMRIA	SIDA	Municipal Base Mapping Project-- Technical assistance to develop a pilot GIS of selected nine municipalities
2000	NAMRIA	JAFTA	Information system development project for management of tropical forest produced land use maps
2000	DPWH	JICA	Cagayan River flood control project included aerial photos and 1:10,000 mapping
2001-02	DPWH	JICA	The Western Pinatubo flood control project included aerial photos and 1:10,000 digital mapping
2002-ongoing	MMDA	JICA	Metro-Manila earthquake impact reduction project included aerial photos and 1:5,000 digital mapping
2002 Oct-Nov	NAMRIA	JICA	A short term project on digital mapping

2) DENR (Department of Environment and Natural Resources)

Although the DENR utilizes maps and GIS data as decision tools, two of the agencies under it are the main generators of maps and GIS data, namely NAMRIA and LMB (Land Management Bureau). NAMRIA produces topographic maps and derivatives as well as GIS data while LMB produces cadastral maps. NAMRIA has been thoroughly discussed in the preceding Chapter. LMB has been briefly discussed below.

3) Land Management Bureau (LMB)

The predecessor of LMB, the Bureau of Public Lands (BPL) was created under Act No. 218 on 2 September 1901. BPL was given charge of all of the public domain of the Government of the Philippines and under its supervision; all instruments for the sale or conveyance of the public lands were to be executed when authorized by law. With the approval of the Land Registration Act (Act No. 496) on February 1, 1903, the survey of a property became a requirement prior to titling.

This was followed by the approval of the first Public Land Act (Act No. 926) on October 7, 1903, which also required survey prior to issuance of land patents. BPL was renamed Bureau of Lands (BL) in 1906 by virtue of Act 1407 which in turn was again renamed LMB

pursuant to Executive Order 192 of 1987 and placed under the Department of Environment and Natural Resources (DENR).

LMB is responsible for the effective administration, survey, management and disposition of alienable and disposable lands (A&D); other lands acquired by the government not placed under control of any other government agency; the execution of cadastral survey of cities and municipalities; and the verification, approval and production of land survey maps according to established standards. Other functions as may be provided by law.

The standard base maps used by the Bureau of Lands are classified into:

(1) Cadastral Maps -14,000 scale detailed sectional maps at 1:2,500 to 12,000;
(2) Municipal Base Maps -1:60,000 scale;
(3) Provincial Base Maps -1:400,000 scale; and
(4) Regional Base Maps -1:800,000 scale.

Status of Land Titling as of December 1999

Out of the 14 million hectares of A & D lands, a total of 6.2 million hectares (44.3%) were administratively titled by LMB/DENR as of December 1999 while 3.1 million hectares (22.1%) were titled judicially. From the remaining untitled 4.7 million hectares of A & D lands, around 1.8 million hectares are non-agricultural lands allocated for road networks and open spaces. Another 1.7 million hectares have been turned over to other agencies by virtue of Presidential Proclamations (e.g. military reservations and the like). The remaining 1.2 million hectares is targeted for disposition in the next five years.

Land Records Management Information System (LRMIS)

LMB has embarked on a computer-based inventory of land records. The project aims to improve the physical condition of old records and facilitate the retrieval of missing records.

As of December 2001, guidelines for the inventory of land records, training of regional officers, and manual inventory of 1.71 million survey records and public land applications were accomplished.

LRMIS, however, is aimed at computerization of textual records only, not graphical information. The latter (Cadastral Maps) is currently being done under a Build-Own-Operate (BOO) Land Title Computerization project (LAKES) operated by a consortium of private companies within the Land Registration Authority (LRA), Department of Justice (DOJ).

4) DPWH (Department of Public Works and Highways)

DPWH generates a large number of engineering maps in various scales required for civil works such as road construction, bridge construction, dam construction and so on. A notable current activity of DPWH is the Roads Information and Management Support System (RIMSS) Project. This Project, which is funded by the World Bank, will supply the fundamental data set on national roads (approx. 28,000 km.) at sub-meter accuracy, with a rich source of road attributes. This data set can serve as the control data set for the acquisition and or updating of provincial, city municipal and barangay roads information, where the latter data sets 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 NAMRIA's topographic mapping (1:50,000 and 1:10,000) for consistency. Custodians of road information will provide digital information to produce a complete road network database for the whole country.

5) DA (Department of Agriculture)

Bureau of Soils and Water Management (BSWM) of DA is the main producer of agricultural related thematic maps in the country and the range of BSWM's map products are

generated based on NAMRIA's topographic base maps of 1:50,000 and 1:250,000 and they are mainly in analogue format and some are in digital format. The following is a list of maps of BSWM.

A. Soil Map
B. Land Factor map
   Hydro-Ecological Zone
   Pedo-Ecological Zone
   Land Management Unit
   Elevation
   Slope
   Flooding
   Geomorphological
C. Land Use and Vegetation Map
D. Decision Map
   SAFDZ maps
   Networks of Protected Areas for Agriculture
   Key Production Areas
   Crop Based Cropping System
   Crop Development Zone
   Prime Land
   Land Use Opportunity
   Land Degradation
   Land Limitation
   Land Limitation & Use Efficiency
E. AGRO-SOCIO-ECONOMIC MAP
   Geographic Flow Map
   Socio-institutional & Support Services

6) NIA (National Irrigation Authority)

NIA is responsible for development, construction, monitoring and maintenance of all irrigation systems throughout the entire country. The total land area which is now under irrigation is 1,338,800 hectares of which 678,500 hectares falls under National Irrigation System (NIS), while 486,100 hectares under Communal Irrigation System (CIS) and the remainder (174,200 hectares) under Private Pump Irrigation System. The potential irrigable area of the country is estimated at 3,128,000 hectares hence there is still about 1,789,200 hectares or 57.2% of the country's total irrigable area to be developed.

Maps utilized by NIA fall into the following categories

(1) Detailed topographic maps - 1:1,000 to 1:4,000 scale with 0.25 to 1.0 meter contours.
(2) Parcellary maps -1:4,000 scale.
(3) Dam Site topographic maps - 1:400 to 1:500 scale with 0.1 to 1.0 meter contours.
(4) Reservoir topographic maps - 1:4,000 to 1:10,000 scale with 2.0 to 10.0-meter contours.
(5) Index, investigation, general layout maps- 1:20,000 to 1:100,000 scale.
(6) Regional administrative maps -1:250,000 scale.

The first four map categories are obtained by NIA through private contractors using ground survey or photogrammetric methods or a combination of both. The last two categories are based on existing NAMRIA maps.

In general, the foregoing maps are still in the analogue state and conversion to digital form has not been done to any significant extent. However, NIA has recently procured GIS software ArcInfo and ArcView in 2000.

7) DAR (Department of Agrarian Reform)

DAR has been conducting Cadastral surveying and mapping to establish a Geographic Information System for planning and monitoring support of the ongoing "Comprehensive Agrarian Reform program" (CARP) with the cooperation of Swede Survey.

Previous activities

The absence of accurate records on land titles, cadastral maps, lot plans, boundary surveys etc. has hampered the land distribution process. Within the previous phases of the project, the modern and efficient technology of surveying boundaries and capturing geographical information has been introduced and combined with capturing of related attribute data about the land such as ownership, tiller, land use, cropping pattern etc.

GIS has been established and run for a number of pilot areas and is now ready for replication on ten of the fourteen regions of the Philippines.

The latest project (Phase IV)

The general objective of the project is to provide assistance in accelerating land distribution and rationalization of land use planning for various Agrarian Reform Communities nationwide. This has to be achieved through the replication of the systems developed in the previous phase of the project. The project consists of four components.

(1) Surveying component
(2) Mapping component
(3) Land Information System component
(4) Geographical Information System component

The Survey Component is concerned with cadastral surveys of lots under distribution in the land reform. New, modern survey equipment such as total station and GPS are introduced as well as the latest surveying methods and software.

The Mapping Component takes care of the editing and processing of data from the Survey Component. Geographical data is also converted from analogue documents to digital data through encoding and digitizing.

The Land Information System (LIS) Component is concerned with the capture, storing and processing of textual information related to the farm lots and its owners.

Geographical and textual data are finally integrated and processed by GIS component. Different reports are produced such as maps, diagrams etc. and the GIS can also be used as a planning tool.

The system has to be replicated to 10 regions and some 50 provinces. Swede Survey is represented in the project with two long-term resident project advisors. In addition to this, the implementation of a comprehensive training program in Sweden as well as in the Philippines is conducted by Swede Survey.

8) DOH (Department of Health)

The Department of Health has been conducting three GIS application projects Malaria Control GIS, Red Tide Monitoring GIS and Family Planning GIS since 1993. As the base map of GIS, 1:50,000 topographic maps of NAMRIA were digitalized. The layers of information were roads, rivers, administrative boundaries down to the barangay level, health facilities, forest cover and contour lines. Some problems on the GIS base map data were reported as follows:

(1) DOH often used GPS for field survey and find the positions indicated on GPS often deviate from those on digital maps. It seems that the accuracy of original 1:50,000 base maps is not adequate.
(2) Administrative boundaries on digital maps sometimes deviate from the actual boundaries and it is because original base maps are very old and outdated.

9) Local Governments (Province, Municipalities, Cities, etc.)

The Department of Interior and Local Government (DILG) was established by virtue of R.A. No 7160 otherwise known as the Local Government Code of 1991 which took effect on 1 January 1992. The Code establishes a system of decentralization with the people being empowered to recall abusive elective officials, initiate and approve local legislation on their own under certain circumstances, and voice their stand on various local issues through referenda. A local government unit (LGU) is defined as a political subdivision of a nation which is constituted by law and has substantial control of local affairs. The LGU may be a province, city, municipality or a barangay.

A pertinent provision of the Code that touches on mapping and GIS is contained in Section 20 (Reclassification of Lands) Paragraph (c) " The local government units shall, in conformity with existing laws, continue to prepare their respective comprehensive land use plans (CLUP) enacted through zoning ordinances which shall be the primary and dominant bases for the future use of land resources Provided, That the requirement for food production, human settlements, and industrial expansion shall be taken into consideration in the preparation of such plans."

In the implementation of the foregoing CLUP provision, the majority of LGUs have been encountering difficulties in regard to obtaining the proper base map to be used which should appropriately be at 1:10,000 scale or larger.

Because of budget limitations, many LGUs have resorted to enlarging the existing NAMRIA 1:50,000 scale maps five times to obtain the needed 1:10,000 scale. This has proven to be a technically unsound practice and provided an inadequate decision tool for local land use planning and development.

Some LGUs, however, obtained foreign assistance or able to allocate sufficient funding from their own resources to generate up-to-date digital maps at the appropriate scale for their CLUP A partial listing of these LGUs follows:

(1) Provinces - Bulacan, Catanduanes, Aurora, Quirino
(2) Cities - Puerto Princess, Iligan, Gen. Samoa, Lucena, Tagbilaran, Cagayan de Oro, Bacolod, Bago, Cebu, Davao, Tagaytay, Antipolo, Iloilo, Marikina, Ormoc
(3) Municipalities - Balanga, Magalang, Taguig, Pateros, San Juan, Baybay, Ormoc

Digital data of attributes/themes/layers based on existing NAMRIA's 1:50,000 scale maps are available for 43 out of the 79 provinces in the Philippines. The following list of attributes/themes/layers are typical for each province Climate, Elevation, Erosion, Forest Cover, Geologic, Groundwater, Index Contour, Infrastructure, Isohyetal (Rainfall, Land Classification, Land Cover, Land Use, Municipal Boundary, NIPAS (Protected Areas), Population, Provincial Boundary, River System, Road Network, Slope, Soil, Spot Elevation, SWIP (Water Impounding Dams), Watershed, Wells.

10) GIS Software and Hardware

As a result of this survey on the concerned government departments and agencies, it was found that GIS is utilized by various departments for their own purposes. Each department

builds a system for GIS and input necessary thematic or attributes data onto available base map to make thematic map and analysis for policy decisions, plan and implement various development projects.

Table 2-2 Inventory of Geographic Information of Government Projects/Activities

Department	Bureau/Agency	Name of Database	Objectives
Dept. of Agriculture (DA)	Bureau of Soil and Water Management (BSWM)	Base Map of the Philippines	Political Boundaries, Roads, Water Names of Places and Important Landmarks
Dept. of Agriculture (DA)	Bureau of Soil and Water Manage-ment(BSWM)	Region 3 Soil Map	Soil Map
Dept. of Agrarian Reform (DAR.)	Bureau of Land Development	DAR Cadastral and Land Information System	Cadastral Surveys
Office of President	Metro Manila Development Authority	Updating Metro Manila Land Use Map	Land Use Map
Dept. of Environment & Natural Re-sources(DENR)	National Mapping and Resource Information	GIS for National Planning	The graphic database of this GIS, generated by MapInfo software, is based on topographic Map Scale 1:250,000. Digitizing is in Autocad.
DENR	NAMRIA	Scale 1:10,000 Topographic Map Sheet	Seashore, Road, Boundary, Railway, River, Lake, House, Contours, etc.
DENR	NAMRIA	Scale 1:100,000 Land Use Forest Type Map Sheet	Old forest growth, Mossy, Pine and Mangrove, Coconut Plantation, etc.
DENR	NAMRIA	Scale 1:250,000 Land Cover Map Sheet	
DENR	Central Office	Resource Management Planning	Residual Forest Resource Management Plans.
DENR	Forest Management Bureau	Forest Land Management	Development of "FORLIST', a system to input and store information.
DENR	NAMRIA	Digitizing of Land Classification Maps	GIS Database of Land Classification.
Dept. of Energy (DOE)	Central Office	Geographic Information System for the Energy Resource Development Bureau.	
Dept. of Science and Technology	Phivolcs	Pinatubo Hazard Map	An ongoing and long term project of the Institute of Volcanic Hazard associated with Pinatubo Volcano is continuously updated. Digital form of these hazards are updated through the facility of GIS

Department	Bureau/Agency	Name of Database	Objectives
National Economic Development Authority	NEDA Region VII	Cebu Integrated Area Development Master Plan	Preparation of an Integrated Area Development Master Plan for the entire Province/Island of Cebu.
NEDA	NEDA Regional Office I	Coastal Area Management Project, Integrated Coastal Fisheries Management Project, Comprehensive Profiling and analysis, Metro Urdaneta Planning Assistance, Metro San Fernando Planning Assistance, Regional Physical Framework Plan Updating.	Update regional capabilities in coastal planning and to establish an information system for storage and analysis of spatial and attribute data on coastal resources. Facilitate planning and management of coastal areas through the application of GIS applied in coastal resources management and planning for the Lingayen Gulf
University of the Philippines		Siltation Assessment of Agno River	Assess causes of siltation in Agno River and derive erosion rates using GIS/RS

Table 2-3 GIS Software & Hardware Used in Government Departments

Name of Department	Bureau/Agency/Office	Main Computer	Name of GIS Software	Type
Department of Science & Technology (DOST)	Philippine Institute of Volcanology and Seismology (PHIVOLCS)	Unix and Intel Pentium	ArcInfo, ArcView, MapInfo	Stand-alone
Department of Agrarian Reform(DAR)	Bureau of Land Development	Intel Pentium	MapInfo, Autocad	Stand-alone
Department of Agriculture (DA)	Bureau of Soils and Water Management (BSWM)	Intel Pentium, IBM Mainframe	ArcInfo, ArcView	Stand-alone
Department of Interior and Local Government (DILG)	Philippine Regional Municipal Development Project	Intel Pentium	ArcInfo, ArcView	Stand-alone
Department of National Defense (DND)	Office of Civil Defense	Intel Pentium	ArcView	Intranet
National Economic Development Authority	Research Monitoring & Special Studies	Intel Pentium	ArcInfo, ArcView	Stand-alone
Department of Science & Technology (DOST)	PAGASA, Asia Trust Bank Bldg., Quezon City	Intel Pentium	Arcview	Stand-alone
Department of Transportation and Communication	Central Office	Intel Pentium	ArcView, ArcInfo	Stand-alone

(2) Digitalization and GIS data

NAMRIA started digital mapping several years ago and still busy with establishing an integrated system for managing digital topographic data. Comparing with conventional analog (printed) maps, digital maps are easier to manipulate and to share in a network environment. It means that digital map needs to have a very strict standardized data format, otherwise the benefits of digital map and GIS will be largely reduced or it may cause serious confusion among users. Interagency Task Force on Geographic Information (IATFGI) was created to resolve issues arising from digital data with NAMRIA as the chair in 1993. The IATFGI was initially composed of the nine member-agencies: NAMRIA as the Chairman; National Statistical Coordination Board (NSCB) as the Co-chairman; Housing and Land Use Regulatory Board (HLURB); National Statistic Office (NSO); National Computer Office (NCC); Department of Public Works and Highways (DPWH); Department of Science and technology (DOST); Bureau of Soils and Water Management (BSWM); and National Economic and Development Authority (NEDA) as members. The functions include Standardization of geographic information such as (1) Cartography and Mapping, (2) Terms and Definitions and (3) Data Security.

Milestones of IATFGI are as follow:

- A general assembly of IATFGI was held at NAMRIA in May 1993, and coordination of the various agencies in geographic information officially began. Five Technical Working Groups (TWG) were organized: TWG on Agriculture, Environment and Natural Resources; TWG on Research, Training and Technology; TWG on Lands and Surveys; TWG on Socio-Economics; and TWG on Infrastructure and Utilities. Since then, the TWGs started meeting regularly. The priority concerns within their sectors are such as the development of data classification standards, mechanism for data sharing, standard map scale to use, and problems related to geographic information.
- In December 1994, member representatives of the TWGs gathered at NAMRIA for a workshop which focused on the data classification scheme and data sharing for universal adoption by all government agencies using GIS. This was the first time that the data classification scheme was presented formally to IATFGI.
- In April 1996, the standard geographic information data classification scheme and definitions were completed and presented to IATFGI by five TWGs.
- In 1997, the Geographic Information Management Framework Plan (GIMFP) was drafted by IATFGI.
- In October 2000, the proposal for National Geographic Information Infrastructure (NGII) was prepared and the Manual on Standard GIS Data Classification and Codes was issued. IATFGI started drafting Executive Order which shall create a National Geographic Information Council (NGIC) to enhance the establishment of NGII.
- In 2001 an Executive Order on creation of a NGIC was drafted for the efficient and effective acquisition, management, dissemination and utilization of geographic information in the country. This EO draft defines roles of NGIC as the government's planning, coordinating and policy making body on geographic information related matters.

(3) Private and Educational Sector

1) Private Sector

Mapping and GIS in the private sector are carried out on a strictly open-job-shop basis, i.e., made to order by clients using their specifications as to scale, contour interval, map content,

legend and format. The services demanded by the clients are usually for project mapping at large scales (1:500 to 1:5,000) and small contour intervals (0.5 to 5 meters) intended for detailed engineering design of irrigation systems, dams and reservoirs, water supply systems, real estate developments, flood control, utilities management and the like. Typical outputs are aerial photography, GPS controls, digital topographic maps, digital elevation models (DEMs), orthophoto with contours, GIS-ready digital data, geo-referenced satellite imagery, satellite image maps (SIMs), land use/land cover maps, etc. Clientele includes government agencies, engineering consultants, financial institutions, and property developers. A partial list follows:

(1) Government Agencies - NAMRIA, DENR, DPWH, NPC, NIA, PNOC, FMB, PCA, DOT, LMB, NHA, MWSS, ATO, BCDA, BSWM, SBMA;
(2) Engineering Consultants - Katahira & Engineers, Nippon Koei, PhiIJAC, Bechtel, PASCO Corp., Camp Dresser & McKee, Tahal Consulting, CTIE Engineering, Pacific Consultants, C. Lotti & Associates, JMM-DCCD-KK, Louis Berger Int'1, Wardrop Engineering, SHELL Exploration, Lahmeyer Int'1, Morrison-Maierle, Aero-Asahi, Sagric Int'1, Raytheon Ebasco Overseas Ltd.;
(3) Financial Institution -ADB, WORLD BANK, AusAID, Kfw, USAID; and
(4) Property Developers - The Land Company Inc., Ayala Land, Group Developers.

To meet these demands, private mapping/GIS companies have developed their capabilities and capacities in varied configurations as the market unfolds.

Results of a survey of capabilities and capacities of the major mapping/GIS companies are summarized in the table below:

Table 2-4 Private Corporation

EQUIPMENT,CAPABILITY & CAPACITY	CERTEZA SURVEYING & AEROPHOTO SYS, INC.	F F CRUZ & CO., GEOMATICS D1V	GEO-SURVEYS & MAPPING, INC.
1.No. of Aircraft	3	2	1
2.No of Cameras	2	2	1
3.Analogue Plotters	3	2	0
4.Analytical Plotters	2	0	0
5.Digital Plotters	3	3	3
6.Precision Scanners	1	1	1
7.GPS Equipment	10	6	4
8.Remote Sensing	Yes	Yes	Yes
9.GIS Capability	Yes	Yes	Yes
10.Technical Staff	40	25	30
11.Area of Operation	Asia/Pacific, US, EU	Philippines	Philippines

2) Professionals in Survey and Mapping

The Professional Registration Commission (PRC) licenses geodetic engineers[2]. The accredited professional organization is the Geodetic Engineers of the Philippines (GEP). As for new technologies in the field of cartography and photogrammetry, there are professional associations but they are not active. Certificates may be issued by software vendors after completion of seminars.

[2] http://www.prc.gov.ph/

Table 2-5 General Practice of Geodetic Engineering

General practice of Geodetic Engineering. - The practice of Geodetic Engineering is a professional and organized act of gathering physical data on the surface of the earth with the use of precision instruments. It is also the scientific and methodical processing of these data and presenting them on graphs, plans, maps, charts or documents. It shall embrace, but is not limited to, the following activities: Professional Geodetic Engineering services with the use of surveying and mapping equipment such as graduated rods, measuring tapes, transits, levels, theodolites, fathometers/echosounders, electronic distance meters, global positioning systems, stereoplotters and all other instruments that are used to determine metes and bounds of lands positions of points on the surface of the earth, water depths, underwater configuration, ground elevation, gravity, isostasy, crustal movements and the size and shape of the earth, and other instruments used for construction survey, and those instruments used to guide the installation of large industrial equipment and machineries; Horizontal and vertical control surveys and political boundary surveys; Land surveys to determine their metes and bounds and prepare the plans thereof for titling and for other purposes; Subdivision, consolidation and/or consolidation subdivision of titled properties; Submission of survey plans of subdivided, consolidated and/or consolidated-subdivision titled properties to the government agencies concerned; hereafter, such plans on surveyed titled properties submitted by geodetic engineers shall not be subject to verification and approval; Preparation and making of sketch, lot and location plans; Conduction of engineering surveys and the technical preparation of engineering survey plans such as topographic, hydrographic, tidal, profile, crosssection, construction and boundary surveys; Parcellary surveys of lands traversed by infrastructure projects; and the preparation of subdivision plans; Conduction of gravimetric and photogrammetric survey and the technical preparation of such survey plans; Survey and mapping works such as the preparation of geographic and/or land information systems; Survey to determine and establish line and grade for the construction of buildings and other structures and its attachments; Construction of as-staked and as-built surveys for infrastructures; Conduction of mineral and mining surveys; Installation of machineries requiring the use of precision instruments; Engagement in the transfer of the knowledge and technology of geodetic engineering in any institution of learning;

http://www.prc.gov.ph/portal.asp?pid=50

3) Educational Institutions

The Study Team identified twenty-five educational institutions of higher learning in the Philippines. These colleges and universities are the foundations of Geodetic Engineers.

Table 2-6 Educational Institutions

No	Name
1	North Western University
2	Saint Louis College-City of San Eernando
3	University of Northern Philippines
4	North Eastern College
5	St. Louis College of Tuguegarao
6	St. Mary's University
7	St Paul University
8	University of La Salette
9	Naga College Foundation
10	University of Northeastern Philippines
11	Central Visayas Polytechnic College
12	University of Bohol
13	University of Southern Philippines
14	Andres Bonifacio College
15	Western Mindanao State University
16	Cagayan De Oro College
17	Immaculate Concepcion College La Salle
18	Notre Dame of Marbel University
19	Feati University
20	National University

21	University of The Philippines-Diliman
22	Baguio Central University
23	Baguio Colleges Foundation
24	Mountain Province State Polytechnic College Tadian
25	Saint Louis University

2-1-3 Institutional Issues

(1) Diversified Map Production in the Central Government Agencies

As stated LMB, DPWH, DA, and local governments have been producing without base map information. The diversification of map production in the central government agencies and local governments will have negative effects over standardization and data exchange.

(2) Institutionalization of Professionals

The Philippine Geodetic Engineers' Association and other professional associations relating to photogrammetry and remote sensing have not established their professional certificate programs to promote professionalism in the field. The professional geodetic engineers have a professional licensing system; however in other areas such as in photogrammetry or cartography, there is no licensing system available in the Philippines. There is no system of recognizing GIS specialists other then the vendor issued certificates on training. Professional licensing systems and certificate systems on advanced engineering regarding photogrammetry and remote sensing shall be institutionalized to motivate future engineers in the fields. Software vendors shall be involved in the efforts to raise professional recognition.

(3) National Development Policies with Basic Maps

The national development programs other spatial policies are being prepared without the base maps at scale of 1:50,000. The base maps are the foundations of land use planning at regional and provincial levels of governments. The mapping scale is appropriate for environmental planning and disaster mitigation planning. All those planning policies are prepared without the 1:50,000 topographic maps.

(4) Lack of Standards

The specifications for topographic mapping at scale of 1:50,000 topographic maps were lacking; this was another objective of the Study. The Study Team has prepared the Specifications and the NAMRIA side has reviewed it; however, other mapping related project such as the geo-hazard mapping project, has been prepare without sufficient specifications.

NAMRIA actually uses U.S. standard for small-scale mapping (1:50,000 and 1:250,000) and Japanese (JICA) standard for medium scale mapping (1:10,000) as NAMRIA's internal standard and recommendation. It is mainly because the Philippines rely heavily on foreign assistance for aerial photography and mapping historically, technically and financially.

(5) Copyright

Interviews to key informants in the private sector identified that the policy of NAMRIA on selling maps and map related information need to be strictly protected to prevent from selling copied products. The Study Team confirmed that the system of selling at the Map Sale Office was to sell at the same time to protect their intellectual properties by registering the names of purchasers of topographic and thematic maps.

(6) Outflow of Engineers

The technical human resources have high incentive to work overseas. The staff that was trained in International Technical Center for one year has a two-year work obligation in

NAMRIA. The trained staff generally seeks higher salaries in the overseas market, such as Saudi Arabia, United State, or the United Arab Emirate after they have adequate training in NAMRIA or major survey and mapping companies in the Philippines.

(7) Rationalization Plan

The rationalization plan was prepared and submitted to the Secretary, DENR/ Chairman, NAMRIA Board of Governors on June 15, 2006 from the Administrator, Mr. Ventura. The rationalization plan describes changing roles of NAMRIA. It says that the functions of NAMRIA has been changing from a single provider to the spatial data network manager. The organizational structure is planned to be changed; the main change in relation to the targeted Mapping Department is the Aerial Survey Division which is not recognized as an independent division in the rationalized organizational structure. The Mapping Department is consolidated with the Geodesy, and forms a single entity called Mapping & Geodesy Service. Under the Service, four divisions are proposed: Geodesy & Geophysics Division; Photogrammetry Division; Cartography Division; and Printing & Archives Division. The rationalization plan does not proposed any lay-offs; All the staff are planned to be stationed within the structure of NAMRIA. The plan is yet to be approved as of December 2007.

The issues of copyright, outflow of engineers and rationalization were analyzed among a number of institutional issues surrounding NAMRIA and related to the Study. The measures to deal with these issues were discussed in Section 4-6 Promotion Plan (copyright), Section 4-5 Human Resource Development Plan (outflow of engineers) and 4-4 Organizational Development Plan (rationalization). The relations between these three issues and topographic mapping work of NAMRIA were described in Section 4-2-1. In Section 4-3, necessity of spatial data for the central government agencies and LGUs, and necessity of collaboration with the private sector including professional organizations, and educational institutions were reviewed, and the institutional capacity development plan was further formulated by analyzing relations with the data, personnel and technologies of NAMRIA.

2-2 Organizational Capacity

2-2-1 Organizational Changes and Development

(1) BCGS (1901-1978)

In 1898, the Philippines were ceded from Spain to its new colonizer--the United States. The United States Coast and Geodetic Survey (USCGS) was established to conduct preliminary studies on execution of territorial surveys of the Philippine islands, and the Manila Field Station was established in 1900.

In 1901 Manila Field Station became the Bureau of Coast and Geodetic Survey (BCGS) and BCGS started basic surveys and data collection for the preparation of maps of the Philippines.

The World War II disrupted BCGS's work and made havoc of all its documents and equipment. Operation of BCGS resumed following the Philippine liberation in 1945. Topographic maps of the Philippines at scale of 1:50,000 were originally published by the US Army Service using aerial photographs taken in 1947-1953 with information from: BCGS; the US Army Map Service; and Department of Public Works and Highways (DPWH). Topographic maps of the Philippines at scale of 1:250,000 were produced in 1954 with information from BCGS, US Army Map Service and other agencies.

In the 1960s the increase of survey and mapping demands necessitated the creation of a coordinating agency of surveying and mapping activities in the government and semi

government corporations. This coordinating agency came to be the Board of Technical Surveys and Maps (BTSM) and BTSM promulgated and adopted national mapping surveying standards. The BCGS absorbed and assumed the function of BSTM in 1972, although main activities of BCGS were still ground surveying and several government agencies had to carry on mapping activities for their own purposes.

(2) NCA (1978-1987)

Before 1978 the Philippine Government established technical and financial cooperation for national base mapping projects with the Federal Republic of Germany (FRG) and the agreement between two governments included a loan of DM6.5 million to procure various mapping equipment and a new building where such equipment was to be installed. BCGS was not a suitable agency of the FRG assisting project, because BCGS's specialty was ground survey rather than mapping works, and BCGS belonged to the Ministry of National Defense. On June 11 1978, President Ferdinand E. Marcos issued Presidential Decree No.1588 to establish a National Cartography, Photogrammetry and Remote-Sensing Center (NCPRSC) under the Office of the President as the central mapping agency of the government to consolidate mapping activities of all government agencies.

It initiated, developed and implemented a continuing and integrated program of aerial photography and base mapping with Foreign Assisted Project Support Fund from FRG. In 1981, NCPRSC was renamed as National Cartographic Authority (NCA and the mapping functions of BCGS including its applicable appropriations, records, equipment, property and personnel were integrated into NCA.

(3) NAMRIA (1987-)

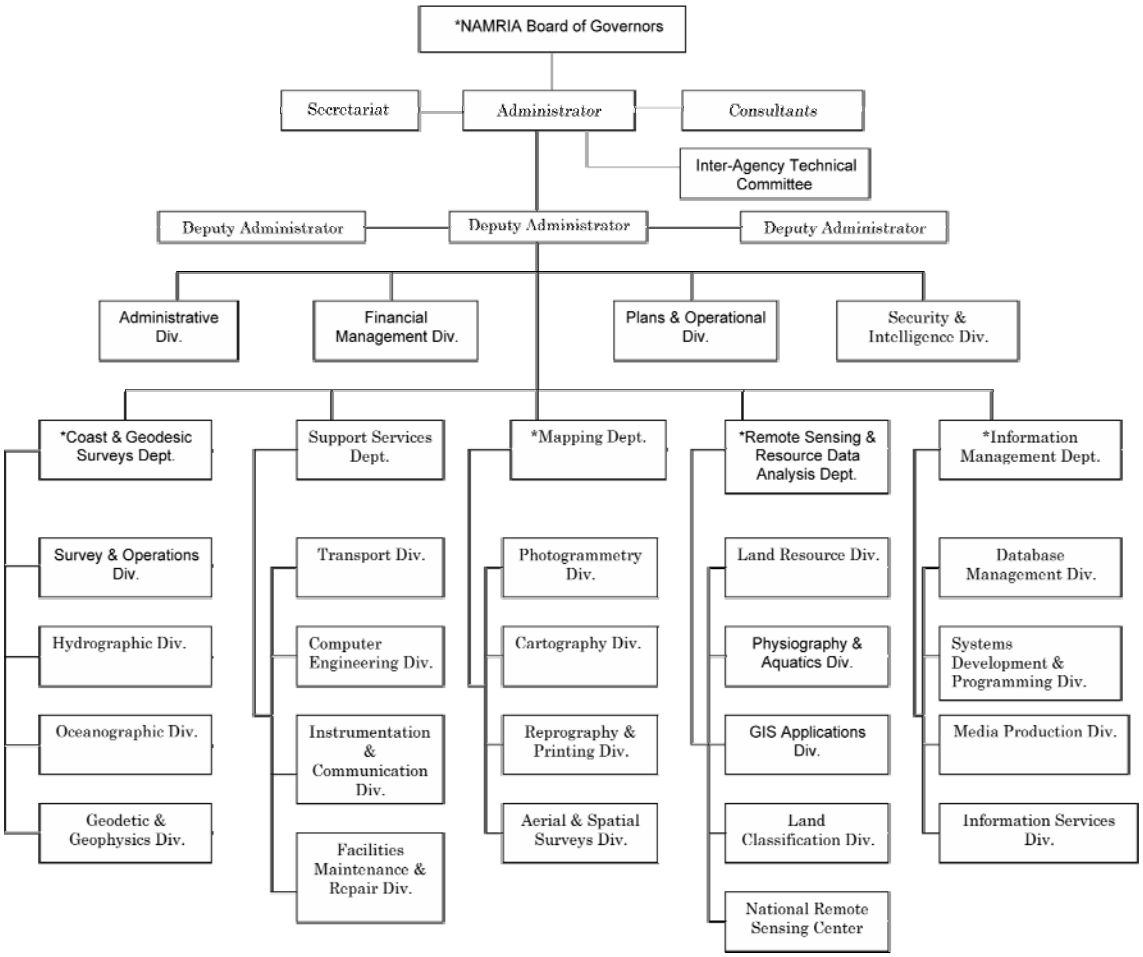
An integrated government reorganization by new President Corazon Aquino in 1987 merged all the surveying and mapping functions of BCGS and NCA with National Resources Management Center (NRMC). The Land Classification teams of the Bureau of Forest Development which were under Ministry of Natural Resources. National Mapping Resources Information Authority (NAMRIA) under Department of Environment and Natural Resources (DENR). NAMRIA is now the central agency of the government responsible for integrated surveys, mapping, charting, oceanography, aerial photography, remote sensing, management of resource information and research development.

Consideration on the history of mapping organizations

NCPRSC (later renamed as NCA) was created under the Office of the President in 1978 by President Marcos to strengthen and consolidate mapping activities in the Philippines with foreign assisted project funds and considerable political powers were given to NCA. For instance, NCA had powers to receive, take, purchase or lease any asset, grant or property from foreign and domestic sources, notwithstanding existing provisions of laws, and to convey such assets, grant or property, to invest and to deal with in such manner as will best promote its objectives. NCA was also authorized to borrow funds from any foreign government and other public or private financial institutions as well as to issue bonds, promissory notes subject to the approval of the President of the Philippines and the Secretary of Finance. It seems that creation of NCA was very politically motivated without long term plan or strategy to strengthen mapping activities in the Philippines, and NCA could not actually improve their mapping activities as originally expected. The creation of NAMRIA in 1987 also seems politically motivated by the Cabinet of President Aquino taking the failure of NCA operations and importance of transparency into account accompanied with the intention to create a real central mapping agency.

2-2-2 Organizational Structure of NAMRIA

Figure 2-1 Organization Structure of NAMRIA



(1) Board of Governors

The top of the NAMRIA organizational structure is the NAMRIA Board of Governors chaired by the Secretary of the Department of Environment and Natural Resources. Members of the Board are the Department of National Defense, the Department of Agriculture, the Department of Public Works and Highways, the Department of Transportation and Communication, and the NAMRIA.

(2) Coast and Geodetic Surveys Department

The functions of the Coast and Geodetic Surveys Department are to acquire and analyze hydrographic and oceanographic data for use in promoting safety through nautical charting, maritime publications and broadcast, tide and current prediction and for use in oceanographic research.

And secondly, to establish and maintain a national geodetic control network intended to serve as common reference for all surveying and mapping activities.

(3) Mapping Department

The Mapping Department is primarily tasked to provide a base mapping system and to produce maps suitable for use by government agencies and the private sector. It is also responsible for the formulation of mapping standards and the conduct of research and development in the application of new technology in mapping and related activities.

(4) Remote Sensing and Resource Data Analysis Department

The Remote Sensing and Resource Data Analysis Department is mandated to provide information on the environment and natural resources, as well as to undertake land classification for the country. Its functions are provision of remote sensing services and vital data on the environment, land use, forestry, agriculture, water resources, the coastal zone and other information needed by the government and the private sector, the conduct of researches on remote sensing and GIS applications as well as on resource information processing and handling.

(5) Information Management Department

The Information Management Department works toward the sharing, transfer, exchange, packaging and dissemination of environment and natural resources data. It develops and maintains information systems and environment and natural resources databanks) databases for use not only within the IMD and other departments of NAMRIA but also outside clients.

It also serves as the marketing arm of NAMRIA for all its products and services. As mentioned before in this report, NAMRIA' s role to produce maps and GIS data in National level is very important and the information on organization, number of personnel and budgets was collected.

Table 2-7 NAMRIA's Personnel (as of March 2007)

Department	Number of staff
Coast and Geodetic Survey	283
Mapping	123
Remote Sensing	96
Information Management	77
Support Service	81
Administration	48
Total:	708

The increase of budget from 2005 to 2006 is the portion of the Geo-Hazard Mapping.

Table 2-8 Budget of Past Four Years

Thousand Pesos

Year	Amount
2003	263,026
2004	261,862
2005	265,226
2006	299,914

In 2007, the budget for NAMRIA more than doubled--819,684 thousand pesos. The increase in the budget is considered to be the costs of: procurement of SPOT images; and PRS92 projects which include GPS survey, first and second order leveling, and gravity survey. The budget increase shows how the central government has recognized the significance of mapping data in the Philippines.

Table 2-9 Budget 2007

Unit: Thousand Peso

PROGRAMS & ACTIVITIES	PERSONNEL SERVICES	MAINTENANCE & OTHER OPERATING EXPENSES	CAPITAL OUTLAYS	TOTAL
I. General Administration and Support				

a. General Administrative and Support Services	36,337	30,321		66,650
1. General Management & Supervision	19, 430	20,907		40,337
2. General Support Services – Engineering	13,023	7,615		20,638
3. Intelligence and Security Services	3,884	527		4,411
4. Human Resource Development		606		606
5. Gender and Development		666		666
Sub-total, General Administration & Support	36, 337	30,321		66,650
II. Operations				
a. Water, Coastal and Land Surveys	81,444	42,123		123,567
1. Land Resource, geodetic control, plans and geophysical surveys	81,444	42,123		123,567
b. Mapping and Remote Sensing	55,476	491, 675	125,469	672,620
1. Production of maps and remote sensing surveys	55,476	491,675	125,469	672,620
c. Information Management and Statistical Services	20,549	2,948		23,497
1. For data processing, updating including resource information management and statistical services	20,549	2,948		23,497
Sub-total, Operations	157,469	536,746		
TOTAL, PROGRAMS & ACTIVITIES	193,806	567,067	125,469	819,684

Source: Official Gazette—Republic of the Philippines, Republic Act No. 9401 General Appropriations Act Manila, Philippines, March 23, 2007

2-2-3 Mapping Department

(1) Positioning of the Mapping Department

The Mapping Department of NAMRIA is the only national organization responsible for national topographic mapping and national geographic information management. It is positioned as the authority with central functions. The Mapping Department, which is responsible in preparation of the national topographic map series showing land areas, is the key department in NAMRIA in maintaining and updating national topographic data with the CDSD, which takes the part of the ocean topography.

(2) Main functions of each division

The total number of staff in the Mapping Department is 119 (as of June, 2006), and the department consist of four sections (division). The main functions of the Mapping Department are preparation and updating of topographic maps including the national topographic base map in the Philippines, and preparation of the topography database for GIS. The organization structure and main function of each division are as follows.

1) Photogrammetry Division

This division is divided into the following three sections, and 26 staff engage in preparation of plotting of large-scale topographic maps, preparation of ortho-photographs and distortion corrected photographs, DTM, and contour line data for GIS.

- Analytical Photogrammetry
- Photo Map Production
- Stereo Compilation

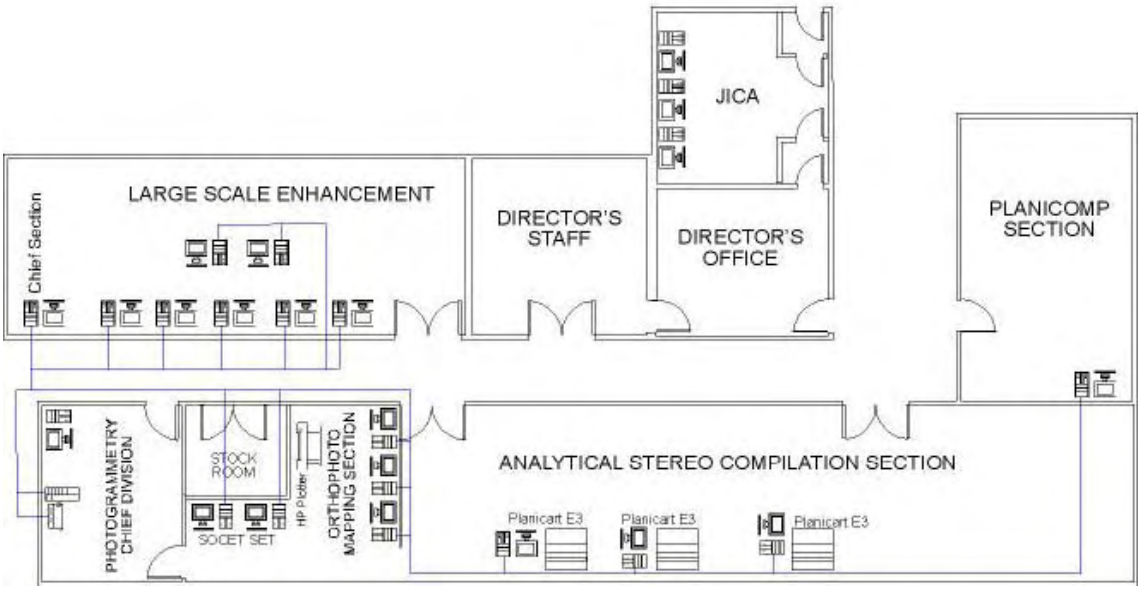
Preparation and updating of topographic maps are the primary role given to this section.

Table 2-10 List of Existing Equipment (Photogrammetry Division)

Photogrammetry Plotters	Number
Digital workstation	3 units
Analogue plotter with computer support system	4 units
Analogical plotter	1 unit
Analogue plotter (only for training use)	4 units
Number of operators (photogrammetrist)	15 units

The large scale enhancement section conducts map symbolization in the large scale enhancement room. A stereo plotter, Planicomp, is place in another room.

Figure 2-2 Network and Layout of Photogrammetry Division



The software used for map symbolization (enhancement) is Adobe Freehand. Different versions of Auto CAD are used. For stereo plotting, SocetSet and SSk-Intergraph are used. Other software is listed in the following table:

Table 2-11 List of Software (Photogrammetry Division)

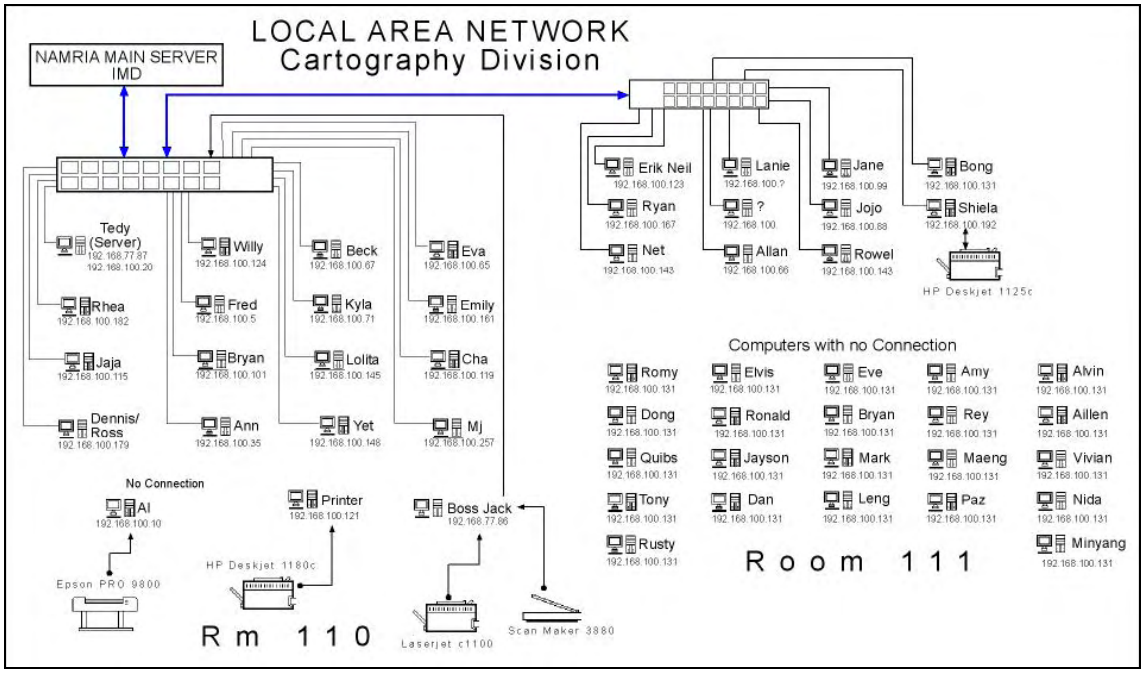
Name of Software	Quantity
SSk-Intergraph	2
SocetSet	3 (one from the JICA Study)
OrthoPro	1
ArchInfo 8.2	1
ArcIMS 4	1
Geomedia 4.0	2
Geomedia Professional 5.1	1
MapInfo 5.5	1
ENVI 3.4	1
AutoCAD 11	5
AutoCAD 13	1
AutoCAD Map 3.0	1
AutoCAD	

2) Cartography Division

The division's main roles are data editing of small to medium scale maps, data editing of thematic maps, and preparation of a database. The division has three sub-sections to share the designated tasks.

- Large Scale Maps: 15 persons
- Medium & Small Scale: 25 persons
- Special Purpose & Thematic Maps: 21 persons

Figure 2-3 Network and Layout of Cartography Division



The software used are similar to the software used in the Photograpmmetry Division. The Cartography Division does not have stereoscopic functionalities of mapping.

Table 2-12 List of Software (Cartography Division)

Software name	Quantity
Macromedia Freehand 8.0	1
Map publisher 5.0	1
AutoCAD Map 3D	10
ER Mapper 7.1	3
Orthowarp 2.2	1
Ortho Master 5.0	1

In the year 2007, five more PCs were added to increase the production capacity of the Cartographic Division.

3) Reprography & Printing Division

It consists of three subsections, "Camera Section", "Reprography Section", and "Press Section." The main tasks are print film preparation and multi-color printing of topographic and thematic maps based on the finished mapping data from the Cartography Division.

4) Aerial & Spatial Survey Division

The office is the Aerial and Spatial Survey Division has merged to the Photogrammetry Division at present. According to the rationalization plan, the Mapping Department will become the Mapping and Geodesy & Geophysics Department. The current staff in the Aerial & Spatial Survey Division is partially form the Geodesy section of the Photogrammetry Division. The basic functions of the Aerial & Spatial

Survey Division will remain in the Photogrammetry Division: planning and outsourcing of aerial-photography , inspection of photography, index preparation of the existing aerial photographs, and reproduction of satellite imagery and aerial photographs.

(3) Projects in 2006 and 2007

The projects for the Mapping Department for the years 2006 and 2007 are summarized in Appendix II Table-1 Mapping Department Projects (2006, 2007).

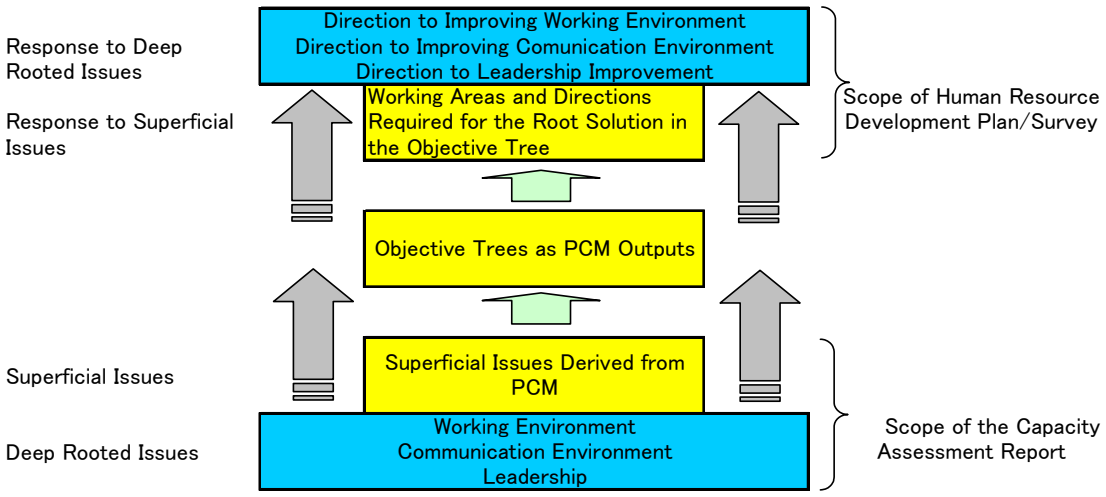
2-2-4 Results of Capacity Assessment

(1) Diagnosis of Corporate Culture

The issues derived from DCC are deeply rooted problems originated in an organization, and they are connected to the superficial problems extracted from PCM as actual phenomena. That is, problems concerning the operating environment, communication environment, and leadership extracted from DCC are presumed to be the origin of the problems which appear tasks of daily work.

Solving the root problem means to solve problems in communication environment, operating environment, and leadership. Solutions to the problems and the process of them have been reflected in the Human Resource Development Program and the Specifications for Topographic Mapping at Scale of 1:50,000 as outputs of the Study.

Figure 2-4 Conceptual Diagram of Relations between DCC and PCM in Capacity Assessment



The agreement, in the Minutes of Meeting on March 8, 2006 was reached to focus the target of human resource to be the Mapping Department; the deep-rooted problems of the five sections of the department are clarified. DCC targeted to five divisions: (1) Office of Director; (2) Photogrammetry; (3) Cartography; (4) Reprography and Printing; and (5) Aerial & Spatial Surveys. The scores are summarized in the following table.

Table 2-13 Detailed Results of DCC in the Mapping Department

STRATEGIC VITALITY

DIVISION	Strategic Thinking	Influence of Management Concepts	Active Reform	Dis-charge of Respon-sibility	Merit Orienta-tion	Improvement Campaigns	Aspira-tions	Definition	Long-Term Outlook	Educa-tion
Office of the Director - Mapping Director	0.18	0.45	0.60	-0.23	-0.16	0.19	0.29	0.37	-0.19	0.10
Photogrammetry	0.28	0.58	0.47	0.54	-0.23	0.23	0.09	0.7	0.03	0.07
Cartography	0.3	0.3	0.36	0.13	-0.16	0.14	0.1	0.52	-0.05	-0.08
Reprography and Printing	0.15	0.45	0.36	0.11	-0.17	0	0.22	0.16	0.01	0.5
Aerial & Spatial Surveys	-0.35	-0.21	-0.39	-0.54	-0.55	-0.51	0.31	0.3	-0.04	0.11
NAMRIA	0.19	0.39	0.26	0.02	-0.12	0.17	0.18	0.44	-0.08	0.12

ORGANIZATIONAL VITALITY

DIVISION	Delegation of Authority	Respect for Dialogue	Appropriate Regulations	Respect for the Individual	Tolerance of Failure
Office of the Director - Mapping Director	-0.16	-0.67	-0.18	-0.08	-0.09
Photogrammetry	0.15	-0.28	-0.08	0.11	0.26
Cartography	-0.11	-0.37	-0.08	0.26	0.41
Reprography and Printing	0.02	0.02	-0.16	0.29	0.09
Aerial & Spatial Surveys	0.21	-0.01	-0.15	0.37	-0.17
NAMRIA	0.03	-0.22	-0.24	0.2	-0.01

Color Classification

Higher than the NAMRIA Average

Lower than the NAMRIA Average

LEADERSHIP

DIVISION	Consideration	Presentation of Goals	Power of Influence	Mentorship	Pressure to Achieve
Office of the Director - Mapping Director	-0.15	0.08	-0.30	0.26	0.05
Photogrammetry	0.18	0.16	-0.18	0.37	0.36
Cartography	-0.15	0.02	-0.41	0.19	0.03
Reprography and Printing	-0.28	-0.32	-0.04	0.08	-0.05
Aerial & Spatial Surveys	-0.65	-0.51	-0.47	-0.08	-0.71
NAMRIA	-0.23	-0.09	-0.15	0.12	0.15

The root problems for each department are summarized below. Further, the links of how those root problems lead to the realization of phenomena are examined and linked to the problem trees extracted by PCM. The extracted problems are the ones whose scores are below the origin of the coordinates (0,0) of the organizational average in the Philippines and the scores 20 percent lower than the average of NAMRIA.

Table 2-14 Results of DCC by Division

	Problems	Measures	Outputs
Office of Director	• The problems extracted are: "merit orientation" on the strategic vitality; "influence" "delegation of authority", "respect for dialogue", "respect for individuals", and "failure tolerance" on the organizational vitality, and "influence" on leadership.	• Leadership in all occasions of improvement. • Clarification of responsible individuals or organizations • Implementation of evaluation • Information disclosure • Others	• Operating division of responsibilities • Capability evaluation manual • Notification on delegation of authority • Others
Photogrammetry Division	• The problems extracted are: "merit orientation" on the strategic vitality; "respect for dialogue" on the organizational vitality; and "influence" on the leadership.	• Clarification of individual roles and operating goals • Introduction of a personal-capability evaluation system • Delegation of authority from the president NAMRIA and the Mapping-Department division manager	• Operating division of responsibilities • Notification on delegation of authority • Others
Cartography Division	• The problems extracted are: "merit orientation" and "education system" on the strategic vitality; "delegation of authorities" and "respect for dialogue" on the organizational vitality. On leadership, there was no apparent problem identified.	• Introduction of capability evaluation system • Review and introduction of education programs • Delegation of authority from the president NAMRIA and the Mapping-Department division manager • Others	• Operating division of responsibilities • Training scheme (to be included in the Human Resource Development Program) • Others
Reprography and Printing Division	• The problems extracted are: "merit orientation" on the strategic vitality; "appropriate regulations" on the organizational vitality; and "consideration", "presentation of goals", "power of influence", and "achievement pressure" on the leadership.	• Implementation of leadership training • Sharing of the existing rule or internal regulations, and documentation as manuals • Introduction of a capability evaluation system	• Operating division of responsibilities • Individual performance evaluation criteria • Various operating manuals • Others
Aerial and Spatial Surveys Division	• All the indices except for "Aspiration", "definition", and "education system" are raised as issue of the strategic vitality, and also all the indices except for "delegation of authority" and "respect for individuals" are extracted as issues of the organizational vitality. All the indices of leadership was raised as issues. There are many issues in this division.	• The fundamental meaning of the organization including its existence needs to be reexamined.	• Reexamination of the role of the division or rationalization.

(2)

(3) Project Cycle Management (PCM)

Although the PCM analysis generally creates the problem tree and solution tree in many cases as the final outputs, our reviews of the past JICA projects could not conclude that PCM has been utilized fully as introductory information to lead to a final conclusion. This study defined a position of PCM itself clearly from the beginning, and utilizes as the main components of organizational development while PCM is positioned as participants' consensus more than in cases in the past. That is, in a very-short-work period of one week, in addition to the work which creates even the conventional problem tree and solution tree, the following additional work was intensively carried. The solution tree was classified into four large problem-solving groups. They are: "human resources issues"; "facility, machines and software issues"; "policy related issues"; and "internal program management."

- The leaders of the applicable departments in each problem group were invited, and sub-committees were set up, programs and action programs required in order to realize "root solution" (the bottom box(es) of the solution tree) were examined.
- In an investigative commission of the subcommittee, program names, priority, contents of programs, responsible organization, schedule, program cost, etc., were discussed and compiled in a report. To the meeting, higher management, a JICA consultant, other experts, etc. who could influence the outcomes of discussions were not allow to participate; leaders on -site took part in the discussion.

Methodology and Forward to Implementation

As stated, PCM was implemented in two steps. The part of the first half is the conventional method, which uses a participatory method to prepare the problem tree and solution tree diagrams.

The second half is the work which decides upon a program and an action plan required for solving root issues shown at the lowest end of the diagram by group after the problem solving tree-diagram is divided into four large issue groups by the participatory discussion method.

Part I had a total of 15 participants, and set the main problem of PCM as "Why NAMRIA does not update 1:50,000 topographic maps?" In addition, Part I also had participation of a JICA consultant, a JICA expert, and the JICA Manila office personnel. The main participating departments are as follows:

Table 2-15 Attributes of PCM Part I Participants

Department	No. of Participants
Coast and Geodetic Surveys Department	1
Engineering Services Department	3
Mapping Department	6
Remote Sensing & Resource Data Analysis Department	4
Information Management Department	1

The issues raised in PCM are summarized in the following table.

Table 2-16 Issues Raised in PCM

Area	Description
(1) Policy related issues	• Preparation, approval and implementation of 1:50,000 topographic mapping
(2) Human Resource Issues	• Introduction of In-house training courses
	• Introduction of overseas training
	• Implementation of researches and developments by engineering and clerical workers
	• Establishment of a charter for engineering clerical workers
	• Tolerance of the personnel who work out of NAMRIA
	• Promotion of scholarship
	• Personnel allocation by introduction of the merit system
	• Rationalization of human resources
	• Presentation of clear career paths
	• Clarification of operations
	• Application of strict penalty on tardiness and absenteeism
	• Efficient recruitment
	• Clarification of accountability
	• Consistency of position and salary class
	• Appropriate application of individual performance appraisal guideline
	• Comprehensive human resource program formulated, implemented and monitored
	• Organizational development of the Human Resource Department for implementation of the human resource development program
	• Enhancement of human resource information system
(3) Facilities, Machines & Software	• Procurement of required software and workstation
	• The purchase of satellite images
(4) Internal Problem Management Issues	• 1:50,000 topographic base mapping program, formulated, approved and implemented as planned
	• Organizational structure more responsive to present and future requirements
	• Staff on policy development and research at the department level assigned
	• Monitoring and evaluation system within the department fully implemented

While Part II classified the problem trees and solution trees created during Part I into four groups, persons to participate in the discussions are selected from sections in charge in NAMRIA. Then, with a small committee type of system, a program or action plan for the initial step was discussed by each group. A total of ten action programs were prepared through the participants' consensus building process.

In addition, during the process of discussions, revising and refining the issue trees and solution trees were encouraged so that it would be certain that the accuracy of both tree diagrams as the revised output was further improved.

During Part II, in order to vitalize the discussions, discussions in Tagalog was conducted, and at the same time, additional participation from the consultant, expert, top management from NAMRIA was encouraged to secure and augment the atmosphere of active discussions.

Table 2-17 Attributes of PCM Part II Participants

	Policy Related Issues	Human Resource Issues	Facilities, Machines, Software	Internal Problem Management Issues
Mapping Department	5	3	4	5
Information Management Department	2	-	1	-
Plans and Operation Division	1	1	1	2
Remote Sensing and Resources Data Analysis Department	3	1	-	-
Development Studies and Standards Office	1	1	1	1
Finance Management Department	-	1	1	-
Administrative Division	-	2	-	-
Engineering Services Division	-	-	1	-
Coast and Geodetic Survey Department	-	-	1	1
Total	12	9	10	9

The PCM report was agreed to be incorporated 100 percent to the main report of the Study on the Human Resource Development Program to be prepared through discussions with the director of the Mapping Department.

Further, the content of the report is to be reflected to the Human Resource Development Program and the Specifications for Topographic Mapping at Scale of 1:50,000, and to be the important components for action planning towards the 1:50,000 nationwide topographic mapping during the study in 2007.

1) Superficial problems extracted from the issue trees and their solutions

These diagrams show the contents of the problem tree acquired as output of a conventional type of PCM, and the solution trees. Both trees created during Part I were corrected during Part II as mentioned. The problem tree and solution tree which were finally corrected are shown at the end of the report. Generally, the box located at the bottom layer of the problem tree is called a root cause. In the case of solution tree, it is the root solution, named by the Study Team. This serves the first step of problem solving, and when solved, the solution tree results in one level higher from the root solution. That is, the root solution can be considered to be the first step or the short-term development target in a comprehensive problem situation.

2) Classification of Problems

The solution tree diagram was classified into four groups. As mentioned, action programs were prepared to initiate the root solution discussions by small committee. Following four groups were created.

(i) Human Resource Issues

Eighteen items of root solution were extracted as follows:

- Introduction of in-house training courses;
- Introduction of overseas training;
- Implementation of researches and developments by engineering and clerical workers;

- Establishment of a charter for engineering clerical workers;
- Permission for the staff to work outside of NAMRIA;
- Promotion of scholarship;
- Personnel allocation by introduction of the merit system;
- Rationalization of human resources;
- Presentation of clear career paths;
- Clarification of operations;
- Application of strict penalty on tardiness and absenteeism;
- Efficient of recruitment;
- Clarification of accountability;
- Consistency of position and salary class;
- Appropriate application of individual performance appraisal guideline;
- Comprehensive human resource program formulated, implemented and monitored; and
- Organizational development of the human resource for implementation of the Human Resource Development Program; and Enhancement of human resource information system.

(ii) Internal Program Management Issues

Four root solution items were extracted:

- 1:50,000 topographic base mapping program, formulated, approved and implemented as planned;
- Organizational structure more responsive to present and future requirements;
- Staff on policy development and research at the department level assigned; and
- Monitoring and evaluation system within the department fully implemented
- Policy Related Issues
- 1:50,000 topographic base mapping program formulated, approved and implemented is the root solution.

(iii) Facilities, Machinery & Software

- As root solution, procurement of software and workstation, and satellite images were raised.

(4) Reflection of DCC and PCM for Human Resource Development

When establishing the technology of the medium-scale mapping of NAMRIA, the training program of a new pertinent art is not prepared in the training center (NGTC) in NAMRIA. As pointed out also by PCM, "there is no effective human resource development program system," there is a weak side of human resource development. This may be because the budget for human resource development is not secured until now so that a strategic programming on human resource development was not possible.

Therefore, in present NAMRIA, it would be necessary to nourish the staff who are self-motivated on continuous training by themselves for establishing the technical organization as securing the budget for human resource development and vitalizing organizations through two training programs of in-house training and overseas studies.

In this Human Resource Development Program, with the factors discussed, the following four themes lacking in technology and human resource development strategies shall be considered to develop training programs suited to NAMRIA and to aim for strategic human resource development including vitalization of organization.

- Insufficient technical knowledge on data processing of satellite and aerial imageries for 1:50,000 topographic map creation
- Efficient recruitment
- Knowledge management systems established
- Incentive package developed and implemented

1) Directions from the results of the diagnosis of corporate culture (DCC)

For continuous human resource development, vitalization of an organization is an important factor. According to the diagnosis of corporate culture (DCC) performed for the whole NAMRIA, the present condition that the strategy degree of activity in the whole NAMRIA was positioned low, and it was found that the degree of activity of the Mapping Department was low compared with other departments on "active reform" and "improvement campaign." That is, what was given is carried out as a responsive individual, but it was pointed out as the corporate culture of the Mapping Department that willingness to acquire new technology or willingness or positive attitude toward improving weakness of old technology is lacking.

Moreover, about the leadership of the management within the Mapping Department, on the goal setting and influence, it was low. The leaders are regarded as "sensitive good person." From subordinates, "unreliable boss" was the tendency. The results show that the direction of the organization is not clear; the leadership is weak.

From the results of the analysis, the possible directions to pursue for effective training in the Mapping Department in NAMRIA are as follows:

- On skills necessary for a project, under a strong leadership, establishment of: career paths for vitalizing the organization through setting specific goals and for raising capabilities as mapping experts; and a training system which enables a technology-learning organization consists of the motivated staff on learning new technologies.
- Through continuing training, sharing minds on required knowledge among many staff without depending on project boundaries shall be promoted. At the same time, as environment of promoting workplace communication through exchanging opinions shall be cherished, and environment of achieving higher HRD's results as individual and as organization shall be established.

2) Directions Set through the Pilot Project (i.e. the questionnaire)

In the Human Resource Development Program, the Pilot Project carried out in this project is first positioned as OJT that triggers human resource development. Therefore, what is important is to find necessity and directions of human resource development based on what was experienced by the counterpart, what kind of training was conducted, and what is expected in the future. Analysis of Questionnaire Results: (summary)

> It cannot be said that there is no problem on the management as a case of going to the field without notifying the meaning of this Pilot Project recognized.

There needs to be an atmosphere of promoting communication among the staff and the management and discussions in the work place for human resource development.

> As the participating staff have experienced a similar study, there is no recognition of learning new technology from the JICA Study Team. The target interest was focused on the new types of equipment brought by the Study Team.

A training program which includes a combination of planning on introducing new equipment and uses of the new equipment shall be taken into considered.

> We basically respect the Japanese experts; however, even in a training session, an authority should have been delegated to have some opportunity to judge things by ourselves.

It is important to design a training program which invokes thinking and problem solving from the side of trainees.

> Many respondents wrote down requests for technical training that raises specialty of each section. In the photogrammetry division, there was no unan-

swered part in the answer sheets; the fact shows high motivation. There is a tendency of requests on technical training of data processing, image analysis software, on plotting software.

The items of training needs to be narrowed down as active discussions by those wished in the work places are promoted.

2-2-5 Organizational Issues by Department

(1) Mapping Department

- Although given tasks of one's own can be executed with responsibility, low degree of consciousness on learning new technologies or willingness of improving weakness of old technologies.
- There are some recognizable situations where capable individuals who are confident on their skills and understand purposes and methods of applying them for their work are buried in an organization or less capable individuals receive favorable treatment without a cause.

Although the training system exists, it is not stable. However, there is a training system which learns the technology of photographic analysis focusing on photometgraphy and cartography for six months at University of the Philippines. Moreover, there is a system which compensates one year's salary in case the employee takes an entrance examination by himself for higher education. The most of overseas trainings are financed by ODA and as of December, 2006 two persons are being dispatched to long-term training (ten months) under JICA.

1) Office of Director

Judging from the characteristic of division, it is unavoidable that neither authority not being transferred nor an argument of an individual is respected. However, consolidation of operation manuals to define staff's responsibilities and re-consolidation of performance valuation basis in order to minimize an individual unfair feeling will be necessary. Moreover, it is considered that the decision of the further authority transfer to the manager class from the NAMRIA top executives is needed to strengthen leader influence, while carrying out leadership training of the management class personnel.

2) Photogrammetry Division

According to the section chief interview, it was pointed out that the request for decision for obtaining the determination approval of top management people takes great time. The delegation of power to subordinate is carried out each time, and the system which demands the responsibility is also established inside.

Furthermore, the issue on the trained engineers flow into overseas was also mentioned. Some staff mentioned that there is no promotion for five years, and they lost working motivation. Although it is difficult to stop skillful engineers' flying abroad from the viewpoint of benefit provided, it is necessary to improve the structure of training new skilful people by fixing technical specification and training manual. The OJT of this division usually uses the Geomatic Center of NAMRIA and carries out OJT for about six months after basic study, such as theory of GPS operation and application, and photograph decipherment training. The division chief is expecting all engineers to master basic study at least (especially basic theory of photogrammetry, and identification of a stereo picture).

3) Cartography Division

There is no special training program in this division and only the introductory training by software provider is provided at the time of purchasing necessary software. As for up-

grading of skill and knowledge for the engineers, the division in collaboration with PSB (Promotion Selection Board) is selecting appropriate engineer who were referred by the Performance Report submitted every six months, through an oral examination. Then, the contents of training and training period have to be determined.

It is supposed that the division wants to cope with the needs of GIS from various government agencies. Such training needs head for the needs of the age, such as image-processing technology of the satellite imagery and production technology of edited geographical data utilizable for GIS.

4) Reprography & Printing Division

The authority regarding decision-making for practical work and management on work process is delegated to the chief of each section. On training, OJT is major initiative and there is no original program peculiar to the organization. This division chief recognizes that the technical training by the specialist from the external organs and civilian agencies are required for the betterment of product quality.

5) Aerial & Spatial Survey Division

Since the division has been the target of rationalization of NAMRIA, there exists the high level of possibility that the division will be broken up and the staff will be reorganized in the future. The result of the capacity assessment by JICA Study Team also entails the necessity of reorganization, because the vitality of division is quite low.

For activation of the organization, it is necessary to examine the state of the organization including the raison d'etre. The review of demarcation or rationalization in the organizational reform should be considered as whole N*AMRIA. The division was dissolved in the beginning of 2007.*

(2) Coast and Geodetic Services Department

The Department has the problem in human resource development as follows;

Lack of ship maintenance technology

As the problem of human resources development, there is especially no ship maintenance technology and it is enumerated that they can do nothing but consigning the majority of ship repair externally. Especially, the maintenance of platform such as the adjustment of the engine etc. cannot be done. Moreover, there are a lot of cases where the staff who trained in foreign countries retires.

Human resource outflow

The organization requests the staff who got a chance to be trained abroad to conclude the contract prohibiting retiring for two years after such training (although it is legally groundless). However, the tendency to change one's job to the place with higher salary is more common for the one who obtain a high technology by such training. This is because of not being given adequate evaluation and the reward that corresponds to one's capability.

External training is limited

Although the human resource development is usually carried out based on OJT, obtaining the training regardless the domestic or overseas conducted under ODA is one of incentives for NAMRIA employee. It is hardly to say that the budget for training of the Department is enough, because it is provided about 30,000 pesos a year which is equivalent to be able to offer the chance of one day training outside the office for 20 people a year.

The main field of the executed training is hydrography, map production, and processing method of oceanographic data and training is executed internally as well because the budget is insufficient. Four to five staff from this Department have sent to one-year overseas training in FY2006. The selection criteria of such trainee are the seniority for executive class and the result of performance evaluation for engineer class, respectively.

(3) Remote Sensing & Resource Data Analysis Department

Both Land Resource Division and Land Classification Division are something of melting pot of new and old staff. According to the result of DCC, it is shown that the vitality of the former is higher than that of the latter, and three reasons to explain this are pointed out as follows:

- As for Land Resource Division, the staff of old and new are unevenly distributed to each section, and the atmosphere generating misunderstanding and dissension as the friction between units is formed.
- As for Land Resource Division, there are a lot of contact with outside and inside the organization because of a lot of deliveries of information to Geographical Information System Application Division. Therefore, it is in the environment where envy arises easily because there coexists the people who stand out and the people not so.
- Though more elderly staff are there compared with Land Resource Division, the constructive ideas to attempt unionizing of both opinions are spearheaded in Land Classification Division because old and new are properly mingled in the unit.

The necessary budget for personnel training is decided by position of the trainee who is assigned. As for the training overseas, the offer is generally come to NAMRIA Secretary firstly, and it is introduced to each director through the personnel division. JICA, FAO, and ITTO, etc. are major sponsors in overseas training in this department.

(4) Engineering Service Department

The followings are thought as a background of low Strategic Vitality for this department. These are extracted based on the interview to Computer Engineering Division and Facilities Maintenance & Repair Division.

The think-tank function to settle national policy and the survey standard exists simultaneously with the department which manages the property, so that the mission as the department is unclear.

Majority of divisions take charge of maintenance of facilities, but their activities are sought only when they are requested by the section in charge. In exception that the Instrumentation & Communication Division maintains survey equipment and expensive telecommunication equipment regularly every month, the maintenance work of the other division is conducted on-demand base. It is thought that such a passive work style has decreased the vitality of the organization.

The budget is not admitted at all in Instrumentation & Communication Division though there are training needs for logic control, operation of survey equipments, and survey tools.

As for the procurement request of survey equipment and PC from each department, the decision is finally made by the NAMRIA administrator. The approved request is turned to the tender conservancy (called Bidding & Award Committee: the director Mapping Department is chairman) and the tender for procurement is carried out. In this process, little discussion whether the newly purchased goods are fit from the viewpoint of maintenance is made and thus, the opinion from Engineering Service Department is hardly being incorporated.

It is difficult to introduce performance evaluation system for individual because there is no substantial routine work. Since it is difficult to find out the necessity to stay still in the office, the staff are not always around and they are killing time. The low degree of "Tolerance of Failure" shows that the business rule is lax and the management is insufficient.

Allowing for the above mentioned situation, there might be an idea assumed that it is better not to exert leadership (lax control is better) because more repulsion from the staff appears as the leadership is strongly pushed out. However, the leadership in Engineering Service Department is worst level in NAMRIA at present by all of the four indexes of DCC: "Consideration", "Presentation of Goals", "Power of Influence", and "Pressure to Achievement" except "Mentorship".

(5) Staff Services Department

The procuring and maintaining of property are undertaken under different jurisdiction to exclude following possibilities; viz. i) possibility that the procurement of property is done not considering maintenance aspect, ii) possibility doesn't consider the side of management and the possibility that the inventory of procured property are not shared, and iii) possibility that the efficiency of the business are ruined etc. While there is a movement to strengthen the function of Property/Supply Unit in NAMRIA, it seems to be more important to provide a unified function of procurement and management for the section in question.

As for the Human Affairs & Human Resource Development unit, it is necessary to strengthen the function for strategic human resource development, because at present, the unit only does filing job. The head of unit is conceiving the weakness and the necessity for further strengthening the function. It is recognized that the weakness of function is also ruining performance management at present.

The department is intending to introduce 'Office Performance Evaluation System (OPES)' from July 2007 in replacement to ruined performance evaluation system at present. The OPES aims to evaluate firstly the performance of belonging organization but not individual through numerated indicator, and then synchronize to individual performance evaluation to obtain finally the relative evaluation. The OPES is trial approach and as of November 2006, they were discussing about indicators used for the evaluation.

The empirical facts say that identifying evaluation index and securing the fairness of selected indicators between other department/division are obviously difficult and it seems that the realization of this new system needs more time. In addition, since the ruining of performance evaluation basically falls into a lot of operational problems, the first thing to do is thought to persist to the rules of evaluation and to foster the organizational climate accordingly.

The department shows the highest Strategic Vitality in entire NAMRIA according to the Diagnosis of Corporate Culture (DCC) conducted in the Study. The DCC results indicate that the Department has vitality and an initiative to lead other departments of NAMRIA. Especially, indexes on “Influence of Management Concept", "Discharge of Responsibility", "Improvement Activity" are high by the following reasons, presumably.

- The distance with the center of political power of NAMRIA is shorter than other departments.
- The job flow is definitive compared with engineering sections and there is little case that the employee is asked to do the job from which deviating job flow.
- Naturally, the Strategic Vitality such as 'Strategic Thinking' and 'Definition' is tend to be high since their job style is characterized as the repeat of routine work continuously.

The following are enumerated as the problem of the department.

The reason why Strategic Vitality is high is that the content of work is standardized and continuous, but not because “Merit Orientation” and "Education" are penetrated. In addition, the department does not always plan/implement constructive plan, and the job flow is rather rooting in the peace-at-any-price principle.

As mentioned above, the function of Human Affairs & Human Resource Development is limited so that powers of proposal and execution ability on promotion of human resource are weak. Further, the capacities on planning and proposing of the observance of the standard as well as on implementing performance rating at integrated level are insufficient.

Because the job is standardized, there is a case where the difference of performance between individuals appears obviously. This generates employee's unfair feeling toward the volume of work given. Likewise, the training to raise the skill level is insufficient.

(6) Information Management Department (IMD)

1) Information Services Division

Although the original role of Archives Section is to unify products/information of NAMRIA and to manage them after archiving, the activity for unification of such products/information is not implemented thoroughly. Accordingly, these materials are still scattered in the produced organizations and in reality, there are only few archives which are handled by the section.

As for Data Services Section, they are offering training to the trainees in- and outside of NAMRIA. For this purpose, they are managing trainings executed in the Geomatics Training Center (GTC) - a training facility owned by NAMRIA. In fact, the training executed in 2006 is tabled as follows. Since the training accepts the participant from the outside with charge, this section is a sole earning section. It is considered that GTC has an important function to maintain staff's vitality though it has not passed long time since the GTC starts to be managed by this section.

The NAMRIA top management are not so much interested in marketing of maps, therefore the support for map sales is not so eager. It is thought that rather low vitality of entire section generally attributes to such job environment.

2) Media Production Division

This division is composed of three sections of Publication, Audiovisual, and Media Relation in the lineup of 13 staff. The Audiovisual section is further divided into two units of Photo Documentation (three staff) and Exhibit (two staff). Other eight staff called Writer in charge of document making are serving both sections of Publication and Media Relation concurrently with high degree of freedom (though the name is tentatively put on the organization chart).

The work contents of the division is summarized as follows:

- Broadcast manufactured contents by each department of NAMRIA through mass media
- Process above manufactured contents and package them for sale (They are calling this operation as Information Packaging)
- Execute the information campaign together with Information Service Section
- Manage above packaged information as database and program
- Research on public relations and advocacy, etc.

The vitality of this division is high. The following reasons are thought for this.

There are many chances of communication with the outside such as mass medias and publishers and receive a lot of stimulation.

There are a lot of chances to take training. This is due to the recognition of the department that there are a lot of contacts with the outside so that it is necessary to promote the skills of staff.

Because comparatively a lot of support (help from the project) turned on to the division, the division is economically rich and the equipment and materials installed are also advanced.

The expertise of staff is high and degree of freedom is also secured.

3) Database Management Division & System Development and Programming Division･

These are the divisions that only belongs to the area of Vibrant in NAMRIA. The work executed in tandem is abundant, and the communications between divisions are active. Moreover, the leadership of both is high, and both division chiefs are trusted from subordinates.

The organizational issues related to the Study can be summarized as keeping and improving technical capabilities as a specialized organization of mapping and surveying, improvement of quality control system, systemization of human resources development and integration of various systems developed by the Information Management Department. The measures to deal with these four organizational issues were discussed in Section 4-4-5 Research and Development Section (keeping and improving technical capabilities as a specialized organization of mapping and surveying), 4-4-3 Quality Control Section (improvement of quality control system), 4-4-4 Human Resource Management Section (systemization of human resources development) and 4-4-6 Tools for Efficient Administration (integration of various systems developed by the Information Management Department). In addition, measures for organizational development of Mapping Department were formulated in Section 4-4 Organizational Development Plan. For organizational development of Mapping Department, this plan proposes establishment of Quality Control and Data Management Section, Human Resource Management Section, Research and Development Section, and also proposes utilization of tools for efficient administration.

2-3 Human Resources

2-3-1 Education and Years in Service

The Study Team conducted a rapid survey on human resources in August, 2007. A questionnaire survey was conducted to all the staff in the Mapping Department, Information Management Department, and Remote Sensing. The attributes of the human resource data are: name, position, date of assignment, educational attainment, and training received.

(1) Educational Attainment

About 73 % of the four departments—Information Management, Mapping, Remote Sensing, and Support Services—are four-year-degree holders. In the Mapping Department, there are more vocationally trained operators especially in the Printing and Repository Division. In the Remote Sensing Department, almost all staffs have four-year-college degrees. Overall the level of education is considered to be high.

Table 2-18 Educational Attainment

	Information Management	Mapping	Remote Sensing	Support Services Department	Total
Vocational	4	35	1	0	40
Associate	0	3	1	1	5
Bachelor of Business Administration	0	1	0	0	1
Bachelor of Education	0	1	0	0	1
Bachelor of Science	59	78	91	31	259
Bachelor in Business Management	1	0	0	0	1

Bachelor of Arts	10	0	1	0	11
Bachelor of Statistics	1	0	0	0	1
Computer Science	0	1	0	0	1
D.D.M*	0	0	0	1	1
Education , Bachelor of Arts major	1	0	0	0	1
Electrical Technology	0	1	0	0	1
Gen Auto Mechanic	0	0	0	1	1
High School Graduate	0	5	0	2	7
Vocational	2	6	1	13	22
Total	78	131	95	49	353

Source JICA Study Team 2007
Note: There are no responses in questionnaire; therefore, the totals may not add up to the total number of the staff.
* Doctor of Dental Medicine

As far as the majors of study are concerned, majority of them have earned civil engineering degree. In the Remote Sensing Department, 46 persons hold the forestry degree out of 95. "Major not specified" did not answer the majors of study; those persons generally hold the vocational or associate degrees. There are fifteen persons who hold dual degrees.

Table 2-19 Majors by Department

	Department				Total
	Information Management	Mapping	Remote Sensing	Support Services Department	
Major Not specified	2	43	1	9	55
Accountancy	0	0	0	1	1
Aeronautical Engineering	2	1	1	1	5
Agricultural Engineering	1	1	1	0	3
Agriculture	1	0	1	0	2
Aircraft Maintenance Engineering	1	0	0	0	1
Architecture	1	7	0	0	8
Architecture& Fine Arts	0	1	0	0	1
Arts	0	1	0	0	1
Automotive Mechanics	0	0	0	1	1
Automotive Technology	0	0	0	1	1
Business Administration	2	2	3	0	7
iBusiness Management	1	0	0	0	1
Chemical Engineering	2	0	1	1	4
Civil Engineering	2	25	21	6	54
Commerce	17	11	0	2	30
Computer Data Processing	2	0	0	0	2
Computer Engineering	0	0	0	2	2
Computer Programming	0	1	0	0	1
Computer Science	4	2	2	0	8
Computer Technician	0	0	0	1	1
Computer Technology	0	0	0	1	1
Criminology	0	1	0	0	1
Development Communication	1	0	0	0	1
Drafting	0	1	0	0	1

	Department				Total
	Information Management	Mapping	Remote Sensing	Support Services Department	
Drafting Technology	0	1	0	0	1
Economics	3	1	0	0	4
Education	0	0	0	2	2
Education Major in Library Science	1	0	0	0	1
Electrical Engineering	3	5	1	8	17
Electrical Engineering Technology	1	0	0	0	1
Electronic Data Processing	1	0	0	0	1
Electronics & Communication Engineering	0	2	0	0	2
Electronics and Computer Engineer	0	0	0	1	1
Electronics and Computer Engineering	0	0	0	4	4
Electronics Services	0	0	0	1	1
English	1	0	0	0	1
Fine Arts	0	1	0	0	1
Forestry	1	1	46	0	48
General drafting	0	0	1	0	1
General Drafting	0	1	0	0	1
General Radio Communication Operator	0	0	0	1	1
Geodetic Engineering	2	8	11	1	22
Geology	0	0	2	0	2
Human Ecology	1	0	0	0	1
Industrial Engineering	1	0	0	0	1
Information and Computer Science	1	0	0	0	1
Liberal Arts	1	0	0	0	1
Management	1	0	0	1	2
Marine	0	1	0	0	1
Marine Engineering	0	2	0	0	2
Mass Communication	2	0	0	0	2
Mathematics	2	2	0	0	4
Mechanical Engineering	0	5	2	2	9
Medical Secretatrial Cource	1	1	0	0	2
Medical Technology	0	1	1	0	2
Nursing	1	0	0	0	1
Nursing Aid	0	0	0	1	1
Philosophy	3	0	0	0	3
Political Science	1	0	0	0	1
Practical Electricity	0	1	0	0	1
Psychology	1	0	0	0	1
Secretarial administration	1	0	0	1	2
Secretarial Administration	1	0	0	0	1
Statistics	3	0	0	0	3
Statistics & Liberal Arts	1	0	0	0	1
Technical Drafting	0	1	0	0	1

	Department				Total
	Information Management	Mapping	Remote Sensing	Support Services Department	
Technical Writing	1	0	0	0	1
Tourism	1	0	0	0	1
Vocational	1	0	0	0	1
Zoology	1	0	0	0	1
Total	78	131	95	49	353

Source JICA Study Team 2007
Note: There are no responses in questionnaire; therefore, the totals may not add up to the total number of the staff.

Eleven persons have received post graduate degrees in the Mapping Department. The degree earned are technical and administrative. Some have earned degrees on photogrammetry and geoinformatics that are directly linked technological advancement. Others earned business degrees that would help to manage their staff.

Table 2-20 Post Graduate Education (Mapping Department)

Graduate Degree	Major	No
Diploma in Geoinformatics	Geoinformatics	1
Master in Public Administration		4
Master of Business Administration		2
Master of Photogrammetry		1
Master of Public Administration		1
Master of Science	Civil Engineering	1
	Environmental & Sanitary Engineering	2
	Geodetic Engineering	1
	Management	1
	Mathematics	1
	Remote Sensing	4
	Remote Sensing (Thesis on-going) Course A	1
Total		11

Source JICA Study Team 2007
Note: There are no responses in questionnaire; therefore, the totals may not add up to the total number of the staff.

(2) Years in Service

In the Mapping Department the range of years in service was from two to thirty-eight years. The mean was 15.61; the value is slightly higher than the other departments. What is to be noted is that in the Reprography & Printing Division, the least value was eighteen years. The Cartography Division and the Photogrammetry Division have relatively even distribution.

Table 2-21 Years in Service, Mapping Department (Summary)

	Number	Minimum	Maximum	Mean
Years in Service	131	2	38	15.61

Source: JICA Study Team 2007
Note: There are no responses in questionnaire; therefore, the totals may not add up to the total number of the staff.

Table 2-22 Years in Service (Mapping Department)

Years	Frequency	Percent
0-5	69	19.5
6-10	67	19.0
11-15	30	8.5
16-20	97	27.5
21-25	55	15.6
26-30	23	6.5
31-35	9	2.5
36-	3	0.8
Total	353	100.0

Source JICA Study Team 2007
Note: There are no responses in questionnaire; therefore, the totals may not add up to the total number of the staff.

(3) Training Received

Most staff have received some in-house training in some way though the training is not systematically organized. GPS, GIS and remote sensing are the some of the key words recognized in the results of the questionnaire. Frequencies, duration, or certificates were not identified; therefore, the effectiveness of the training received could not be evaluated based on the results of the questionnaire survey.

2-3-2 Administration

(1) Recruitment and promotion

When there is a vacancy, the Personnel Management Services posts the List of Vacant Positions. Recent vacancies are submitted to the Civil Service Commission.

For an original appointment following documents are required:

- Updated personal data sheets
- Service record from previous employer
- Certified xerox copies of relevant training certificates
- Original and xerox copies of eligibility/Board Rating
- Original and xerox copies of diploma and transcript of records
- Medical and NBI Certificates including drug test
- Two copies each of 1 x 1 and 2 x 2 pictures

Other documents that may be required by the Personnel Management Services

- For promotion following data documents are required:
- Update personal data sheet
- Service Record
- Description of actual duties and responsibilities
- Certified xerox copies of relevant training certificates
- Diploma/transcript of records
- Office clearance (in case of transfer)
- Other documents that may be required by Personnel Management Section

All the public employees in the Philippines are required to fill out the Personal Data Sheet which can be downloaded from the web site of the Civil Service Commission. It is the fundamental record which includes skills and training records. Individual Performance Appraisal is conducted every six months.

(2) Positions

NAMRIA's jobs are classified into three: Key Official, Technical; and Administrative. The relations between positions and classifications are shown below:

Table 2-23 Job Level Classification

Position	Classification
Administrator	Key Officials
Deputy Administrator	Key Officials
Director	Key Officials
Assistant Director	Key Officials
Division Chief	Key Officials
Engineer	Technical
Photogrammetrist	Technical
Cartographer	Technical
RS Technician	Technical
Clerical	Administrative

The following tables show personnel structure in the Mapping Department. Because of the rationalization plan yet to be approved; there is a gradual shift of the staff from the Aerial Survey Division to the Photogrammetry Division. According to the positions, the salary grades are defined. One salary grade has eight step (eight subdivision) to determine exact monthly salaries. The lowest salary grade is the salary grade one - step one; the monthly salary is P. 5,590. The highest is the salary grade 33 - Step one; the monthly salary is P. 63,525. Both data are effective as of July 1, 2007.

Table 2-24 Staff in the Photogrammetry Division

Position	Classification	No. of Staff	Salary Grade
Engineer V	Key Official	1	24
Engineer IV	Technical	5	22
Engineer III	Technical	4	19
Engineer II	Technical	5	16
Laboratory Technician II	Technical	4	8
Carto III	Technical	1	11
Carto II	Technical	3	8
Carto I	Technical	2	6

Table 2-25 Staff in the Cartography Division

Position	Classification	No. of Staff	Salary Grade
Engineer V	Key Official	1	24
Engineer IV	Technical	2	22
Engineer III	Technical	6	19
Engineer II	Technical	6	16
Cartographer IV	Technical	3	15
Cartographer III	Technical	9	11
Cartographer II	Technical	30	8
Cartographer I	Technical	12	6
Clerk III	Administrative	1	6

Table 2-26 Staff in the Aerial Survey Division

Position	Classification	No. of Staff	Salary Grade
Seaman 1st Class (Geodetic Engineer Aide I)	Not specified	2	Not specified
Petty Officer 3 (Geodetic Engineer Aide II)	Not specified	2	Not specified
Lt. Junior Grade (Geodetic Engineer)	Not specified	2	Not specified
Lt. Senior Grade (Senior Photogrammetric Engineer)	Not specified	2	Not specified
Engineer V	Technical	1	24
Engineer IV	Technical	2	22
Engineer III	Technical	1	19
Aerial Photo Analyst II	Technical	2	16
Engineer II	Technical	3	16
Clerk III	Administrative	1	6

Table 2-27 Reprography and Printing

Position	Classification	No. of Staff	Salary Grade
Engineer V	Key Official	1	24
Production Planning & Control Officer IV	Technical	1	22
Supervising Pressman	Technical	1	16
Photographer	Technical	2	15
Printing Quality Control Officer II	Technical	1	14
Head Pressman	Technical	2	13
Photographer IV	Technical	1	12
Photographic Color Processor III	Technical	7	11
Photographer III	Technical	7	10
Printing machine Operator III	Technical	4	9
Photo-Lithographic Technician II	Technical	2	8
Photographer II	Technical	2	7
Clerk	Administrative	1	6
Photo-Lithographic Technician I	Technical	5	6
Printing Machine Operator II	Technical	9	6

The NAMRIA's staff are assigned to particular positions. Each position has its responsibility. The structure of the positions may be changed; some of the names of the positions have been changed; however, the old positions names are still used in some cases. (c.f. Appendix II Table-2 Position Description)

Functions of position classification are: salary administration; recruitment; examination; training; and job opportunities.[3] The classification has been administered by the Compensation and Position Classification Bureau of the Department of Budget and Management.

2-3-3 Human Resource Development System

The existing "human-resource-development system" in NAMRIA including the Mapping Department in training system and experiences of training for technical skill acquisition are as follows:

[3] Leveriza, Jose P. Personnel Administration in the Government, Second Edition. (1995) National Book Store. P.69.

(1) The Human-Resource-Development System in NAMRIA as a Whole

At present, a program for strategic human resource development for technical improvement is not fundamentally improved as a whole in NAMRIA.

However, Qualification Standard of CSC (Civil Service Commission) specifies fundamental education programs aiming to raise ethical standards as public servants, service improvement, and professional attitudes. This regulation defines the number of training periods according to position and rank. A duty of training of four hours is shortest imposed for Engineer I.

For the technical specialized education, NGTC (NAMRIA Geomatic Training Center) is organized in NAMRIA. In this training center short-term trainings are offered on GIS, CAD GPS, digital topographic mapping, Remote Sensing and others required for the work. The records on training in the fiscal 2005 in NGTC are as follows.

Table 2-28 Training Program and Number (2005) of Participants

Year	2003	2004	2005	Total
Introduction to GIS	7	8	7	22
Advanced GIS	3	3	2	8
GPS		3	4	7
GIS for Executives		1		
HTML programming		1		
Structured System Analysis		1		
Map Digitization using AutoCAD	1			1
Total	11	17	13	41

Although most of the trainees of the short-term training are the government staff including those of NAMRIA, about 5 percent of the total trainees are from private institutions. From NAMRIA, about six to ten staff have mainly participated in the programs such as Introduction to GIS, Applied GIS, and Practical GPS.

The actual condition is that only one map digitization course using AutoCAD was conducted in 2003 in the past several years; no training on the latest technology was conducted for the medium-scale-base-map preparation.

The training center does not function fully on the digital topographic mapping at the scale of 1:50,000 in a context of human resource development in NAMRIA.

One in five years, in general, one of the staff is sent to ITC (International Institute For Geoinformation and Earth Observation) to be trained as managerial level engineers for acquiring special technologies along with the in-house training. A studying-at-a-university-in-its-own-country program is established for deepening professional know-how in the Philippines University.

(2) Training History of the Mapping Department, and Institutional Situations

Each division within the Department has different ways of thinking and contents to be introduced toward training.

In the photogrammetry division, the central part of the training is the basic theory of plotting in topographic mapping. Especially, the basic theory of photogrammetry Improvement and orientation of stereo image etc. are the targets for technical improvement. The selected personnel are sent to the stated NGTC for the following three topics of training:

- GPS operation
- Theory and application of GIS
- Fundamentals of photographic-interpretation techniques.

It is taking out to short-term training for the technique of three. Other than this training, a six-month OJT for technical training is the foundation of human resource development at present. Standardization of the basic theory of a photogrammetry and a stereo image etc. is targeted especially. In the Cartography Division, there is a training system to select trainees after interviewing and to decide contents and period of training to raise technical levels of staff under the Promotion Selection Board. In the interview for the trainee selection, the Performance Report, which is a record on the routine work by the staff in the department, submitted every six months is referred. The engineer nominated for this training can receive professional education on GIS and geodetic theory in the Philippine University for a year.

In addition, for other general staff, there is an opportunity to receive an introductory training by a software vendor upon purchasing new software for their work. Further, at present, other than these two divisions (Reprography & Printing Division and Aerial & Spatial Survey Division), neither training program nor human resource development program is established. It seems that accumulated experience on each technological area through OJT is the common practice of training, other than the NAMRIA-short-term-training program.

2-3-4 Monitoring and Evaluation Process

The Civil Service Commission has issued a new form of the Personal Data Sheet in 2005. The data sheet is the basic data for the civil servants in the Philippines. The data includes: personal information; family background; educational attainment; civil service attainment; work experiences; voluntary work or involvement in civic/ non-government/people/voluntary organizations; training programs/study/scholar- ship grants; and other information.

The Revised Rating Sheet for Selection/Promotion is the form to be used for promotion. The criteria includes: performance; work experience; education and training; potentials; physical characteristics & personality traits; service reputation; and special awards/office recognition.

The individual appraisal is conducted semi-annually. The NAMRIA Performance Appraisal Form is used to evaluate staff performance. The form is filled out by oneself. Then a supervisor and a peer rate the functional and actual duties. The targets of functions and duties are set by individuals. The appraisal system is used for promotion.

Since the rationalization plan has not put into practice, there has not been any promotion since the plan was submitted for two years. The individual appraisal system of NAMRIA has not been functioning as it was planned because: the objective criteria have been lacking for appraisal; target setting guideline is vague, leading to relatively low targets to be achieved; supervisors and peers tend to rate the same for different staff.

2-3-5 Issues of Human Resources

(1) Technical Capacity

The Study Team members have identified technical issues during the Pilot Projects. The Section 3-6-1 summarizes the technical issues and 3-6-2 explains technical issues by mapping methods. Overall, technical capacities are lower in Level C category-Cartographer III, II, and I. In the human resource development plan, Level C shall have more resources allocated than other categories.

(2) Assignment of Master Degree Holders to Potential Instructors

The education attainment data shows that eleven individual have masters' degrees or in the process of receiving masters' degrees. The highly educated individuals have not been assigned nor trained as instructors.

(3) Retraining of Senior Operators

As the result of years-in service identified, the average years-in service is about sixteen years. Lack of training is more problematic in younger staff with education in digital technologies. Challenges are how to empower those staff in digital technologies and how they could provide their experiences in quality control and in project management.

2-4 Data and Information in NAMRIA

2-4-1 Maps and GIS Data in NAMRIA

The most comprehensive topographic map coverage of the whole Philippines is the 1:50,000 NAMRIA map series consisting of 993 map sheets and its derived 1:250,000 map series consisting of 66 map sheets. The 1:50,000 scale topographic map series was originally compiled by the US Army Map Service soon after the end of World War II using aerial photographs taken in 1947-1953. Subsequently, some areas of Luzon were updated in planimetric features only using 1976-1979 aerial photographs. In 1988, NAMRIA started to revise and reformat the old Series 711 and 70l to be known as the Philippines National Topographic Map Series (PNMTS) comprising 653 map sheets and have so far completed 103 map sheets (16% of the country's area) covering selected areas of the country.

Evidently, the old 1:50,000 map series is outdated ranging from 50 years countrywide to 20 years for northern and central Luzon. The 20-meter contours depicted in the map series have largely remained unchanged since its original compilation 50 years ago. It had been observed that the accuracy of the contours is not homogeneous throughout the map series. The contours along the coastlines and major roads where the ground controls were located are relatively good while those in the interior parts and mountainous areas are not reliable. This could be expected as aerial triangulation techniques 50 years ago were not as well developed as they are today.

(1) Basic Maps in NAMRIA

All the basic maps of the Philippines are kept in NAMRIA. They are the standard data with the correct geographic coordinates that can be referred to by other map or GIS data generators. All the other maps and GIS data generated by other sectors referred to the coordinates system of the basic maps.

1) Topographic maps of 1:250,000 scale

The Philippine topographic maps at 1:250,000 scale were produced in 1954 with information from the Philippine Coast and Geodetic Survey; the US Army Map Service, Corps of Engineers, the US Coast and Geodetic Survey, the Bureau of Public Highways, and other agencies. Elevation is expressed in a 100-m contour line interval.

Scale:	1:250,000
Size:	73 cm x 59 cm
Coverage:	Philippines
Number of Sheets:	55

These maps are fundamental tools for planning, researches and studies.

These are used as base maps and form an essential part in the preparation of other kinds of thematic maps. They are also the graphic representations of the earth's natural and man-made features. The shape and elevation of the terrain are portrayed in them.

The map index of 1:250,000 scale topographic maps is shown in Appendix II Figure-1.

2) Topographic Maps of 1:50,000 Scale

There are three series of 1:50,000 topographic maps: 701; 711 and PNTMS.

(i) Series 711

The Philippine topographic map at scale 1:50,000 were originally published by the US Army Service and compiled from aerial photographs taken in 1997-1953, with information from Bureau of Coast and Geodetic Survey (BCGS), the US Army Map Service and the Department of Public Works and Highways (DPWH).

Five different map series were prepared corresponding to the five island groups, namely- Luzon, Visayas, Mindanao, Palawan and the Sulu Archipelago.

Universal Transverse Mercator and the Clarke Spheroid 1866 Luzon Datum were used in map projection. The maps were printed in 10' x 15' map interval.

Scale: 1:50,000

Size: 73 cm x 59 cm

Coverage: Philippines

Number of Sheets: 842

The map index of 1:50,000 topographic maps for series 711 is shown in Appendix II Figure-2.

Note: Elevation is expressed in 20-meter contour line interval

(ii) Series 701

Series 701 of NAMRIA covers only the Luzon Island replacing Series 711 maps.

Topographic map Series 701 was produced using the 1976-1979 aerial photographs.

Scale: 1:50,000

Size: 76 cm x 61 cm

Coverage: Luzon Island

Number of Sheets: 151 (149 in stock)

The map index of 1:50,000 topographic maps for series 701 is shown in Appendix II Figure-3.

(iii) Philippine National Topographic Map Series (PNTMS)

The PNTMS will eventually replace the S711 and S701 topographic maps. It will cover the whole Philippines in 663 sheets. Maps in this series are in 15' x 15' interval. The updating of topographic map scale 1:50,000 started in 1988.

Scale: 1:50,000

Size: 61 cm x 61 cm

Coverage: Philippines (Selected areas)

Number of Sheets: 103

The map index of 1:50,000 topographic maps for series PNTM3 is shown in Appendix II Figure-4.

1:50,000 scale maps are also fundamental tools for planning, researches and studies and utilized by many government organizations. These are used as base maps and form an essential part in the preparation of other kinds of thematic maps. They are also the graphic representations of the earth's natural and man-made features. The shape and elevation of the terrain are portrayed in them.

3) Topographic Maps of 1:10, 000 Scale

Topographic (contour) maps at 1:10,000 scale were produced using 1:32,000 scale aerial photographs taken in 1982. The production of the map is a joint project of the NAMRIA and JICA.

The maps were printed in a five color scheme. Contours are expressed in a two-meter contour line interval. The maps cover an approximate area of 1,500 sq. km., encompassing the whole of Metro Manila and the adjoining provinces.

Scale: 1:10,000

Size: 73 cm x 64 cm (Neat Line: 3' x 3')

Coverage: Metro Manila and Other Vicinity

Number of Sheets: 57

Sources of information include BCGS, the Bureau of Lands, the Bureau of Soils the Metro Manila Commission, the National Economic & Development Authority and Department of Public Works and Highways.

Twenty topographic maps covering Ilocos Norte, La Union, Baguio City, Subic, Legaspi City, Roxas City and Zamboanga City at 110,000 are also available.

The map index of 1:10,000 topographic maps for Manila is shown in Appendix II Figure-5.

4) Topographic Maps of 1: 5,000 Scale

Urban large scale mapping at 1:5,000 scale is the largest-scale topographic map ever produced by NAMRIA. This covers the urban areas of Bacolod City, Iligan City, Metro Iloilo, Metro Cebu and Cagayan De Oro City.

Topographic map of Metro Cebu (Cebu City) was produced in cooperation with the German Agency for Technical Cooperation (GTZ) from aerial photographs in 1988, with information from DPWH, NEDA, The Department of Environment and Natural Resources (DENR), the Local Government's City Engineer's Office and the National Statistics Office.

Scale: 1:5,000

Size: 73 cm x 61 cm

Coverage: Bacolod City, Iligan City, Metro Iloilo, Metro Cebu

Number of Sheets: 35

The map distribution of 1:5,000 topographic maps is shown in Appendix II Figure-6.

5) Metro Manila.A Planimetric, Land Use And Land Condition Maps of 1:10, 000 Scale

Metro Manila maps were printed in cooperation with JICA using the 1:32,000 aerial photographs taken in 1982 and 1:10,000 topographic maps as base map.

The project produces three map themes Planimetric maps, Land Use maps and Land Condition maps.

Planimetric maps are printed in a two-color scheme showing the different earth features without elevation. It covers approximately 1,500 sq. km. of land area.

Land Use maps show existing land use patterns such as commercial, residential, industrial, agricultural, forest, public and government facilities. It covers 823 sq. km. of land area.

Land Condition maps are printed in 12 colors representing the different land form classifications such as mountain, hill, plateau, piedmont land form, terrace, alluvial fan, flood plain and delta, and unstable slope.

Table 2-29 Planimetric, Land Use, and Land Condition Maps

Type of Maps	Planimetric	Land Use	Land Condition
Scale	1:10,000	1:10,000	1:10,000
Size	73 cm x 64 cm	76 cm x 64 cm	76 cm x 64 cm
Coverage	Metro Manila & Vicinity	Metro Manila	Metro Manila
Number of Sheets	57	33	16

The map index of 1:5,000 planimetric, land use and land condition maps is shown in Appendix II Figure-7.

6) Land Use and Forest Maps of 1:100, 000 Scale

Land Use and Forest Type Maps give emphasis on the type of forest such as old growth, mossy, residual, sub marginal, pine and mangrove, usage of land such as brush reproduction, coconut, plantation, grass lands, agriculture, bare/rocky and built up area. Statistics supporting classification is contained in a book called Forest Register. These maps were the results of Wide Area Tropical Forest Resources Survey (FY 1994) which were carved out by Japan Forest Financial Association (JAFTA) These were based on LANDSAT TM data of 1993, selected from the image scenes with least cloud cover. Topographic maps at 1:50,000 scale were used as the base maps.

Scale: 1:100,000

Size: 82 cm x 67.3 cm

Coverage: Luzon and Visayas

Number of Sheets: 108

The list of land use and forest maps of 1:100,000 scale is attached in Appendix II Figure-8.

7) Land Cover Maps of 1:250, 000 Scale

The Land Cover maps were produced using the SPOT satellite imageries taken in 1987-1988. These maps were outputs of the project, "Mapping of the Natural Conditions of the Philippines," which was funded by the World Bank and studied by the Swedish Space Corporation.

Given emphasis in these maps are forests, extensive and intensive land use, and coastal areas in the Philippines covering approximately 300,000 sq. km of land area. Supporting statistics are also available. Topographic maps at 1:250,000 scale were used as the base maps.

Scale: 1:250,000

Size 73 cm x 63 cm

Coverage: Philippines (90%)

Number of Sheets: 43

The list of land cover maps of 1:250,000 scale is attached in Appendix II Figure-9.

8) Administrative Maps

These maps show administrative (regional, provincial or municipal) boundaries with road networks and drainage systems. It is very important for national and local government to grasp updated administrative borders to show the area of responsibilities and duties of each administrative office. As a result of the creation of new administrative entities such as the Cordillera Administrative Region (CAR.), the Autonomous Region of Muslim Mindanao and CARAGA (Region XIII), regional and provincial maps were updated.

Available administrative maps are five national maps, 13 regional maps and 77 provincial maps as follow

Table 2-30 National Maps

Map Sheet No.	Scale	Size
25	13,651,400	49cm x 63cm

Table 2-31 Regional Maps

Scale	Size	Coverage
1:250,000	Varies	Region 1,2,3,5,6,7,8 and CAR
1:250,000	Varies	Region 4 (4 sheets)
1:250,000	Varies	Region 9,10,11 and 12

Table 2-32 Administrative Map

Region	Province	Map Scale	Region	Province	Map Scale
ARMM	Lanao del Sur	1:150,000	NCR	Manila	1:50,000
ARMM	Maguindanao	1:200,000	V	Albay	1:150,000
ARMM	Sulu	1:250,000	V	Camarines Norte	1:150,000
ARMM	Tawi-Tawi	1:250,000	V	Camarines Sur	1:150,000
CAR	Abra	1:150,000	V	Catanduanes	1:50,000
CAR	Apayao	1:150,000	V	Masbate	1:200,000
CAR	Benguet	1:150,000	V	Sorsogon	1:150,000
CAR	Ifugao	1:150,000	VI	Aklan	1:150,000
CAR	Kalinga	1:150,000	VI	Antique	1:200 000
CAR	Mt. Province	1:150,000	VI	Capiz	1:150,000
I	Ilocos Norte	1;150,000	VI	Guimaras	1:50,000
I	Ilocos Sur	1:200,000	VI	Iloilo	1:200,00
I	La Union 1.	1:50,000	VI	Negros Occidental	1:250,000
I	Pangasinan	1:200,000	VII	Bohol	1:150,000
II	Batanes	1:150,000	VII	Cebu	1:250,000
II	Cagayan	1:250,000	VII	Negros Oriental	1:250,000
II	Isabela	1:200,000	VII	Siquijor	1:50,000
II	Nueva Vizcaya	1:150,000	VIII	Biliran	1:50,000
II	Quirino	1:150,000	VIII	Eastern Samar	1:250,000
III	Bataan	1:150,000	VIII	Leyte	1:250,000
III	Bulacan	1:150,000	VIII	Northern Samar	1:200,000
III	Nueva Ecija	1:150,000	VIII	Samar	1:200,000
III	Pampanga	1:75,000	VIII	Southern Leyte	1:100,000
III	Tarlac	1:100,000	X	Bukidnon	1:200,000
III	Zambales	1:150,000	X	Camiguin	1:150,000
IV	Aurora	1:200,000	X	Misamis Occidental	1:150,000
IV	Batangas	1:150,000	X	Misamis Oriental	1:150,000
IV	Cavite	1:50,000	X	Surigao del Norte	1:150,000
IV	Laguna	1:150,000	XI	Cotabato S	1:150,000
IV	Marinduque	1:50,000	XI	Davao del Norte	1:150,000
IV	Occidental Mindoro	1:250,000	XI	Davao del Sur	1:150,000
IV	Oriental Mindoro	1:200,000	XI	Davao Oriental	1:250,000

Region	Province	Map Scale	Region	Province	Map Scale
IV	Palawan	1:100,000	XII	Cotabato North	1:200,000
IV	Quezon	1:250,000	XII	Lanao del Norte	1:150,000
IV	Rizal	1:100,000	XII	Sultan Kudarat	1:150,000
IV	Romblon	1:100,000	XIII CARAGA	Agusan Del Norte	1:150,000
IX	Basilan	1:75,000	XIII CARAGA	Agusan Del Sur	1:200,000
IX	Zamboanga del Norte	1.200,000	XIII CARAGA	Surigao Del Sur	1:200,000
IX	Zamboanga del Sur	1:200,000	XIII CARAGA	Surigao Del Norte	1:150,000

(2) Digital Data in NAMRIA

The digital data includes digital map data and GIS data. The digital map data is cartographic data to be used for printing maps. GIS data is the spatial data that can be used by computer-based applications.

1) Digital Map Data

NAMRIA started to convert the analogue map to digital map in 2000. The progress of this conversion work is shown in next figure. Because of their budget and technology limitation, the work progress is slow. It takes approximately one month to complete a new digital map sheet at scale of 1:50,000. The digital data format is kept in CAD software and the data is not structured for GIS use. For cartography or map printing, the digital map data is edited by "Free-Hand" software. Because this type of digital data will not be easily imported into GIS database completely, the production process and specifications should be redesigned and reconstructed, otherwise the construction of GIS fundamental database will be very troublesome and double efforts may be required in the future. There are about 50 map sheets converted in Agusan Del Norte, Surigao Del Norte, and Aurora.

2) GIS Data

NAMRIA has produced GIS data for 200 sheets of contour layer, 93 sheets of administrative maps, 43 sheets of land cover maps, and a GIS database for Agusan Del Norte, Surigao Del Norte, Siquijor, Mt. Mayon and Makati. The lists of GIS data are as follow.

(i) Contour Database

This is a spatial database of topographic maps showing 20 meters interval of contour lines. This database will provide elevation data of ground surface and be used to analyze slopes and cross sections for such works as dam construction design, land slide analysis and land potentiality analysis etc.

Table 2-33 Topographic Maps 1:50,000 Contour Lines (20-m), Data Format: Arc/Info

Region	Province	Map Title	Map No.
IV	Palawan	Aborlan	2619-I
		Apurawan	2620-II
		Baton-baton	2619-II
		Birong	2619-1V
		Cleopatra Needle	2721-ll
		Northwest Head	2721-Ill
		Puerto Princesa	2720-III
V	Albay	Iriga City	3627-I
		Pio Duran	3627-I
	Sorsogon	Bulan	3726-II
		Matnog	3826-III
		Gubat	3826-IV
IX	Zamboanga del Norte	Batorampon Point	3415-III
		Sibuco	3415-IV
	Zamboanga del Sur	Mialim	3415-I
		Manicahan	3415-ll
		Siay	3516-II
		Dinas	3616-II
		Margosatubig	3616-III

(ii) GIS Database for Urban Large Scale Maps

The GIS database available in NAMRIA are summarized in Appendix II Table-3 GIS Database.

(iii) Administrative Boundary Database

This spatial database is generated by converting the provincial and municipal administrative boundaries from 77 provincial map listed below.

Table 2-34 Administrative Boundary Data (Arc/Info Format)

Region	Province	Map Scale	Data Size	Region	Province	Map Scale	Data Size
ARMM	Lanao del Sur	1:150,000	0.038	NCR	Manila	1:50,000	0.085
ARMM	Maguindanao	1:200,000		V	Albay	1:150,000	0.045
ARMM	Sulu	1:250,000	0.018	V	Camarines Norte	1:150,000	0.133
ARMM	Tawi Tawi	1:250,000	0.04	V	Camarines Sur	1:150,000	0.037
CAR	Abra	1 150,000		V	Catanduanes	1:50,000	0.139
CAR	Apayao	1:150,000	0.02	V	Masbate	1:200,000	0.072
CAR	Benguet	1:150,000	0.096	V	Sorsogon	1:150,000	0.142
CAR	Ifugao	1:150,000	0.116	VI	Aklan	1:150,000	0.11
CAR	Kalinga	1:150,00	0.06	VI	Antique	1:200,000	0.056
CAR	Mt. Province	1:150,000	0.159	VI	Capiz	1:150,000	0.028
I	Ilocos Norte	1:150,000	0.004	VI	Guimaras	1:50,000	0.024
I	Ilocos Sur	1:200,000	0.003	VI	lloilo	1:200,000	0.124
I	La Union	1:150,000	0.003	VI	Negros Occidental	1:250,000	0.101
I	Pangasinan	1.200,000	0.003	VII	Bohol	1:150,000	
II	Batanes	1:150,000	0.004	Vll	Cebu	1:250,000	
II	Cagayan	1:250,000	0.085	VII	Negros Orienal	1:250,000	0.05
II	Isabela	1:200,000	0.057	VII	Siquijor	1:50,000	0216
II	Nueva	1:150,000	0.057	VIII	Biliran	1:50,000	0.082

	Vizcaya						
II	Quirino	1:50,000	0.238	VIII	Eastern Samar	1:250,000	0.164
III	Bataan	1:150,000	0.048	VIII	Leyte	1:250,000	0.071
III	Bulacan	1:150,000	0.077	VIII	Northern Samar	1:200,000	0.03
III	Nueva Ecija	1:150,000	0.079	VIII	Samar	1:200,000	0.06
III	Pampanga	1:75,000	0.166	VIII	Southern Leyte	1:100,000	0.043
II	Tarlac	1:100,000	0.193	X	Bukidnon	1:200,000	
III	Zambales	1:150,000	0.127	X	Camiguin	1:150,000	0.058
IV	Aurora	1:200,000	0.078	X	Misamis Occidental	1:150,000	0.053
IV	Batangas	1:150,000	0.077	X	Misamis Oriental	1:150,000	0.049
IV	Cavite	1:50,000	0.115	X	Surigao del Norte	1:150,000	0.035
IV	Laguna	1:150,000	0.06	XI	Cotabato S	1:150,000	0.044
IV	Marinduque	1.50,000	0.06	Xl	Davao del Norte	1:150,000	0.057
IV	Occidental Mindoro	1:250,000	0.433	XI	Davao Del Sur	1:150,000	0.065
IV	Oriental Mindoro	1:200,000	0.064	XI	Davao Oriental	1:250,000	0.036
IV	Palawan	1:100,000		XII	Cotabato North	1:200,000	0.048
IV	Quezon	1:250,000	0.076	XII	Lanao del Norte	1:150,000	0.056
IV	Rizal	1:100,000	0.099	XII	SuItan Kudarat	1:150,000	0.169
IV	Romblon	1:100,000	0.151	XIII CARAGA	Agusan Del Norte	1:150,000	0.134
IX	Basilan	1:75,000	0.364	XIII CARAGA	Agusan Del Sur	1:200,000	0.073
IX	Zamboanga Del Norte	1:200,000	0.089	XIII CARAGA	Surigao Del Sur	1:200,000	0.055
IX	Zamboanga Del Sur	1:200,000	0.063	XIII CARAGA	Surigao Del Norte	1:150,000	0.151

(iv) Land Cover Database

This GIS database was generated from 1:250,000 land cover maps; The database was kept in both Arc/Info and DXF format.

(v) Agusan Del Norte, Surigao Del Norte, and Siquijor Database

This spatial database is kept in Arc/Info format. The unit of the database is in area name.

It includes seven layers of administrative, elevation, slope, soil, river, land classification and land cover.

(vi) Mountain MAYON Database This database is in Arc/Info format, and includes 10 layers, Administrative, 100 meters contour, erosion, flooding area, geology, land classification, land cover, land management unit, land use/vegetation, and slope.

(vii) MAKATI Database This spatial database features the road network, and covers city of MAKATI and 23 barangays except Fort Bonifacio.

The data are kept in Arc/Info format.

2-4-2 Products

(1) Current Products and Services

The Information Services Division lists the products with the set prices as shown in Appendix II Table4 Prescribed Rates for NAMRIA Services. The Map Sales Office generally dealt with maps in paper media. Other digital data are prepared by request basis.

The Photogrammetry Division sells aerial photographs and digital maps. The prices of the services are summarized in the following table.

Table 2-35 Current Products and Services

Division	No	Item	Price
CARTOGRAPHY - Small Scale (1:50,000 - smaller)	1	Digital Maps (Vector - 1:50,000)	PHP6,000.00/ map sheet
	2	Raster Maps TIF - 1 GEOTIF	 PHP300.00/map sheet PHP600.00/map sheet
	3	Relief Map	MOA
	4	Map Evaluation & certification	MOA
	5	Administrative Boundaries Research Work	MOA
	6	Print-out of Maps - Administrative Map	PHP0.90/sq.in
PHOTOGRAMMETRY - Large Scale (1:10,000 - up)	1	Reproduction of Aerial Photos in standard large format	 PHP250.00/per photo MOA
	2	Digital Maps (Vector - 1:10,000)	PHP9,000.00/ map sheet
	3	Printout of Maps (Topo) Raw Enhanced	 PHP800.00/ map sheet PHP1,200.00/ map sheet
	4	Printout of Orthophoto	PHP2,400.00/ map sheet
	5	Consultancy Services Topographic Compilation (Digitizing) Orthophoto Mapping	 PHP120.00/ha.

The aerial photographs and digital maps are sold in the Photogrammetry Division. The sale records of aerial photographs and digital maps are as follows:

Table 2-36 Map Sales of Aerial Photographs and Digital Maps

	Aerial Photograph	Digital Maps
2000	97,560	299,233
2001	108,550	329,114
2002	n.a.	n.a.
2003	145,340	357,681
2004	166,220	386,732
2005	205,360	398,668
2006	291,978	429,804

Source: Map Sales Office

(2) Current Map Distribution System

The Map Sales Offices control all the sales of 1:50,000 topographic maps. The total sale of the Map Sales Offices in the fiscal years in 2005 and 2006 are summarized in the following table.

Table 2-37 Sales Comparison for CY 2005-2006.

MSO	2005	2006	Percentage Increase/Decrease
Binondo	3,478,070.00	3,170,330.00	-9.71
Fort Bonifacio	3,144,505.00	2,505,725.00	-25.49
Cebu	1,150,510.00	1,002,715.00	-14.74
Quezon City	764,235.00	749,265.00	-2.00
Iloilo	238,225.00	270,985.00	12.09
Davao	157,855.00	171,630.00	8.03
Baguio City	124,275.00	107,895.00	-15.18
Palawan	115,035.00	97,390.00	-18.12
Cagayan de Oro	114,420.00	128,030.00	10.63
Tacloban City	68,355.00	62,270.00	-9.77
Pampanga	55,715.00	56,240.00	0.93
Legazpi City	47,085.00	47,250.00	0.35
Tuguegarao	42,750.00	77,965.00	45.17
La Union	31,485.00	22,020.00	-42.98
Butuan	29,245.00	10,135.00	-188.55
Nueva Ecija	28,770.00	14,980.00	-92.06
Zamboanga City	17,230.00	29,415.00	41.42
Ilocos Norte	2,910.00	3,290.00	11.55
Koronadal City	0.00	14,030.00	100.00
TOTAL	9,610,675.00	8,541,560.00	-12.52

Source: Map Sales Office

Among the maps, the topographic maps at scale of 1:50,000 are sold most. The total quantity sold are 24,720 sheets annual in the year 2006, and the total sale was just below three million pesos.

Table 2-38 Map Sales by Product

RANK	PRODUCT	QTY.SOLD	SALES
1	Topographic Map 1:50,000 scale	24,720	2,966,400.00
2	Nautical Chart (Black & White)	5,418	1,896,300.00
3	Topographic Map 1:250,000 scale	3,948	473,760.00
4	Topographic Map 1:10,000 scale (Contoured)	2,984	358,080.00
5	Nautical Chart (Colored)	2,134	853,600.00
6	Tide & Current Table	1,386	554,400.00
7	Administrative Map (Provincial)	943	183,885.00
8	Administrative Map (regional)	562	109,590.00

Source: Map Sale Office 2006

All the Map Sales Offices are equipped with the Sales Reporting Recording Inventory System (SRRIS). It is a standard system equipped in all the twenty Map Sales Offices in the Philippines. A purchaser needs to fill out a order slip which includes name, affiliation and purpose of purchase. The order is then encoded in the SRRIS. At the end of the day, a daily report is generated. A monthly report is sent to the Information Management Department, also. The Map Sales Offices report the position and issue slip. When their stock is low, the Map Sale Offices request particular maps to the headquarters.

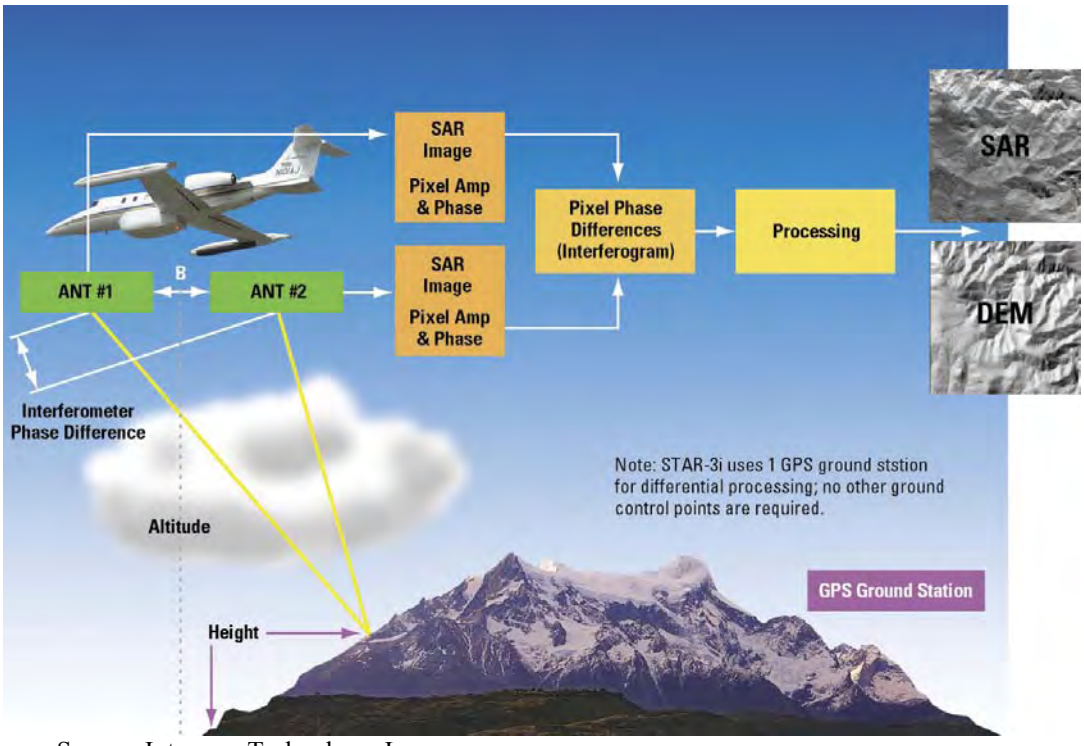
2-4-3 Available Information

The Study Team examined IFSAR and Satellite Image Data owned by NAMRIA as well as NAMRIA's products, and as related information, checked out current situation with ISO 19100 and free software. The results are summarized below. As for free software, especially, the products which seemed utilizable for the Study were listed up, and problems of the free software products were identified.

(1) IFSAR

IFSAR (Interferometric Synthetic Aperture Radar) is the latest multiple-purpose mapping technology which determines elevations of topography by interference processing using two synthetic aperture radar (SAR) image data. NAMRIA signed an agreement with INTERMAP TECHNOLOGIES INC in association with CERTEZA Surveying and Aerophoto System, Inc (NEXTMap Philippines Consortium) for the purpose of acquiring the IFSAR technologies. NAMRIA and the Consortium have initiated the IFSAR data acquisition project in the whole areas of Minidanao Islands (78,000 sq. km) including Sulu Islands from 2005 and completed in 2006 with as the Phase I of the project. These IFSAR data were collected using the STAR-3i Airborne IFSAR system of INTERMAP TECHNOLOGIES INC. The concept of IFSAR, the specification of the radar data of Phase I, and the range are as follows.

Figure 2-5 Concept of Interferometric Synthetic Aperture Radar



Source: Intermap Technology, Inc.

1) NEXTMap Philippines Product Specifications in Phase I:

Vertical datum (geoid model):	EGM96
Horizontal (geodetic) datum:	WGS84
Projection:	UTM
File format (DSM):	32-bit floating binary grid (.bil)
File format (ORI):	8-bit unsigned GeoTIFF (.tif)

Table 2-39 NEXTMap Philippines Product Specifications

DSM			Measures of Vertical Accuracy (m)
Product Type	Year of acquisition	Post Spacing (m)	RMSE
III	2005, 2006	5	3

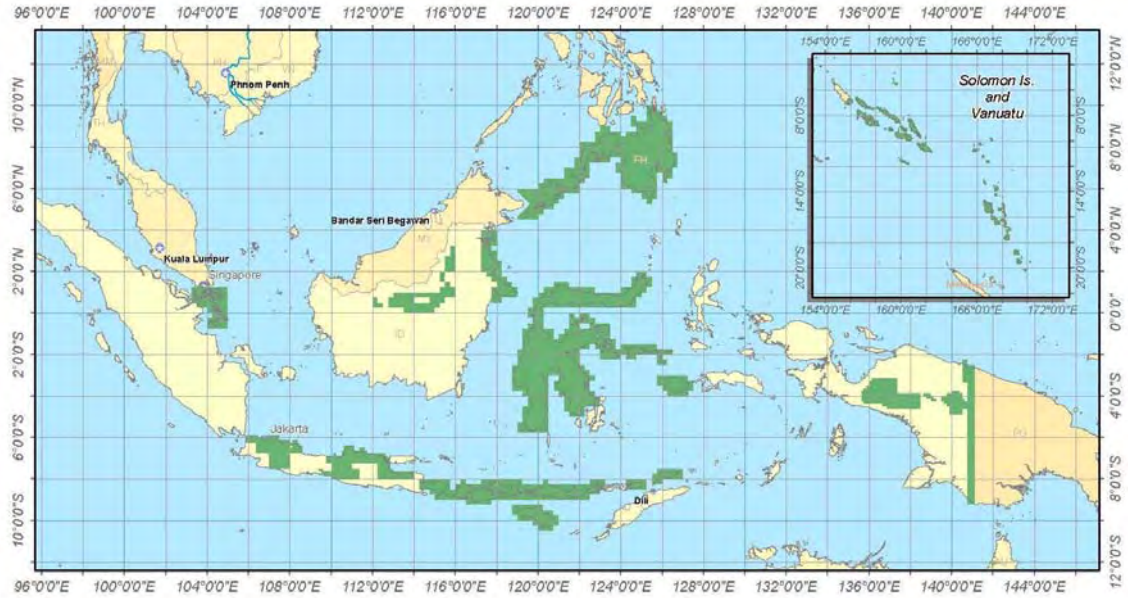
ORI		Measures of Horizontal Accuracy (m)
Pixel Size (m)	Year of acquisition	RMSE
1.25	2005, 2006	2

Source: Intermap Technology, Inc.

2) Area coverage of IFSAR data in Phase I:

The collected radar data are created by a digital surface model (DSM), a digital ortho radar image (ORI), and the topographic line maps (TLM) using the STAR-3i system. It is used as data for the application on the geographic space of topographic mapping. The advantages of the mapping using this IFSAR technique are: acquisition of the 3-dimensional geographic spatial information using the high-resolution sensor; short period of work that is not affected by weather; and capability of multiple-purpose topographic mapping. However, since SAR data are radar data, they cannot be used for vegetation classification analyses. For this reason, topographic mapping require combination of synthetic aperture radar data and high-resolution satellite imagery. Staff of NAMRIA has received some IFSAR training conducted by INTERMAP TECHNOLOGIES INC in 2005 and 2006. From the next year, topographic mapping project using IFSAR data in the Mindanao Island will be implemented.

Figure 2-6 IFSAR Coverage (Phase I)



(2) Satellite Image

The satellite images that can be used for 1:50,000 topographic maps, which are available in the market in the Philippines, are as follows:

Table 2-40 Satellite Images Available

Name	Product name	Resolving power
IKONOS (Pan)	Geo Ortho Kit	1.0m
QuickBird-2 (Pan)	Basic Imagery	0.61～0.72m
OrvView-3 (Pan)	OrbView BASIC Enhanced	1.0m
SPOT-5 (HRG-P)	SPOT Scene Level 1A/1B/2A	2.5m
ALOS (PRISM)	PRISM Level 1A/1B1/1B2	2.5m

NAMRIA has acquired the SPOT images for the Geo-Hazard Project described in 2-3 Related Development Plans and Policies. A total of 288 scenes were procured from the year 2002 to 2007. Most of them, about 40% of the total, were procured in 2006. The types are 1/2, 1/4 and full scenes. Over 70% of them are full scenes.

See Appendix II Table-5 SPOT Scenes Available in NAMRIA (December 2007).

Table 2-41 Scene Acquired Year (SPOT5)

	Frequency	Percent	Valid Percent
2002	6	2.1	2.1
2003	66	22.9	22.9
2004	46	16.0	16.0
2005	30	10.4	10.4
2006	117	40.6	40.6
2007	23	8.0	8.0
Total	288	100.0	100.0

Table 2-42 Type of Scenes (SPOT5)

	Frequency	Percent	Valid Percent
1/2 Scene	61	21.2	21.2
1/4 Scene	18	6.3	6.3
Full Scene	209	72.6	72.6
Total	288	100.0	100.0

(3) ISO19100

ISO19100 is the geographic standards specified by the ISO Technical Committee 211 (ISO/TC 211) since 1994. The detailed series of the standards are as follows:

Table 2-43 ISO19100

ISO19101	Geographic Information - Reference Model
ISO19102	Geographic Information - Overview
ISO19103	Geographic Information - Conceptual schema language
ISO19104	Geographic Information - Terminology
ISO19105	Geographic Information - Conformance & testing
ISO19106	Geographic Information - Profiles
ISO19107	Geographic Information - Spatial schema
ISO19108	Geographic Information - Temporal schema
ISO19109	Geographic Information - Rules for application schema
ISO19110	Geographic Information - Feature cataloguing methodology
ISO19111	Geographic Information - Spatial referencing by coordinates
ISO19112	Geographic Information - Spatial referencing by geographic identifiers
ISO19113	Geographic Information - Quality principles
ISO19114	Geographic Information - Quality evaluation procedures
ISO19115	Geographic Information - Metadata
ISO19116	Geographic Information - Positioning services
ISO19117	Geographic Information - Portrayal
ISO19118	Geographic Information - Encoding
ISO19119	Geographic Information - Services
ISO19120	Geographic Information - Functional standards
ISO19120/amd 1	Geographic Information - Functional standards/amendment 1
ISO19121	Geographic Information - Imagery & gridded data
ISO19122	Geographic Information - Geomatics/Qualifications and Certification of personnel
ISO19123	Geographic Information - Schema for converge geometry and functions
ISO19124	Geographic Information - Imagery & gridded data components
ISO19125-1	Geographic Information - Simple Feature Access-Part 1: Common architecture
ISO19125-2	Geographic Information - Simple Feature Access-Part2: SQL option
ISO19125-3	Geographic Information - Simple feature access- Part 3: COM/OLE option
ISO19126	Geographic Information - Profile-FACC Data Dictionary
ISO19127	Geographic Information - Geodetic codes & parameters
ISO19128	Geographic Information - Web Map Server Interface
ISO19129	Geographic Information - Imagery, gridded & coverage data framework
ISO19130	Geographic Information - Sensor & data models for imagery and gridded data
ISO19131	Geographic Information - Data Product Specifications
ISO19132	Geographic Information - Location based services possible standards
ISO19133	Geographic Information - Location based services tracking and navigation
ISO19135	Geographic Information - Procedures for registration of geographical information items

Source: http://www.isotc211.org/ ISO/TC 211 Geographic information/Geomatics

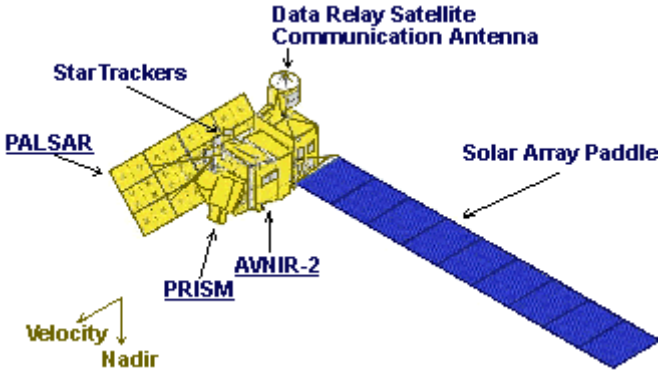
The Republic of the Philippines (Bureau of Product Standards) has participated in the First Meeting of ISO/TC 211 as an observing member.

(4) Advanced Land Observing Satellite (ALOS)

The purpose of launching ALOS is to acquire high-resolution earth observation data at the global level and to conduct topographic mapping, regional observation, disaster monitoring, and resource surveying.

ALOS has three remote-sensing instruments: the Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) for digital elevation mapping, the Advanced Visible and Near Infrared Radiometer type 2 (AVNIR-2) for precise land coverage observation, and the Phased Array type L-band Synthetic Aperture Radar (PALSAR) for day-and-night and all-weather land observation. In order to utilize fully the data obtained by these sensors, the ALOS was designed with two advanced technologies: the former is the high speed and large capacity mission data handling technology, and the latter is the precision spacecraft position and attitude determination capability. They will be essential to high-resolution remote sensing satellites in the next decade. (Source: JAXA Website)

Figure 2-7 Mechanism of ALOS



Source: JAXA

The characteristics of ALOS is summarized in the following table:

Table 2-44 ALOS Characteristics

Launch Date	Jan. 24, 2006
Launch Vehicle	H-IIA
Launch Site	Tanegashima Space Center
Spacecraft Mass	Approx. 4 tons
Generated Power	Approx. 7 kW (at End of Life)
Design Life	3 -5 years
Orbit	Sun-Synchronous Sub-Recurrent
	Repeat Cycle: 46 days
Sub Cycle: 2 days	
	Altitude: 691.65 km (at Equator)
	Inclination: 98.16 deg.
Attitude Determination Accuracy	2.0 x 10-4degree (with GCP)
Position Determination Accuracy	1m (off-line)
Data Rate	240Mbps (via Data Relay Technology Satellite)
120Mbps (Direct Transmission)	
Onboard Data Recorder	Solid-state data recorder (90Gbytes)

Source: JAXA

Since the launch was after the commencement of the Study, the possibility of utilizing the data was not explored for the Study; however, the resolution is 2.5 meters, which is

equivalent to the resolution of SPOT. The cost of ALOS per square kilometer is PHP 160[4], while the square kilometer cost of SPOT image is about PHP2,500. The cost of ALOS imagery is substantially lower than that of SPOT; therefore, the data would become a useful source for NAMRIA in future.

(5) Free Software

The JICA headquarters have requested the Study Team to review free software available. The Study Team has searched and listed relevant software. However, since testing and evaluating the software is not within the scope of the work, the software listed in the table has not been used nor test for possible use for the counterpart agency.

Free software that can be downloaded through the internet has various kinds. The Study Team has searched free software that could be used for 1:50,000 topographic data after thorough examination in terms of the functionalities of search, observation, editing and others. The free software includes "open source software." The license types are free and open source. The open source software may not be compiled to use as application software. Free software is application software readily used by users. The items researched are: name of software, developer, version, operation system, license type, format supported. The functionalities are summarized in Appendix II Table-6 Free Software and Table-7 Free Software (Functionalities).

The free software the Study Team studied had limited functionalities compared to commercial mapping and GIS software that generally has integrated image processing, aerial triangulation, and plotting. The free software can be used for limited functionalities such as compilation or structurization. When bugs or other errors in the programs were found, the developers or authors of the software are not liable to losses or damages caused by the defects unlike commercial applications. The software can be used for limited tasks while the users need to be aware that troubles caused by possible defect.

It should be kept in mind that copyright of free software belongs to authors or developers and that there is no user support for free software. Open source software can be altered by users; however, source codes need to be compiled to be used as application. Open sources also have restrictions such as the Open Source Definition by the Open Source Initiative in 1988 or licensing (BSD license, Apach license, Common Public License); therefore, when open sources are to be used, the users need to pay attention to the restrictions.

The Study Team has conducted an initial research on the free software listed above; however, it does not mean that the Study Team is in a position to recommend the free software. Even after a thorough examination and testing, specifications and functionalities will be changing beyond the control of the Study Team. Users shall be responsible for the uses of the software listed above.

2-4-4 Analysis of Topographic Maps (1:50,000)

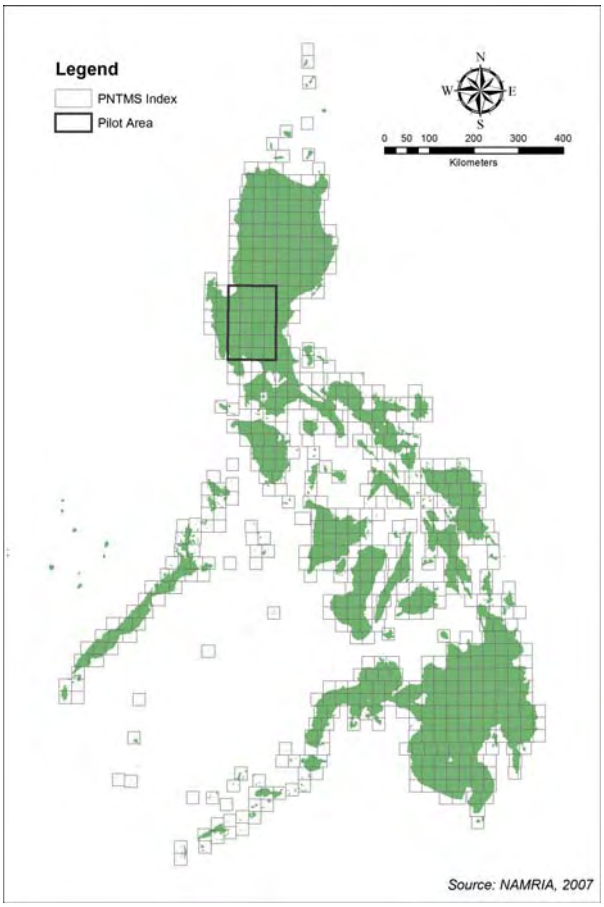
Analysis of 1:50,000 topographic maps was conducted with the aim of preparing cost estimation data for nationwide deployment of 1:50,000 topographic maps as described in Section 4-8-1. The analysis included Map Year Identification, and Analyses of Planimetry Density and Contour Density. All these results were incorporated into the GIS database.

(1) Map Year

Obsolete information of topographic maps at scale of 1:50,000 was the one of the major reasons of the Study. Determining map years was not as simple as it seemed since there were two series of topographic maps to be integrated to the PNTMS.

[4] The cost is the purchasing price in Japan.

Figure 2-8 PNTMS Map sheet layout



There are three series of 1:50,000 topographic maps. Series 711 has 842 sheets which were produced using aerial photographs taken between 1953 and 1997. Series 701, with 151 sheets, were produced based on aerial photographs taken between 1976 and 1979. Philippine National Topographic Map Series, or PNTMS, has a different coverage in one sheet, and other series were converted to PNTMS. In determining map years, though updating of PNTMS has not completed yet, the oldest section overlapping was determined as the years of the PNTMS`. The result shows that over 50% of the map information was produced before 1959.

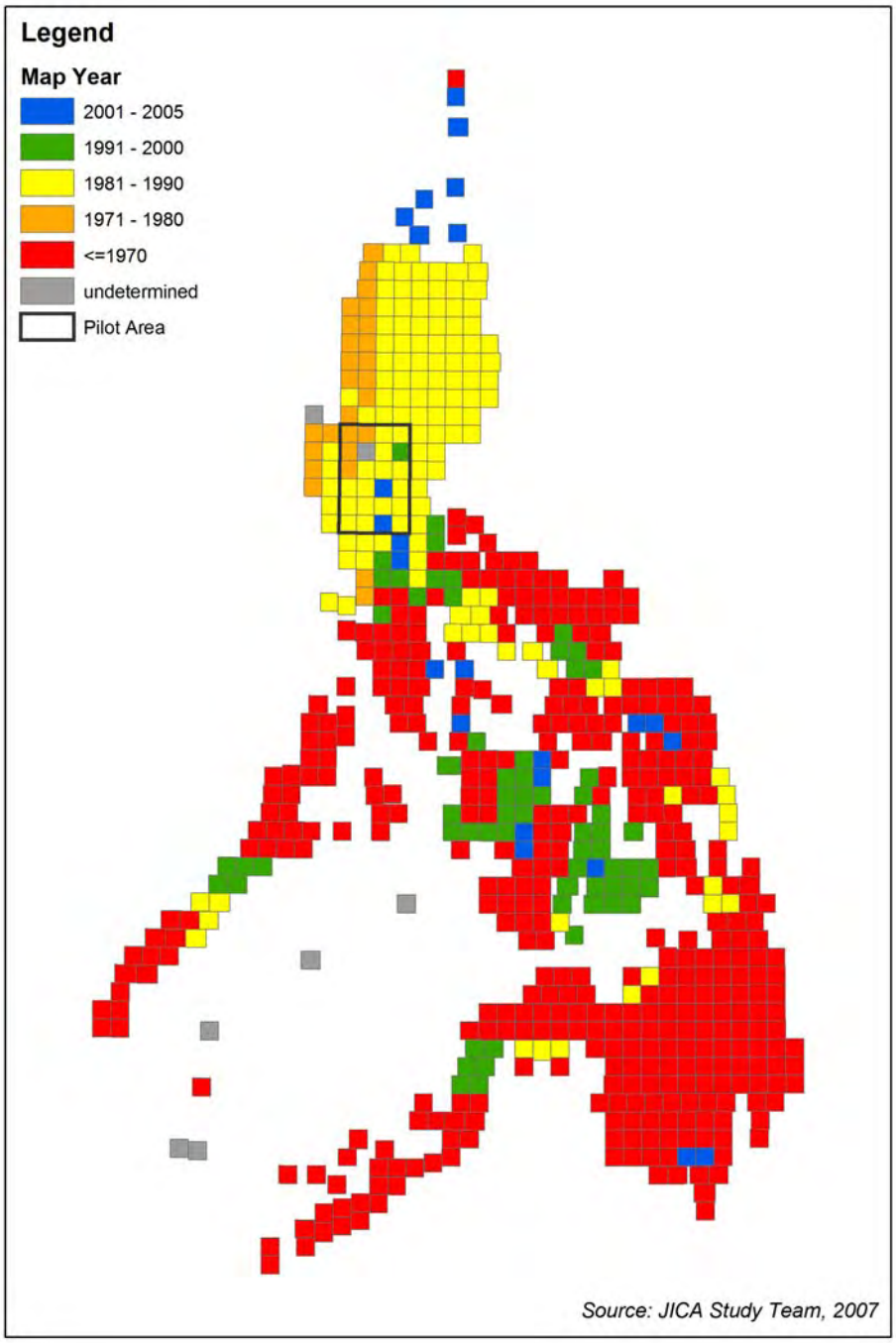
Table 2-45 Map Year

	Frequency	Percent
1952	5	.8
1953	9	1.4
1954	14	2.1
1955	142	21.7
1956	54	8.3
1957	29	4.4
1958	67	10.3
1959	54	8.3
1960	1	.2
1961	21	3.2
1977	26	4.0
1981	10	1.5
1982	21	3.2
1983	25	3.8
1984	20	3.1
1985	14	2.1
1986	7	1.1
1987	18	2.8
1988	6	.9
1989	5	.8
1990	10	1.5
1991	13	2.0
1992	2	.3
1993	11	1.7
1994	9	1.4
1995	11	1.7
1996	9	1.4
1997	3	.5
1998	4	.6
1999	2	.3
2001	4	.6
2002	2	.3
2004	9	1.4
2005	9	1.4
Total	646	98.9
Missing	7	1.1
Total	653	100.0

Source JICA Study Team 2007

The following thematic map shows the map year distribution based on the analysis. In the southern part of the Philippines, revision work of the 1:50,000 topographic maps has been delayed.

Figure 2-9 Map Year



(2) Analyses of Planimetry Density and Contour Density

To measure the complexity of each map sheet, each map sheet was given grades to measure the planimetry and contour density. The grades range from 1 to 5 with 1, being the most complex to 5, being the least complex. The grades give an indication of the difficulty of performing mapping tasks such as feature plotting and contour mapping works associated with each map sheet. The grades were then used as basis for computing the time/resource/cost requirements to update each map sheet.

Planimetry was estimated based on the following factors: Population (Source: NSO Year 2000 census); Built-up area (Source: NAMRIA Land cover maps 2007); Existence of Major Roads (Source: DPWH 2000)

The factors were selected because the information gives good indication of the planimetric features that exist in the areas covered by each map sheet. Another consideration is that data for the three factors can cover the whole Philippines, thus offering an unbiased and quantifiable way to measure the amount of planimetric features that has to be encountered in each map sheet. GIS analysis was used to assess planimetry using the three factors. Figures 2-9, 2-10 and 2-11 show the different factors used to estimate planimetry.

Table 2-45 summarizes the assessments based on the three factors:

Table 2-46 Factors Used for Planimetry Density Assessment

Planimetry Density Assessment	Population Count per Map sheet (Persons)	Built-up area per Map sheet (Sq km)	Length of Major Roads per Map sheet (km)
1 – Most Difficult	More than 300,000	More than 8.01	More than 100
2	250,001 – 300,000	6.01 – 8	50.01 – 100
3	200,001 – 250,000	4.01 – 6	35.01 – 50
4	150,001 – 200,000	2.01 – 4	20.01 – 35
5 – Least Difficult	Less than 150,001	Less than 2.01	Less than 20.01

Figure 2-10 Population Count per Map Sheet

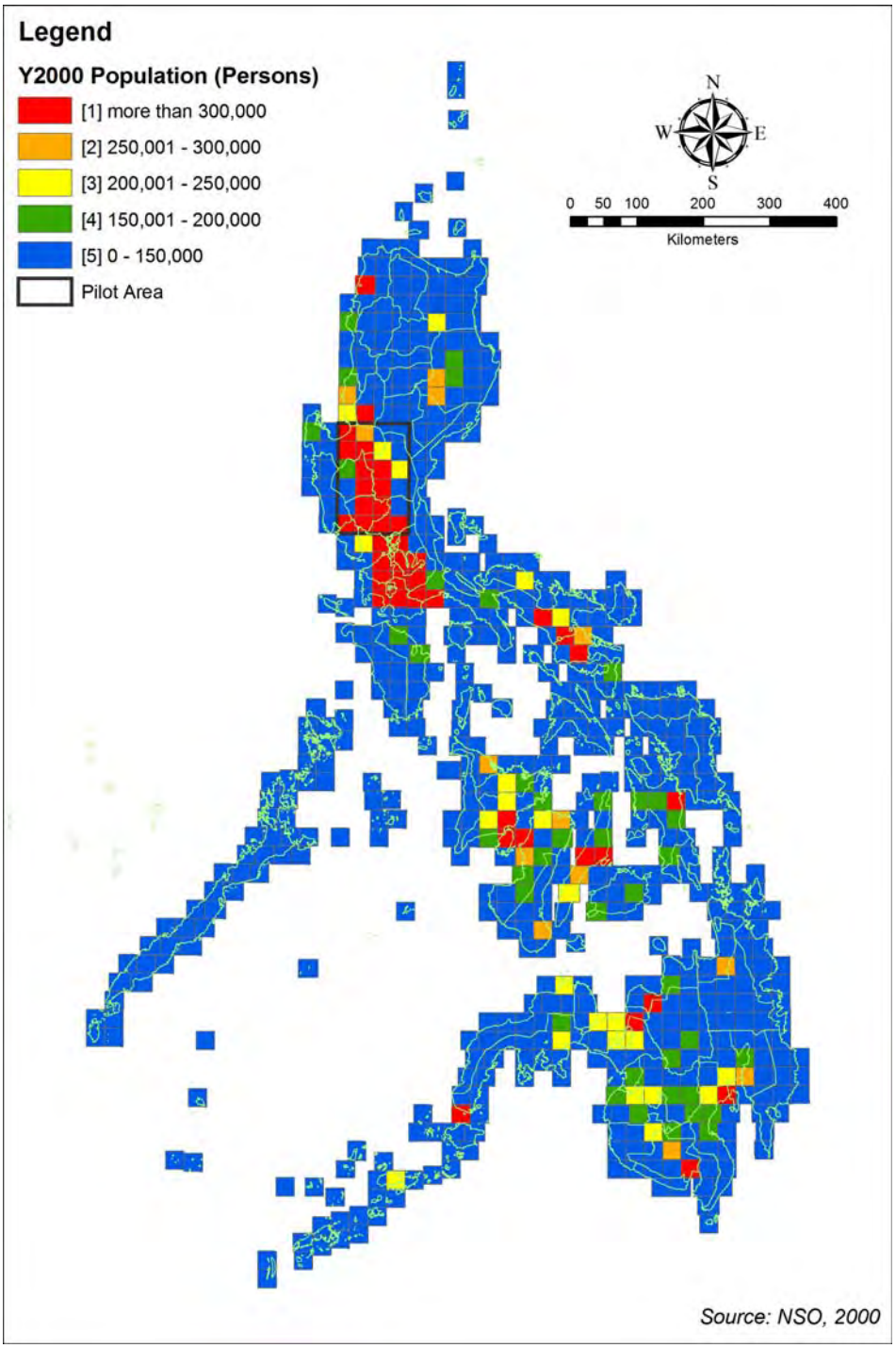


Figure 2-11 Built Up Area per Map Sheet (Sq km)

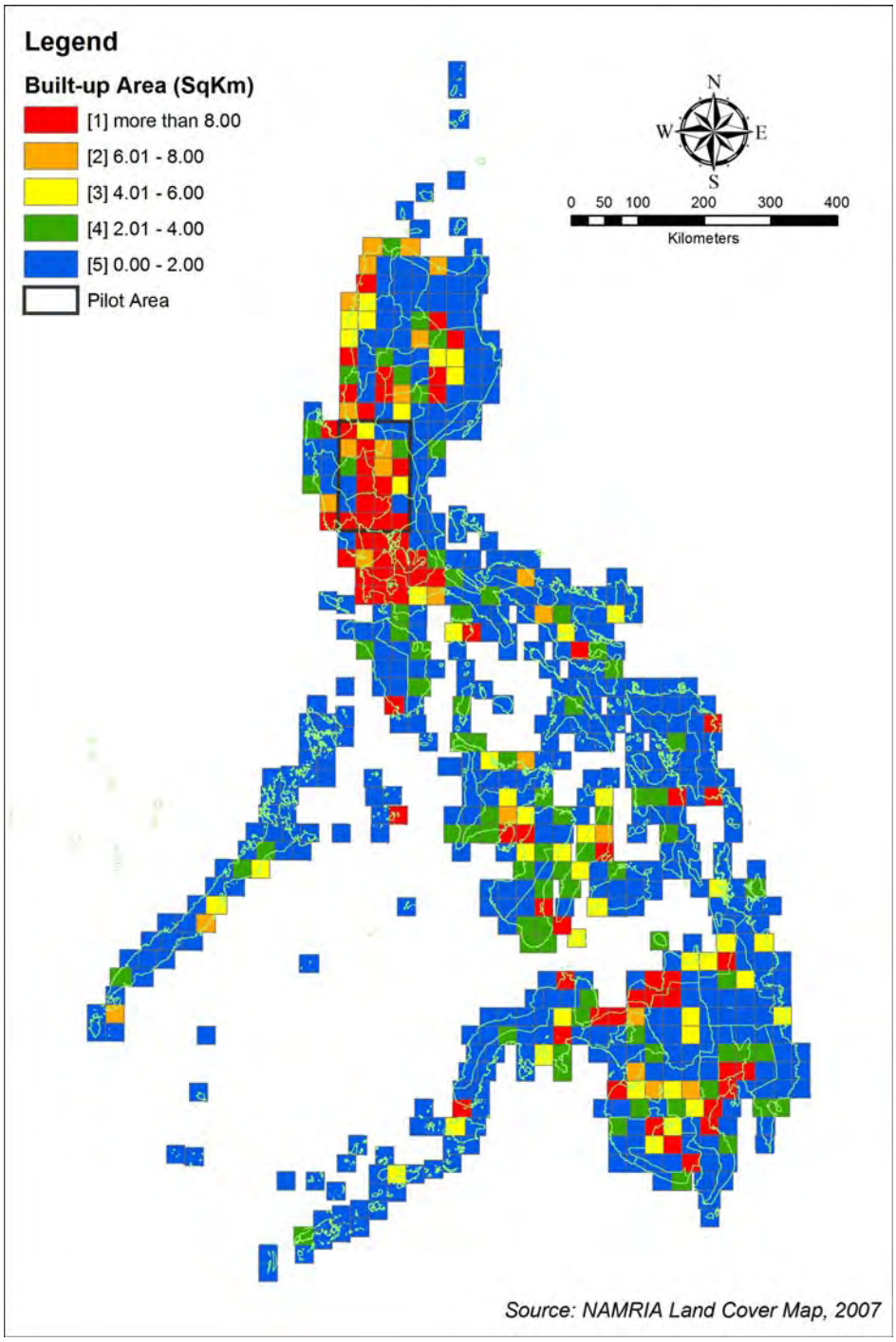
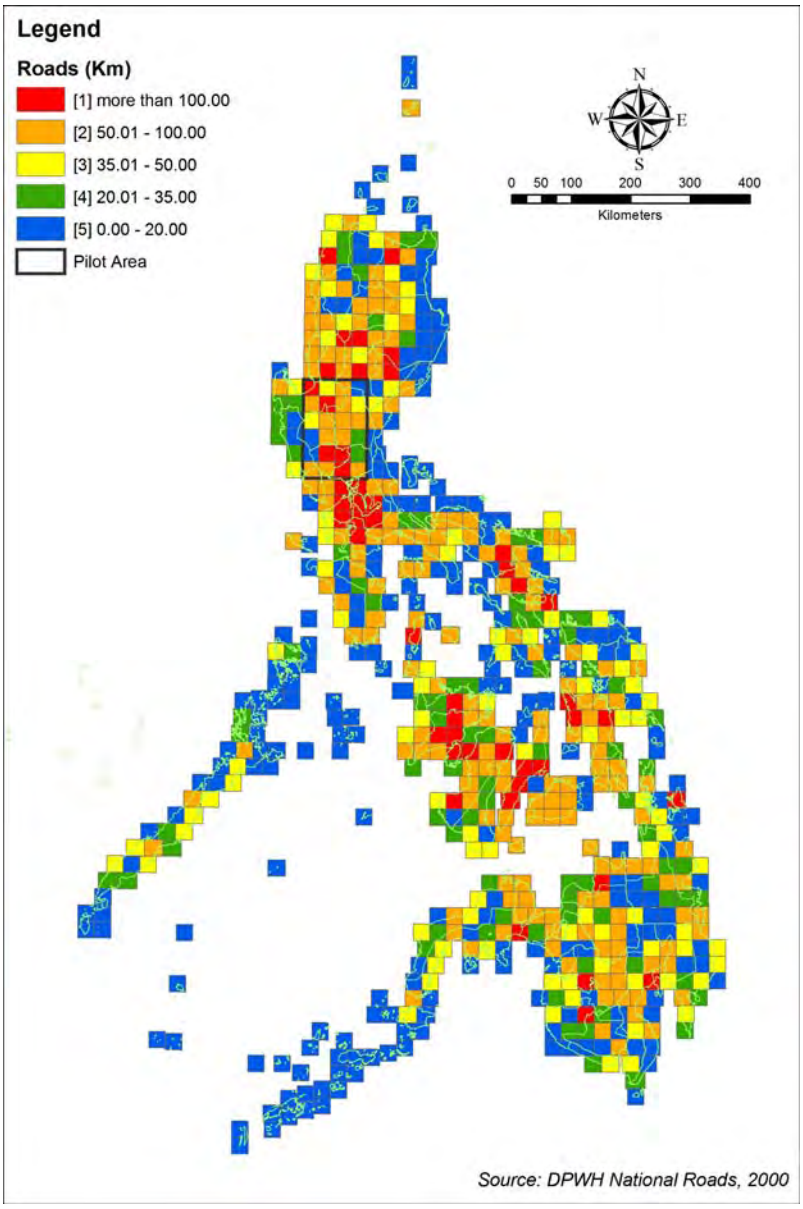
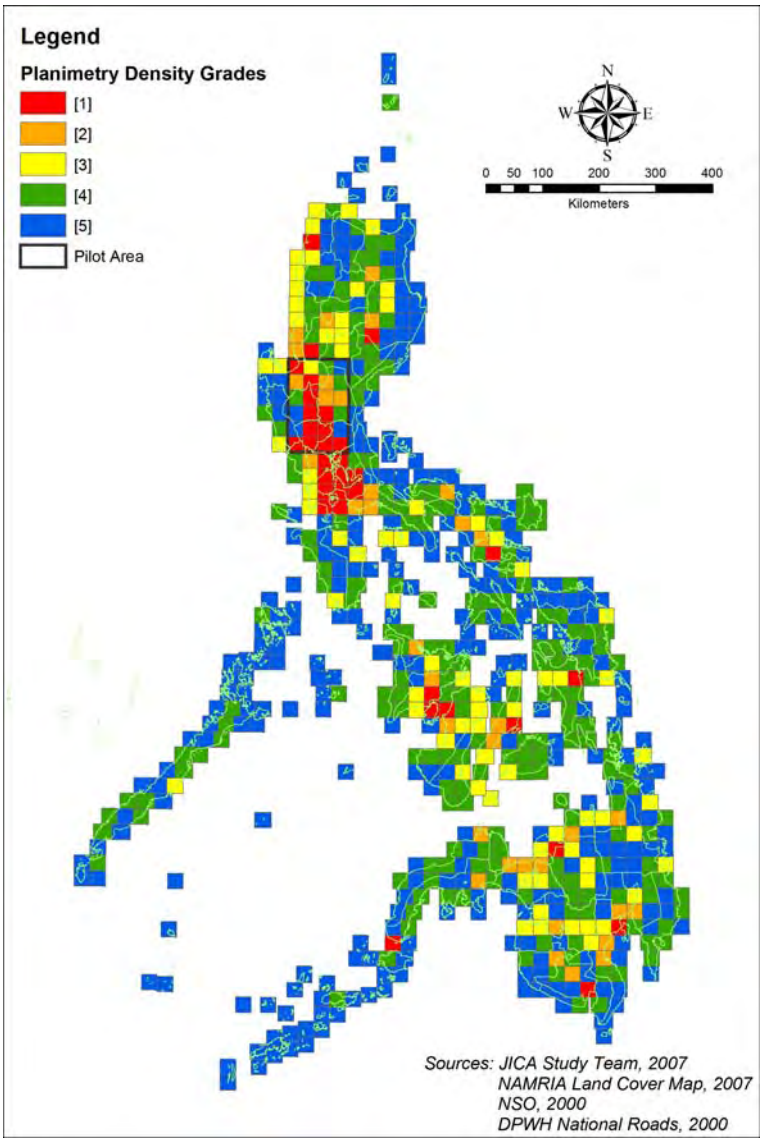


Figure 2-12 Major Roads per Map sheet (km)



Planimetric density assessment was conducted from aspects of population, road density and built-up area information. Population data were provided by the National Statistic Office, existence of major roads – by Department of Public Works and Highways, and built-up area information – by NAMRIA in its Land cover maps. Utilizing the result of the Pilot Projects which are described in Chapter 3, the time required for extracting planimetric features was estimated. As seen in parameters, Metro Manila and adjoining areas in the South, and Davao and vicinities have dense planimetric-features, and it is expected to take long time to update planimetric-features of red and orange colored areas in the map.

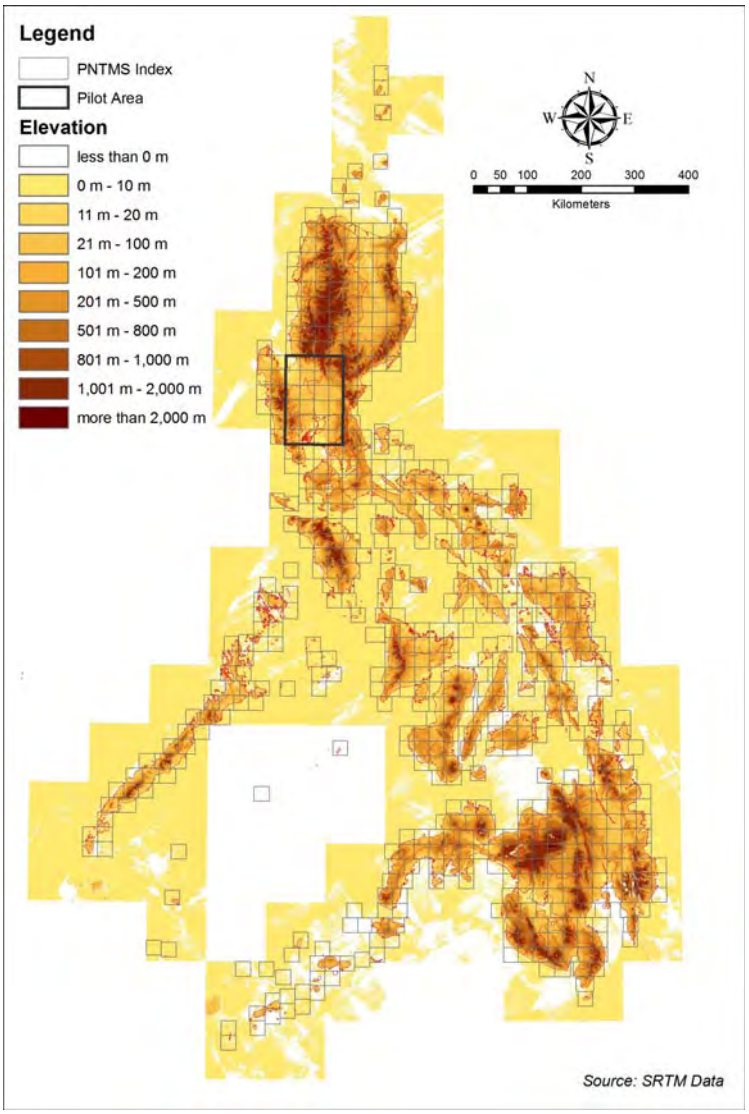
Figure 2-13 Planimetric Density Grades



Contour Density Grade was estimated using Shuttle Radar Topography Mission (SRTM)[5] elevation data for the whole country downloaded from the US Geological Survey's EROS Data Center website. The SRTM data contains elevations at 90 m intervals. Using these elevation data, contours at 20 m intervals were generated to approximate actual contours that can be found on the 1:50,000 scale maps to be updated. To calculate contour density, the total length of contours were summed up for each map sheet. Figure 2-13 shows the elevation data used as source for contour density analysis.

[5] The Shuttle Radar Topography Mission (SRTM) data are produced by the National Aeronautics and Space Administration (NASA) and the National Geospatial-Intelligence Agency (NGA)—the German and Italian space agencies are involved in the effort. The mission is to acquire three dimensional data for the globe. There are two type s of data available: one is SRTM-1--one second (about 30 meters) mesh and three second (about 90 meters) mesh. The data are downloadable at ft://e0srp01u.ecs.nasa.gov. The Jet Propulsion Laboratory, California Institute of Technology has a comprehensive web site regarding the SRTM technology.

Figure 2-14 Elevation Map of the Philippines based on SRTM data



2-4-5 Issues of Data and Information

(1) Maps and GIS Data in NAMRIA

1:50,000 topographic maps are the most important base maps of the Philippines to cover the whole country Mapping Department of NAMRIA started the National Topographic Base Mapping Program in 1988 that will produce a new topographic map series (NTMS) to replace outdated 711 and 701 series 150,000 topographic maps and until now, 62 maps sheets or 9.2% of NTMS have been produced for selected areas where new aerial photographs to cover such areas became available with NAMRIA. Digitalization of 1:50,000 topographic base maps also started a few years ago and 45 maps or 6.7% of the country had been digitalized for selected areas, which are mostly 711 and 701 series and the products are digital cartography data for printing without GIS data structure.

Meanwhile, IATFGI lead by Information Management Department of NAMRIA has promoted programs to establish National Geographic Information Infrastructure which will consist of fundamental GIS datasets, data sharing system and networking system.

LATFGI's recommendations include preparation of fundamental GIS data sets of 1:50,000 and 1:10,000 scale which can be derived from 1:50,000 NTMS and 1:10,000 scale topographic map.

The following points are noted:

1. Activities of Mapping Department and Information Management Department within NAMRIA are going separately without integration of programs, technology and production flow.

   Production of digital map data in Mapping Department does not consider technical standards for GIS fundamental datasets proposed by IATFGI or Information Management Department of NAMRIA.

2. Progress of NTMS program and data digitalization is very slow due to lack of consistent program plans, and limitation of funds and production capacity.

(2) Products and Sales Systems

The very fundamental problem of products are the years produced. What customers need is recent spatial information.

All the product information is said to be included in the web site of NAMRIA; however, the Flash based information dissemination system function slow when the internet connection is not the broadband.

In 2006, the sale dropped by about 12 % from the previous year; however, no strategic measures were formulated to encounter the loss.