

Enhancing Coastal and Marine Management through Effective Information Management (The Bataan IIMS Case Study)



**GEF/UNDP/IMO Regional Programme on
Partnerships in Environmental Management
for the Seas of East Asia**

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THROUGH
EFFECTIVE INFORMATION MANAGEMENT
(THE BATAAN IIMS CASE STUDY)**



*GEF/UNDP/IMO Regional Programme on Building Partnerships in Environmental
Management for the Seas of East Asia (PEMSEA)*

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2007

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ACRONYMS/ABBREVIATIONS

| | | |
|---------|---|--|
| BCS | – | Bataan Coastal Strategy |
| BICMP | – | Bataan ICM Program |
| Brgy | – | <i>Barangay</i> (community or village) |
| CENRO | – | Community Environment and Natural Resources Office |
| DENR | – | Department of Environment and Natural Resources |
| DOLE | – | Department of Labor and Employment |
| FARMCs | – | Fisheries and Aquatic Resources Management Councils |
| GIS | – | geographic information system |
| IFARMC | – | Integrated Fisheries and Aquatic Resources Management Council |
| IIMS | – | Integrated Information Management System for Coastal and Marine |
| IT | – | Information Technology |
| LGUs | – | local government units |
| MBEMP | – | Manila Bay Environmental Management Project |
| MOA | – | Memorandum of Agreement |
| MPDOs | – | Municipal Planning and Development Offices |
| MPP-EAS | – | Regional Program for the Prevention and Management of Marine Pollution in the East Asian Seas |
| MRFs | – | materials recovery facilities |
| NGOs | – | nongovernmental organizations |
| NSO | – | National Statistics Office |
| PEMSEA | – | Global Environment Facility/United Nations Development Programme/ International Maritime Organization Regional Programme on Partnerships in Environmental Management for the Seas of East Asia |
| PENRO | – | Provincial Environment and Natural Resources Office |
| PMO | – | Project Management Office |
| PPDO | – | Provincial Planning and Development Office |
| RQ | – | risk quotient |

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INTRODUCTION

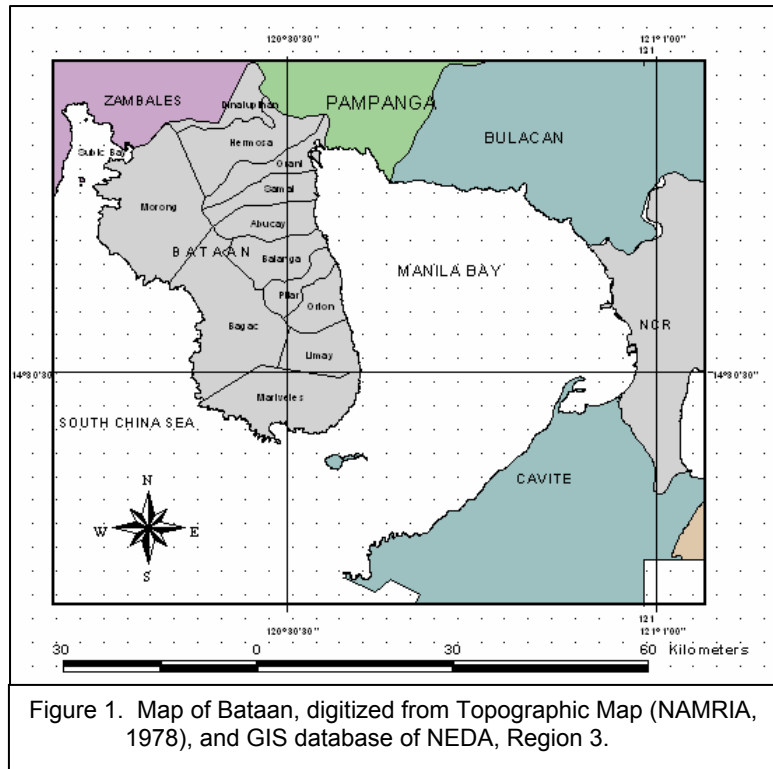
Information management is an essential tool in integrated coastal management since it can provide data and/or information needed in attaining the necessary outputs towards the realization of sustainable development goals in coastal areas. The Integrated Information Management System for Coastal and Marine Environment (IIMS) is a desktop database application that provides timely data recording, the updating of information for management and technological intervention, and also facilitates data sharing. PEMSEA developed the IIMS to assist stakeholders, managers, and decisionmakers to meet their information needs in a timely manner and in the required format (standardized).

The following paper describes how IIMS helped solve some of the information management issues in Bataan to facilitate not only improved environmental management but also to strengthen local governance.

DESCRIPTION OF ICM SITE IN BATAAN

The Bataan ICM Program was initiated in late 1999 as a joint effort of the provincial government and the local industry.

Bataan is a strategic peninsular province in the Philippines located at the southwestern tip of the Central Luzon Region and jutting out of the mouth of Manila Bay. It is bounded in the northwest by the province of Zambales, in the northeast by Pampanga, in the east by Manila Bay and in the west by the South China Sea. The province is composed of 12 municipalities covering a land area of 1,373 km². Its



capital is Balanga City, about 124 km by land from Manila City via San Fernando City, Pampanga and is 31.30 nautical miles from Manila City across Manila Bay. Except for the towns of Dinalupihan (the entry point from the north) and Hermosa, the rest of the municipalities are located in the coastal area. The towns of Samal, Orani, Abucay, Balanga, Pilar, Orion and Limay are located along the Manila Bay coastline in the east while Mariveles is in the southern end, facing the point where the Manila Bay meets the waters of the South China Sea. The towns of Bagac and Morong straddle the South China Sea coastline. Coastline is 177 km from Orani to Morong (Figure 1).

The province is drained by more than 100 rivers and small tributaries originating from three watershed groups such as the Subic watershed (from Morong to Bagac), the Mt. Natib watershed (Dinalupihan to Balanga City) and the Mariveles watershed (from Mariveles going to Pilar and Bagac). These watersheds provide water supply for irrigation and a reservoir in addition to an extensive groundwater reserve, extracted through numerous deepwells and freeflow areas in all municipalities. Most upland areas of Bataan are composed of rocky hills, brushlands, grasslands and plantation forests planted with various fast-

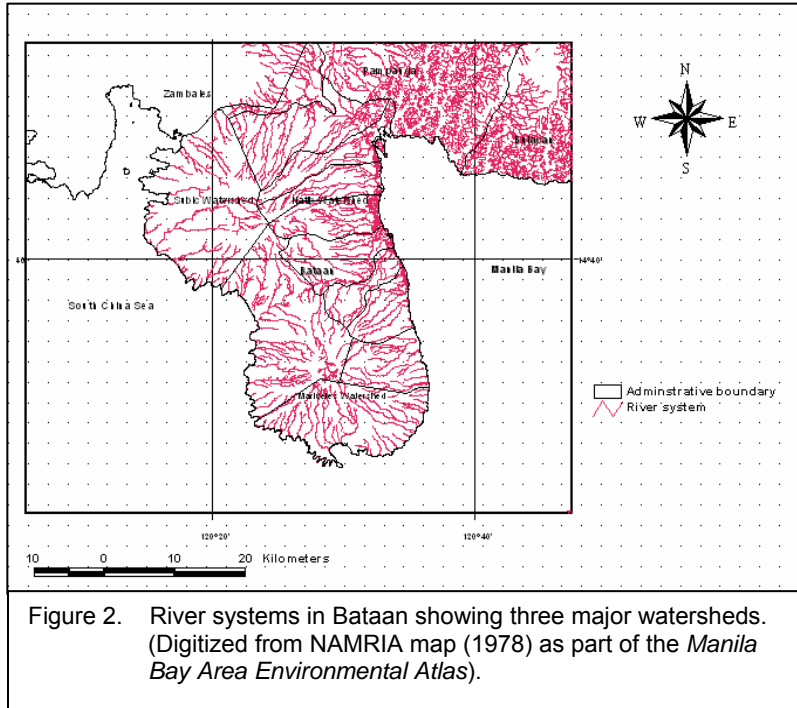
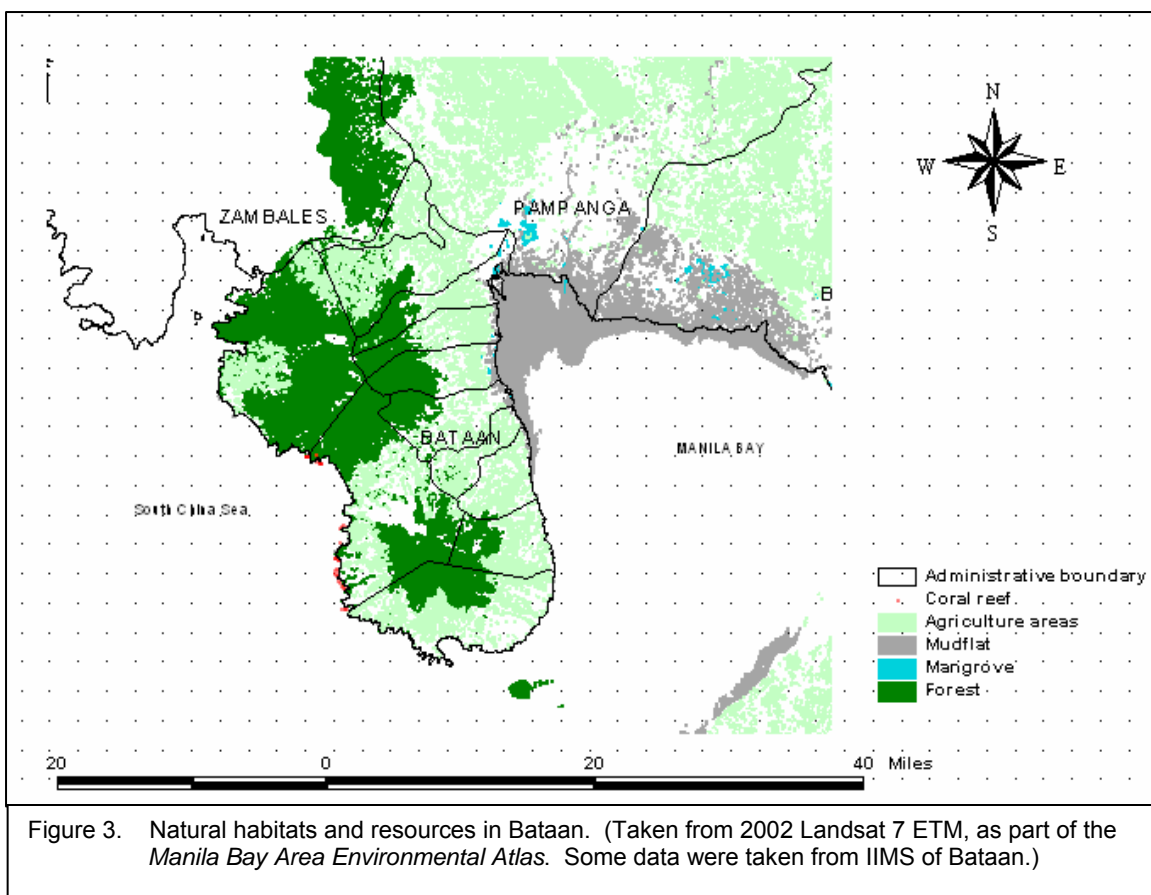


Figure 2. River systems in Bataan showing three major watersheds. (Digitized from NAMRIA map (1978) as part of the *Manila Bay Area Environmental Atlas*).

growing forest species such as the giant *ipil-ipil* and *gmelina*. These areas have mixed orchards such as cashew and mango plantations. Upland areas gently slope down to lowland areas, floodplains and coastal plains where most agricultural areas are located.

Bataan is divided by two mountain groups of volcanic origin (Figure 3). The northern side is composed of Mts. Natib, Sta. Rosa and Silangan. The southern area is composed of Mts. Mariveles, Cuyapo and Samat. A narrow pass from Pilar to Bagac separates the two mountain groups. The Bataan Natural Park, established in 1945 and with an area of 313 km², can be found in the northern mountain ranges. It is one of the protected areas in the Philippines owing to its biological diversity, serving as home to rare and endemic floral and faunal species. The park covers portions of the municipalities of Hermosa, Morong, Orani, Samal, Abucay and small areas of Balanga and Bagac.

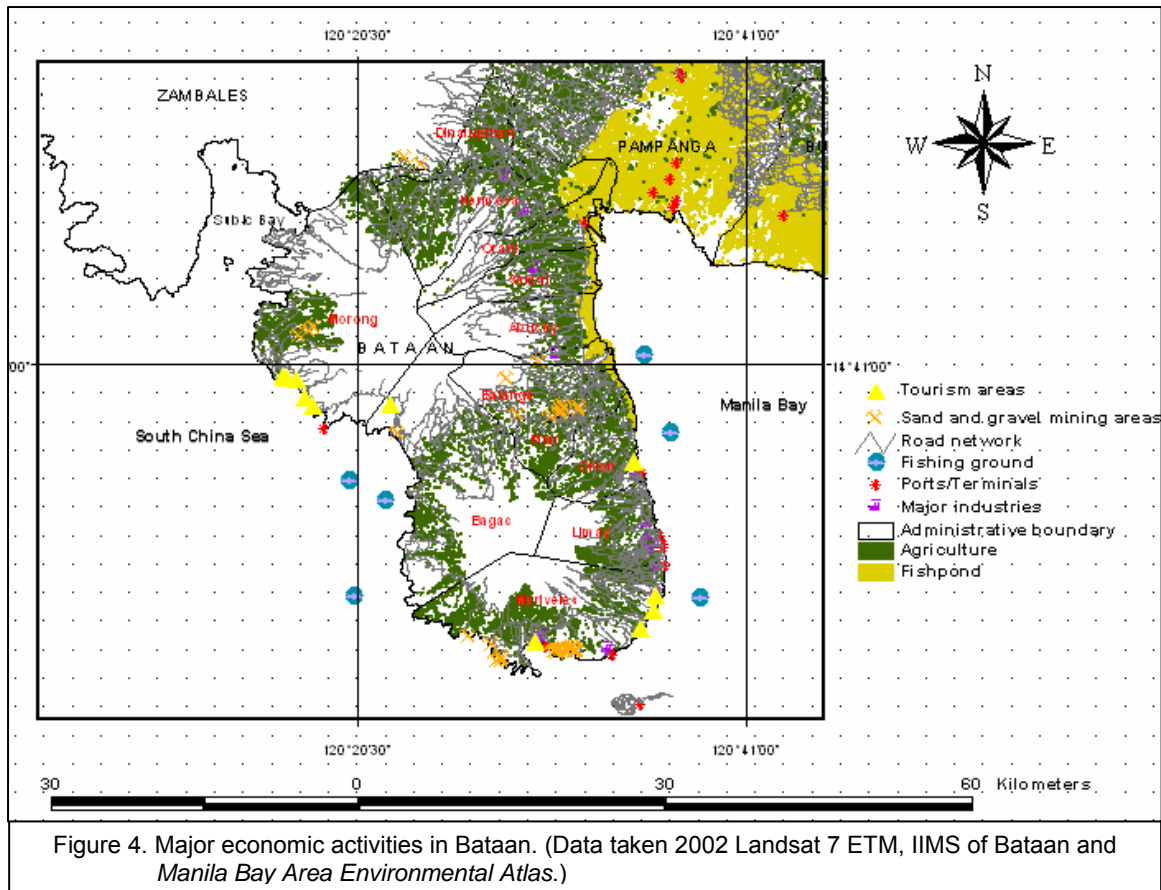


The Bataan-Manila Bay coastline in the east is characterized by an extensive estuarine and mudflat areas with patches of mangrove forests from Orani to parts of Limay (Figure 3), where mussels, oysters, mudcrabs and other shellfish abound. The deeper portions of Manila Bay from Orion going to Mariveles have a sandy to rocky character suitable for ports, industrial jetties, docking and other shipping activities. In the western side, Bataan has pristine and rocky beaches with coral reefs, seaweeds and seagrass beds. Coral reefs abound in the coastal areas of Mariveles near the mouth of the Manila Bay and in the north channel going to Bagac and Morong. The coastal waters of Bagac and Morong abound with numerous fish species associated with coral reef formations and seagrass patches. The area also serves as breeding areas of marine turtles (*pawikans*), particularly, olive ridleys, the smallest marine turtle species. A turtle sanctuary has been established in Barangay Nagbalayong, Morong, and is managed by a community-based organization.

The source of livelihood in the province is agriculture, aquaculture and fisheries, largely augmented by employment in various industries hosted by the province (Figure 4). Rice, vegetables and fruits are the main agricultural products along with a variety of freshwater, brackish water and saltwater fishes, tiger prawns, mussels and oysters, mudcrabs and other shellfish. The main fishing grounds are the Manila Bay and the South China Sea.

Bataan serves as the industrial heartland of Central Luzon, being the host for such anchor industries as an oil refinery, a petrochemical park, an arsenal development plant, an export processing zone, light industry technology parks, a shipyard and several ports for private and industrial uses. Bataan is a prime business and tourism hub in Central Luzon as well as transshipment area for about 30,000 vessels making port calls in the Manila Bay area.

Bataan's population, as of the year 2000, was about 557,659 with an annual growth rate of 2.74, the highest among the provinces in Central Luzon, and even higher

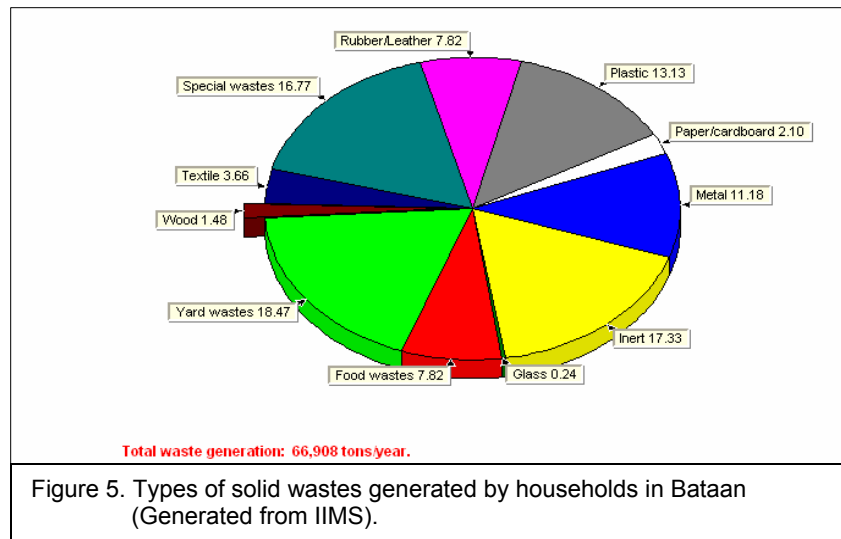


than the national annual growth rate average of 2.24. About 35 percent of Bataan's population resides in coastal areas (NSO, 2000).

Owing to its burgeoning population and growing economic demands, Bataan's natural resources and overall environmental integrity cannot avoid pressure and ecological stress. In 2001, the Bataan ICM program formulated the Bataan Coastal Strategy to serve as the province's sustainable development framework. As presented in the coastal strategy, the major environmental problems in Bataan are:

a. Solid waste and water pollution

The solid waste problem stems out from the lack of appropriate solid waste management to address the impact of wastes coming from residential, commercial and industrial areas. This is compounded by a lack of awareness on proper waste management practices by the burgeoning population. Figure 5 shows the type of waste generated by households in year 2000.



Water pollution is caused by lack of sewage facilities and uncontrolled and untreated discharges from various sources such as residential, industrial and commercial establishments. Sea-based activities, such as ports, shipping, fisheries and aquaculture, also contribute to the pollution loading of the coastal waters.

b. Habitat degradation and overexploitation of natural resources

Through the years, rapid development and the burgeoning population contributed to habitat degradation and overexploitation of natural resources. Mangrove, mudflat areas and beaches were converted to fishponds; forests and upland areas gave way to intensive agriculture and mineral extraction; rich agricultural areas were converted to residential, commercial and industrial areas. These are compounded by lack of awareness among people on the importance of these habitats and impacts of misuse and their ensuing destruction and uncontrolled economic development.

c. Siltation and sedimentation

While these are natural processes, inappropriate development, such as unsustainable extraction of forest cover, shifting cultivation in upland areas, unsustainable agriculture, mining and quarrying, hastened siltation and sedimentation. This is also compounded by the reclamation of coastal areas and the conversion of mangrove areas for other uses. Solid waste accumulation in waterways also contributes to siltation, which results in the shallowing of waterways, and causes flooding in some low-lying areas.

d. Overfishing, illegal and destructive fishing

In 1987, a fisher can catch 46 kg of fish in an hour in Manila Bay. By 1993, an hour's fishing netted about 10 kg (MBEMP, 2004). In Bataan today, a sustenance fisher spends 3–5 hours but is barely able to catch 10 kg of fish. Overfishing is prevalent in Manila Bay due to population increase, lack of alternative livelihood opportunities and open access to fishery resources. The situation is compounded by illegal and destructive fishing such as the use of dynamite and cyanide. There is also a lack of awareness on this issue, short-term motives and easy-money schemes,

political accommodation and lack of political will, as well as ineffective law enforcement and poor decisionmaking processes.

e. Multiple-use conflicts

Multiple-use conflicts among users and beneficiaries of the coastal resources arose due to the fact that the various users derived various benefits from a common resource-base, creating different interests and conflicts. Use-conflicts are also caused by lack of integrative management approaches, lack of coastal use zonation scheme which may also result in loose coordination among stakeholders, overlapping and conflicting priorities accorded to the use of resources.

PROVIDING THE FRAMEWORK: THE BATAAN COASTAL STRATEGY

To address issues and to conserve the natural, cultural and economic values of the province, the Bataan Coastal Strategy was formulated as one of the efforts of the ICM program and the stakeholders. The Bataan Coastal Strategy (BCS) is a framework for coastal management in the Province of Bataan. It embodies the vision and mission of the people of Bataan to chart a course of action for the preservation of Bataan's rich natural endowments. The BCS constitutes broad statements of actions which serve as a comprehensive framework that provide directions in achieving targeted outcomes and formulating a series of action plans and programs which will involve the concerted efforts of all stakeholders (PMO-BIGKIS-Bataan, 2001). The BCS was adopted by the Provincial Board of Bataan as the primary framework for sustainable coastal development and democratic environmental governance (Erni, et al., 2004).

The BCS stipulates the establishment of IIMS as one of the action programs under the Develop Strategy: to ensure that data collection, research and environmental monitoring, information management and analysis are coordinated and will provide concrete direction and support to management, policymaking and decisionmaking." This objective identified the establishment of an Integrated Information Management System (IIMS) with geographic information system (GIS) capability as a centralized data collection service and information processing (PMO-BIGKIS Bataan, 2001, 54 p).

The establishment of IIMS would facilitate the operationalization and implementation of the various strategies and action programs listed in the BCS, and implementation of ICM. This will be done through the provision of required data or information at the provincial/city or municipal levels. Some examples are presented in Box 1.

Box 1. Information Requirements for the ICM Program and Implementation of the BCS that can be provided by IIMS.

ICM Program Implementation

Coastal Environmental Profile

- Demographic characteristics
- Socioeconomic activities and their contribution to the economy
- Rules, laws and ordinances
- Key/major stakeholders
- Biological habitats and resources in the area, their location and stock
- Location of industries, tourism establishment, mining sites, dumpsites

Environmental Risk Assessment

- Sources of pollutions and concentration of contaminants in the water column, sediment, groundwater and in fish and shellfish tissues, including standards/criteria for each contaminant
- Risk quotient for each contaminants for the conduct of risk assessment
- Biological habitats and their status

Institutional Arrangements

- Government agencies, nongovernmental organizations (NGOs), the private sector and civil society groups involved in environmental management
- Related regulations, laws, rules and ordinances

Coastal Strategy Implementation

Coastal Use Planning and Zoning

- Land use plans, development plans, environmental management plans
- Existing ordinances, laws and regulations
- Economic activities
- Data used in environmental profiling

Solid Waste Management

- Location and capacity of existing dumpsite
- Solid waste load projections
- Existing ordinances and laws
- Types of solid waste and corresponding volume

Permitting and Licensing

- Mining areas
- Volume of extraction
- List of existing permits

ROLE OF IIMS IN RESOLVING INFORMATION MANAGEMENT ISSUES

The establishment of IIMS in Bataan faced major challenges, including capacities of staff, lack of computer facilities and appropriate institutional setup to ensure sustainability of IIMS in the province and municipalities. Data management in various municipalities in the province is being done manually, except for Balanga City where a computerized system for permitting exists. Most of the offices or departments maintain their own filing system. While some offices have computers, they are mostly used for word processing or spreadsheets. In some cases, data are stored in spreadsheet formats such as MS Excel. None of the municipalities' planning, agriculture or fishery offices have a database management system where data can be stored and accessed easily.

The Municipal Planning and Development Offices (MPDOs) have the most comprehensive collection of data among the different units in the municipalities. Data are gathered from various units and collated at the MPDO for purposes of preparing socioeconomic profiles, municipal development plans, comprehensive land-use plans and other required reports. The MPDOs, however, do not have any information management system that would support their planning needs so that data are retrieved easily and presented in the required format.

Issues related to information management in the municipal and provincial offices include repository of data, data collection, data format, access to information and presentation in the required format, and spatial data analysis. These are clearly shown in Annex 1, where the data repository, type of data, manner of collection and access are identified. The IIMS can assist local government units (LGUs) to overcome these constraints.

Repository of Data

There is no central repository of data in any LGU. Each sector/department collects and stores its own data based on its needs. Data are stored manually, usually in a folder and are available in hard copies or sometimes in digital format such as MS Word or MS Excel. Agencies or units in need of the data are responsible for compiling and

presenting them in the format required. The planning units, for instance, when preparing a socioeconomic profile or a medium-term development plan, compile data from each sector. Annex 1 shows some examples of data being handled by different units at the municipal and provincial level.

This situation results to difficulties in consolidating data from the different offices, slow data access and retrieval, and poor maintenance of the databases of each office. This arrangement is not also secured and there are more chances of losing data or misplacing folders compared to a computerized system.

IIMS provides a central repository of data where each office can store and retrieve data systematically. The categories of data that can be stored in IIMS are presented in Box 2. Data are categorized according to sectors. In a municipality, adopting IIMS as database platform would require various offices to store data based on the sectors they represent. An agricultural office will store its data under the socioeconomic category — agriculture and fisheries category and the biological resources category. Similarly, tourism, health, engineering, education offices can store their data in the corresponding categories. In this way, data from sectors are stored in just one database that can be accessed by all departments.

Box 2. Categories of Data in IIMS.

Regional codes, data codes and geospatial category

Data about the site, data classification in the database, geospatial data, water bodies and maps

Bioresources and biological data

Data on habitat and biological resources that can be found in the sites, including fisheries, coral reefs, seagrass and seaweed, plankton, wetlands and forests

Socioeconomic category

Data on various socioeconomic activities having impact to the environment. These include fisheries, tourism, mining, industrial development, commercial and institutional establishments, provision of basic utilities and forestry

Demographic category

Data on population such as census, income, education, employment, vital health statistics, religious affiliation and incidence of poverty

Institutional category

Data on government agencies with mandates on environment and related fields, and other sectors involved in the management of the environment.

Pollution sources category

Data on land-based and sea-based sources of pollution such as industrial discharges, hazardous wastes, solid waste, river pollution, and spills of oil and chemicals

Monitoring data category

Parameters on water and sediment quality of water bodies, contamination of tissues of fish/shellfish and ground water quality

Physiographic category

Data on oceanography and hydrology

Model inventory category

Results generated from models such as oil spill and predictive models

Insufficient Data for Coastal and Marine Environment

While there are already available data at the municipal and provincial offices, data for coastal and marine environment are lacking. For instance, data on water quality of rivers, hazardous waste, discharges coming from industries, existing status of coastal habitats and resources, solid waste, and other data on habitats and resources are lacking. Some national agencies, the private sector and NGOs have some of these data which they can share with the local government for better environmental management. In some cases, the local government may not be aware of available data from these sources, such as data that may be useful for better coastal and marine management.

The IIMS does not only provide a database but also serves as a guide on the important data needed in coastal and marine environment. Each field or datum serves a specific purpose. For instance, the longitude and latitude in some entry forms would allow linking the database to a GIS map to enhance spatial analysis. Data on volume and value of production in each economic activity are useful in determining values of coastal resources and benefits derived from them. The levels of concentration of contaminants are important in determining the risks of these contaminants emanating through the environment to human and ecosystems health, which will be further used to determine the type of management intervention needed to prevent or reduce those risks.

Data are not uniform in format and in level of aggregation

Formats of data are not standardized and not readily available for decisionmaking. For instance, 'area' is expressed in square kilometers or hectares. Some data are also aggregated at different levels such as monthly, quarterly or annually. Some data are aggregated at *barangay*, municipal or provincial levels. This situation makes data analysis and packaging more difficult as the data has to be converted into a uniform unit of measure and consolidated into uniform temporal and spatial aggregation.

To solve these problems, IIMS was developed to standardize the unit of measure and level of data aggregation for each datum, resulting in lesser time spent for analyzing and packaging data into a format required by users. In packaging information for planning and decisionmaking, users will no longer convert each time they use data from

IIMS but instead have a readily available data of uniform format and level of aggregation that makes their task easier.

Information is not readily accessible in a required format

Access to timely data is also a problem, along with the lack of a central data repository where anyone can go and access reports. Data are kept by different units within the municipality. One has to visit all the offices concerned to collect data. This problem is compounded by the lack of staff to prepare the requests as it takes time to retrieve and package information required by data users. For instance, MPDOs have only 2–5 staff already tasked with the preparation of plans, profiles and other reports. After data is requested, it takes time to prepare the required data and usually, researchers are told to return when the information is ready. In some cases, whatever reports available are the ones loaned to the researchers. The number of users who can access these data depends on the number of copies of reports in those units.

With IIMS, data stored can be accessed and presented in tabular or graphical format using its query system. Researchers can be provided with certain degrees of access to the database without any fear for system security, such as breaches resulting in data being altered.

Lack of spatial analysis

Projecting information into map and analyzing them provides clear pictures on how the local government programs and management intervention impacts on various locations, especially the critical ones. At the municipal/city level, except for Balanga City, spatial analysis of data or information is lacking. Some maps do not have the projections or scale to allow stakeholders or users to conduct further analysis. Maps are in hard copies and sometimes not available. Spatial analysis is important in land-use planning, zoning, road construction, establishment of waste management facilities, providing health services and other environmental, social and economic programs.

The IIMS can be linked with a GIS database that allows spatial analysis. This provides a clear view on how actions impact on critical areas. With this information,

actions to be taken would not lead to any or further damage. An example of linking IIMS and GIS database is the case in sand and gravel mining as described in the section on permitting.

APPLICATIONS IN COASTAL AND MARINE MANAGEMENT

Environmental Profile

A coastal environmental profile describes and assesses the state of a coastal area to prioritize issues and draw corresponding options to address these issues. It describes features of the area such as biophysical characteristics, socioeconomic activities, demographic characteristics, state of the environment in terms of water quality, legal and institutional arrangements, and resource-use patterns.

The following are examples of information presented in tabular or graphical format that can be generated out of the IIMS database.

Natural Resources and Habitats

Knowledge on resources and habitats in terms of their quality and quantity and their location will allow program implementers and stakeholders to determine the course of actions to undertake for their conservation. For the case of Bataan, these are also important in regulating permits to aquarium fish gatherers in the area, including areas to be

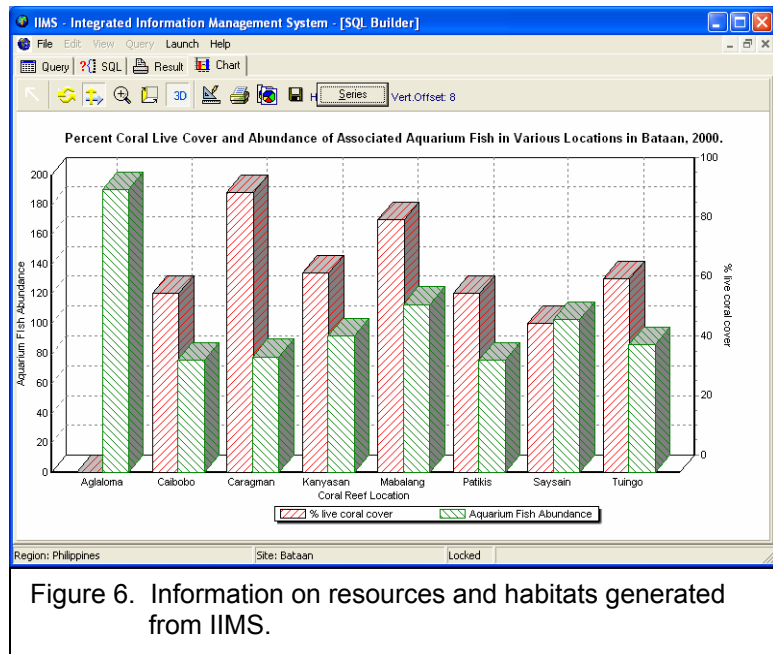


Figure 6. Information on resources and habitats generated from IIMS.

protected such as those with fragile coral reefs or those areas with lesser abundance of aquarium fish. Figure 6 shows the percentage of live cover of coral reefs and associated aquarium fish species. From the information, the awarding of permits for aquarium fish gatherers in terms of site and species can be regulated to ensure sustainability of the habitat and resources.

Figure 7 shows the distribution of mangrove areas in Bataan along the Manila Bay coastline. There are few remaining mangrove areas in the province, most of which are already replanted.

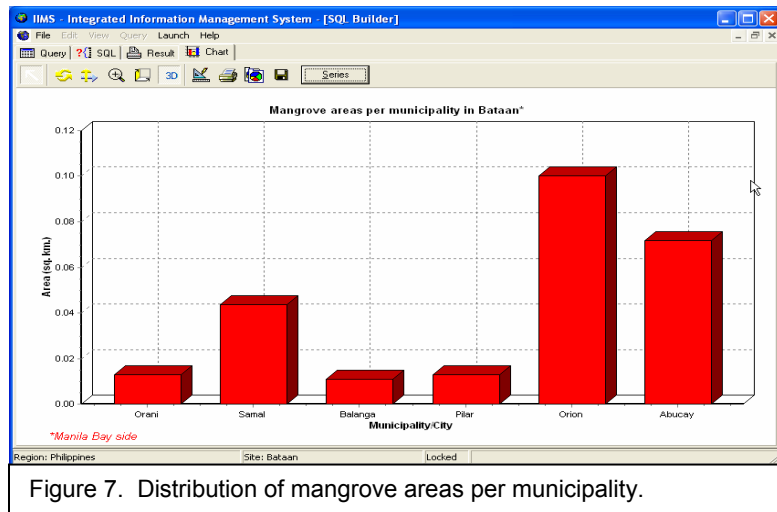


Figure 7. Distribution of mangrove areas per municipality.

Livestock Waste Load

IIMS can also store data on animal waste load per type of animal, which can be important inputs to assess the pollution load of livestock and poultry farms into the environment.

Wastes from livestock farms contribute to pollution of waterways, which eventually contribute to siltation of these waterways. Table 1 is an example of information generated from IIMS on the waste loading of livestock per type of animal. This information can be used to

| Animal | Waste (metric ton/year) |
|-------------------|-------------------------|
| Carabao | 14,105 |
| Cattle | 14,083 |
| Chicken (broiler) | 394 |
| Chicken (layer) | 180 |
| Chicken (native) | 804 |
| Ducks | 99 |
| Goat | 1,439 |
| Hog | 6,519 |
| Pigeon | 2 |
| Total | 37,625 |

formulate actions to mitigate the impacts of animal waste in waterways and in the community. The information can also be presented graphically using IIMS.

Institutional Arrangements

IIMS can also capture data on institutional aspects such as government agencies involved in environmental management and related mandates, plans and programs of these agencies, including ordinances, resolutions and laws. These data are useful in assessing appropriate institutional arrangements for ICM or in coastal use zoning. Table 2 is an example of an output listing, through IIMS, of some ordinances related to environmental management in the Municipality of Morong.

Table 2. Municipal Ordinances Related to Coastal Management, Municipality of Morong, Bataan.

| Effective Date | Ordinance |
|-----------------------|---|
| 03/08/1993 | Municipal Ordinance No. 04-93: Prohibiting the residents to dispose their garbage in rivers, roads to maintain the cleanliness of the community. |
| 10/28/1996 | Municipal Ordinance No. 04 Series of 1996: An ordinance prohibiting and penalizing selling/disposing and buying/acquiring public lands or national parks. |
| 01/18/1999 | Municipal Ordinance No. 04 Series of 1999: Regulating the gathering, shipment, sale and distribution of shellfish within the municipality of Morong, Province of Bataan. |
| 02/22/1999 | Municipal Resolution No. 9 Series of 1999: Resolution penalizing unsanitary backyard piggery owners emitting bad odor inimical to the health of neighboring residents. |
| 06/07/1999 | Municipal Resolution No. 24 Series of 1999: Resolution enacting Municipal Ordinance No. 06, otherwise known as an ordinance on DENR Pawikan Conservation Project (PCP) within the Municipality of Morong, Province of Bataan. |
| 03/06/2000 | Municipal Ordinance No. 10 Series of 2000: Basic Fishery Ordinance No. 10 of the Municipality of Morong. |
| 01/06/2000 | Municipal Ordinance No 11, Series of 2000: Comprehensive Solid Waste Ordinance of the Municipality of Morong. |
| 10/03/2001 | Municipal Resolution No. 70 Series of 2001: A resolution approving the establishment of a fish cage project by the Alson Aquatic Technologies, Inc. at Subic Bay Freeport Zone. |
| 12/10/2001 | Municipal Resolution No. 15, Series of 2001: Resolution on the establishment of Fisheries and Aquatic Resources Management Councils (FARMCs) in the Municipality of Morong. |

Table 2. Municipal Ordinances Related to Coastal Management, Municipality of Morong, Bataan.

| Effective Date | Ordinance |
|----------------|--|
| 12/12/2001 | Municipal Resolution No. 88 Series of 2001: Resolution adopting the comprehensive land use plan of the Municipality of Morong, Bataan. |
| 03/11/2002 | Municipal Resolution No. 16 Series of 2002: Resolution reserving an area within the municipal water of Morong for the establishment of a mariculture park. |
| 05/13/2002 | Municipal Resolution No. 36 Series of 2002: Resolution requesting Hon. Secretary Patricia A. Sto. Tomas, Department of Labor and Employment (DOLE) to assist in sourcing out financial assistance to the municipality of Morong for acquiring of two (2) units of patrol boats with an estimated cost of PhP 400,000. |
| 09/02/2002 | Municipal Resolution No. 70-A Series of 2002: Resolution requesting the Department of Environment and Natural Resources (DENR) through the Provincial Environment and Natural Resources Office (PENRO) and Community Environment and Natural Resources Office (CENRO) to determine the boundaries of alienable and disposable land from foreshore land area. |
| 09/02/2002 | Municipal Resolution No. 66 Series of 2002 Resolution authorizing the Honorable Municipal Mayor Norberto G. Linao Jr. of the Municipality of Morong, Province of Bataan as a signatory to the Memorandum of Agreement (MOA) for the Integrated Fisheries and Aquatic Resources Management Council (IFARMC). |

Environmental Risk Assessment

“Environmental risk assessment involves estimating the likelihood of harm being done to human health and/or ecosystems through factors emanating from human activities that reach their targets via the natural environment” (MPP-EAS, 1999, 2 p). The results of environmental risk assessment are used to provide bases for managing the risk. They roughly indicate the priorities for management actions which can be basis for identifying options available to control the risk.

IIMS can be used to facilitate the process of risk assessment. Aside from the data that can be generated from the database, IIMS has the capacity to

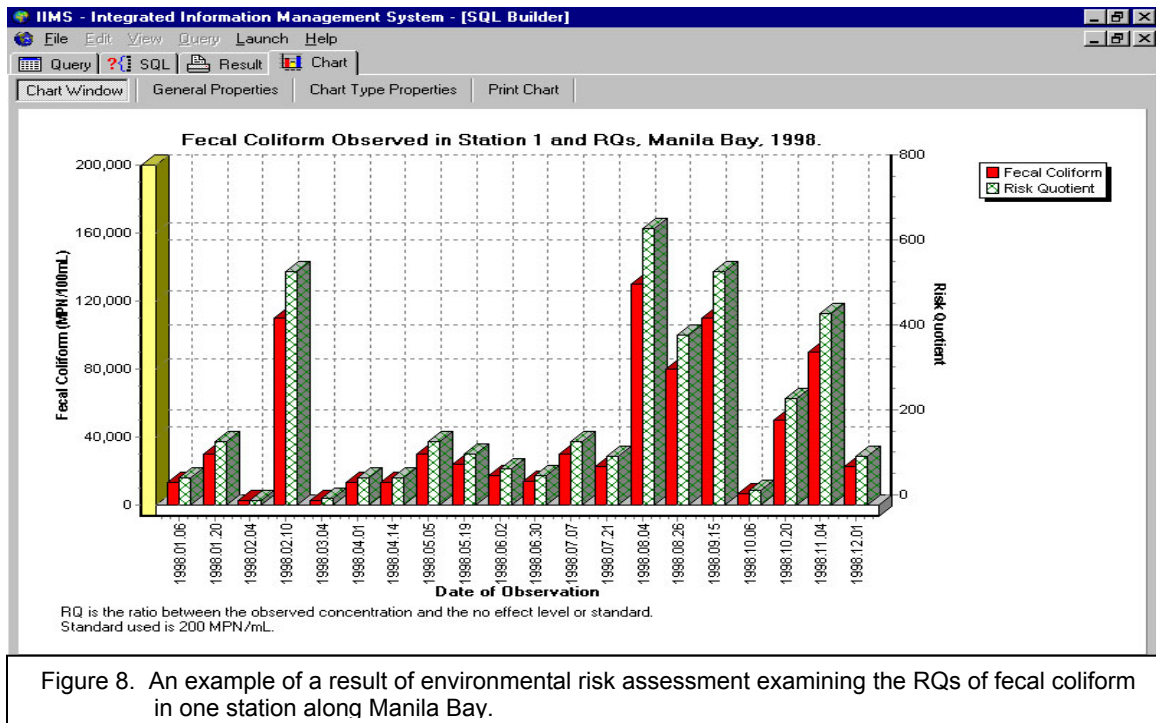
Risk quotient (RQ)

$$RQ = \frac{\text{estimated_exposure_concentration}}{\text{Threshold_no_effect_concentration}}$$

If RQ ≥ 1, a management action is required to control the risk.

compute for the risk quotient (RQ) using its query system and provides preliminary analysis.

An example of a risk assessment done in Manila Bay is shown in Figure 8. In this example, all RQs > 1. A management action is required to address the risk on human health. This can also be undertaken in Bataan.



Environmental Investments

IIMS was used to facilitate the process of conducting contingent valuation survey in Bataan for the integrated solid waste management facility. In contingent valuation, data on population of coastal communities, their income and expenditure and types and volume of waste generated were provided by IIMS. IIMS can also provide necessary information in the conduct of a pre-feasibility study for a waste management facility. Data on demographic characteristic, solid waste loading, assessing proposed sites, institutional aspects and others are provided in a format required by the study. Below are

some examples on how data were analyzed and presented to facilitate the development of environmental investment.

Assessing Location of Existing Dumpsites

In designing an integrated solid waste management facility, IIMS and GIS can be employed especially in assessing the location of the facility. In

Box 3. Clustering of Municipalities for MRF.

Cluster 1 – Dinalupihan, Orani, Hermosa and Samal
 Cluster 2 – Abucay, Balanga, Pilar, **Orion** and Limay
 Cluster 3 – Mariveles, **Bagac**, Morong

Bataan, the solid waste management design called for the formation of three clusters of municipalities (Box 3). A centralized sanitary landfill will be established in the municipality of Bagac along with three materials recovery facilities (MRFs) to be put up for each cluster. For existing dumpsites (Figure 9), one from each cluster will be converted into MRF. In selecting which dumpsite would be used for each cluster, the distances from the municipality were estimated, and the shortest hauling distance was considered. The proposed MRF for each cluster is presented in Figure 10. Take note however, that there are other criteria in selecting sites for solid waste management facility where IIMS and GIS can be used to facilitate assessment.

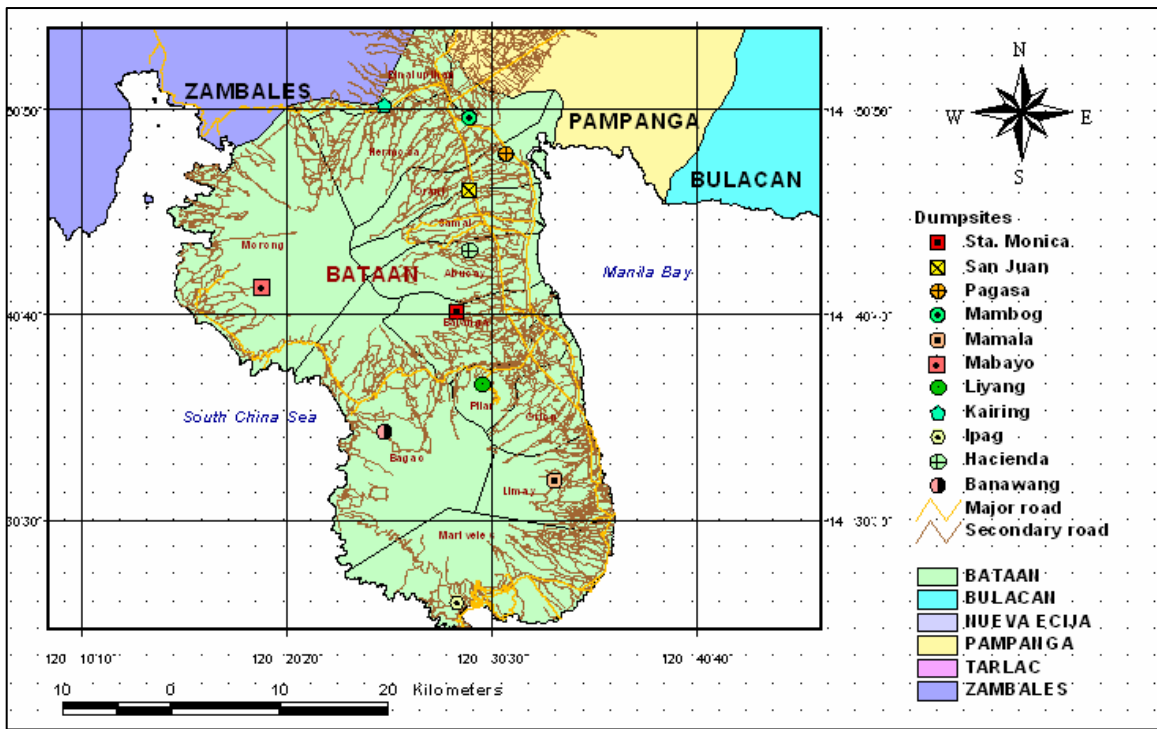


Figure 9. Existing dumpsites in Bataan and their proximity to the road network.

The use of IIMS and GIS was displayed in Figure 9, where the provincial/municipal administrative boundary was used as the base map. The road map was overlaid to visualize the existing major and secondary roads in relation to the municipal boundary. The data on existing dumpsites from the IIMS database were linked and projected into the GIS map. With these overlays, one can infer that most of the dumpsites can only be accessed through a secondary road, most of which are rough roads.

Following the clusters of municipalities, three sites were selected for MRF establishment based on the hauling distances from the municipalities under each cluster (Figure 10). This information can be used to initially validate and further assess the sites by considering other criteria set forth by RA 9003, the Ecological Waste Management Act of the Philippines.

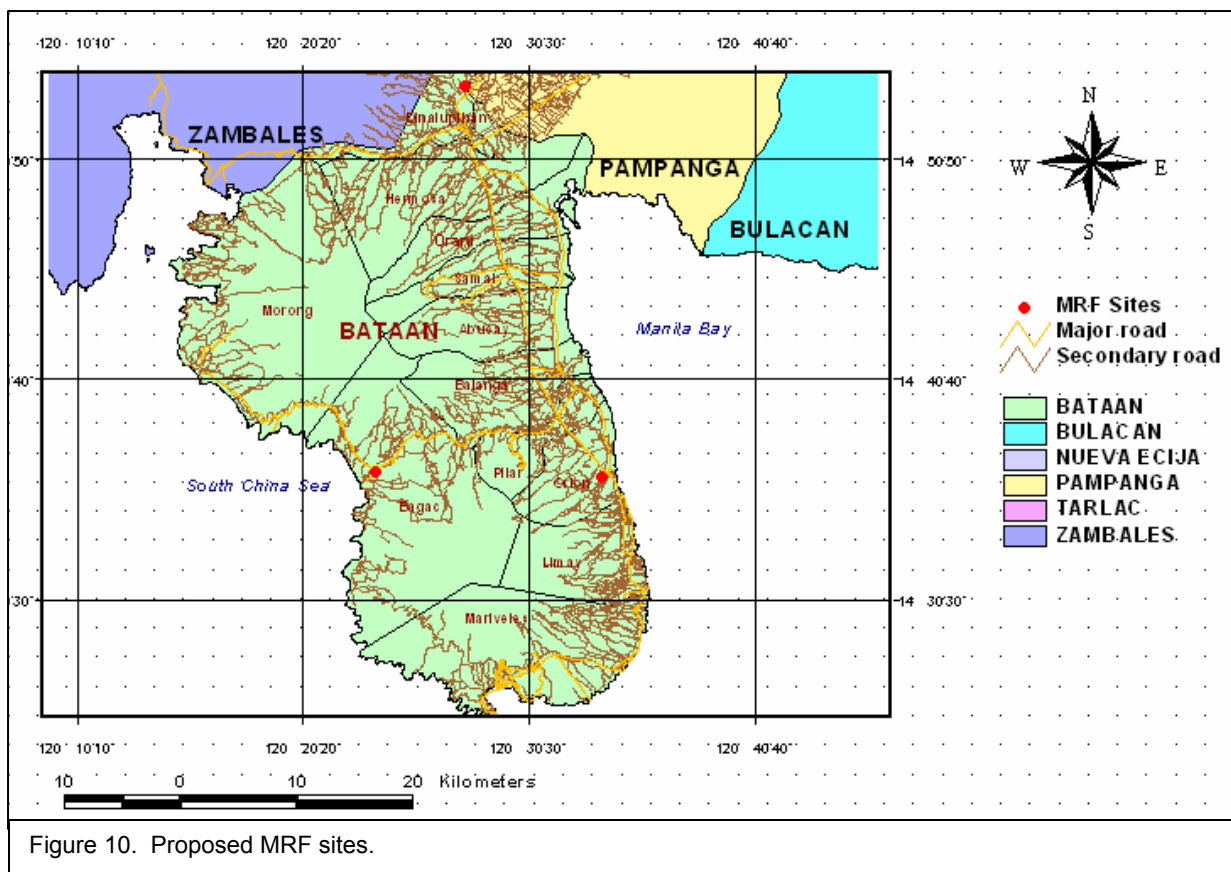


Figure 10. Proposed MRF sites.

IIMS and GIS can also be used in other stages or phases of environmental investments, such as the planning and construction of the facility and even during its operations.

Projecting Population and Waste Generation

In determining the capacity of a solid waste management facility like a sanitary landfill, one has to project the volume or weight of waste generation based on a projected population over a period of time. IIMS can provide and perform initial data analysis such as determining population growth and projecting the population over a period of years. With the projected population and existing waste generation, one can project waste volume, which should be considered in designing the facility.

Using data on census of population in 1995 and 2000 (Figure 11), there are two ways to use IIMS in computing the population growth rate and the population projection: a) use the SQL builder; and b) export to MS Excel for further computations. Using MS Excel, the growth rate and the population projection for the next five years, for instance, is shown in Table 3.

Once the population has been projected over a period of time, (e.g., from 2005 to 2010), waste generation can be computed using the 2000 waste generation for each municipality (Figure 12). Projection

Box 4. Projecting the number of population.

$$y = x(1 + i)^n$$

where i = growth rate, usually computed considering sex, fertility rate, mortality rate and migration.
y = the population in year 2
x = the population in year 1
n = number of years

| Municipality_City | DataYear | Tot_Population |
|-------------------|----------|----------------|
| Abucay | 1995 | 29270 |
| Abucay | 2000 | 31796 |
| Balanga | 1995 | 60912 |
| Balanga | 2000 | 70753 |
| Dinalupihan | 1995 | 65159 |
| Dinalupihan | 2000 | 76114 |
| Hermosa | 1995 | 38764 |
| Hermosa | 2000 | 46176 |
| Limay | 1995 | 40064 |
| Limay | 2000 | 46587 |
| Mariveles | 1995 | 76626 |
| Mariveles | 2000 | 85317 |
| Morong | 1995 | 18731 |
| Morong | 2000 | 21273 |
| Orani | 1995 | 48695 |
| Orani | 2000 | 52430 |
| Orion | 1995 | 39537 |
| Orion | 2000 | 43990 |
| Pilar | 1995 | 28207 |
| Pilar | 2000 | 32318 |
| Samal | 1995 | 24560 |
| Samal | 2000 | 27382 |
| Bagac | 1995 | 20894 |
| Bagac | 2000 | 22353 |

Region: Philippines Site: Bataan

Figure 11. Number of population during two census years as stored and generated from IIMS.

for each year can be used to compute 'per capita' waste generation in 2000, which will be used to determine the waste generation for each municipality per year. The projected waste generation from 2005 to 2010 is shown in Table 4.

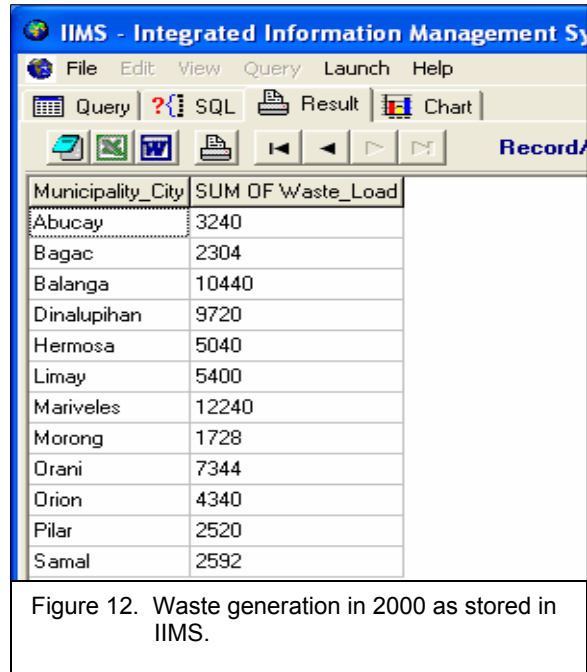


Table 3. Population Projection from 2005 to 2010.

| Municipality/City | 1995 | 2000 | Growth rate* | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|-------------------|--------|--------|--------------|--------|--------|---------|---------|---------|---------|
| Abucay | 29,270 | 31,796 | 1.79 | 34,745 | 35,367 | 36,000 | 36,645 | 37,301 | 37,969 |
| Bagac | 20,894 | 22,353 | 1.44 | 34,009 | 24,355 | 24,706 | 25,062 | 25,423 | 25,789 |
| Balanga | 60,912 | 70,753 | 3.37 | 83,506 | 86,320 | 89,229 | 92,236 | 95,344 | 98,558 |
| Dinalupihan | 65,159 | 76,114 | 3.4 | 89,964 | 93,022 | 96,185 | 99,456 | 102,837 | 106,333 |
| Hermosa | 38,764 | 46,176 | 3.86 | 55,803 | 57,957 | 60,194 | 62,518 | 64,931 | 67,437 |
| Limay | 40,064 | 46,587 | 3.79 | 56,110 | 58,237 | 60,444 | 62,735 | 65,112 | 67,580 |
| Mariveles | 76,626 | 85,317 | 2.45 | 96,293 | 98,652 | 101,069 | 103,546 | 106,082 | 108,681 |
| Morong | 18,731 | 21,273 | 2.78 | 24,399 | 25,077 | 25,774 | 26,491 | 27,227 | 27,984 |
| Orani | 48,695 | 52,430 | 1.63 | 56,845 | 57,771 | 58,713 | 59,670 | 60,643 | 61,631 |
| Orion | 39,537 | 43,990 | 2.35 | 49,408 | 50,569 | 51,757 | 52,973 | 54,218 | 55,492 |
| Pilar | 28,207 | 32,318 | 2.99 | 37,447 | 38,567 | 39,720 | 40,908 | 42,131 | 43,391 |
| Samal | 24,560 | 27,382 | 2.38 | 30,799 | 31,532 | 32,283 | 33,051 | 33,838 | 34,643 |

*Based on the Bataan Socioeconomic Profile, 2004.

Table 4. Projected Waste Generation from 2005 to 2010.

| Municipality/ City | Waste generation in 2000 | Waste generation per capita, 2000 | Waste generation (tons/year) | | | | | |
|-----------------------|--------------------------------|--|------------------------------|--------|--------|--------|--------|--------|
| | | | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Abucay | 3,240 | 0.1018996 | 3,520 | 3,638 | 3,638 | 3,699 | 3,761 | 3,823 |
| Bagac | 2,304 | 0.1030734 | 2,465 | 2,498 | 2,532 | 2,567 | 2,602 | 2,637 |
| Balanga | 10,440 | 0.1475556 | 12,127 | 12,495 | 12,875 | 13,267 | 13,670 | 14,086 |
| Dinalupihan | 9,720 | 0.1277032 | 11,354 | 11,713 | 12,082 | 12,464 | 12,857 | 13,263 |
| Hermosa | 5,040 | 0.1091476 | 6,004 | 6,218 | 6,439 | 6,668 | 6,906 | 7,152 |
| Limay | 5,400 | 0.1159122 | 6,279 | 6,472 | 6,670 | 6,874 | 7,085 | 7,302 |
| Mariveles | 12,240 | 0.1434650 | 13,628 | 13,924 | 14,227 | 14,536 | 14,851 | 15,174 |
| Morong | 1,728 | 0.0812297 | 1,963 | 2,013 | 2,065 | 2,118 | 2,173 | 2,229 |
| Orani | 7,344 | 0.1400725 | 7,907 | 8,025 | 8,145 | 8,266 | 8,389 | 8,514 |
| Orion | 4,340 | 0.0986588 | 4,829 | 4,933 | 5,039 | 5,148 | 5,259 | 5,373 |
| Pilar | 2,520 | 0.0779751 | 2,887 | 2,967 | 3,049 | 3,133 | 3,219 | 3,308 |
| Samal | 2,592 | 0.0946607 | 2,890 | 2,953 | 3,018 | 2,085 | 3,153 | 3,222 |

There are other applications of IIMS in coastal and marine management, such as environmental risk assessment, coastal use planning and zoning, environmental investments, environmental impact assessment, oil spill contingency planning and others, including establishing baseline information for a site.

APPLICATIONS IN LOCAL GOVERNANCE

There are several applications of IIMS in local governance, ranging from compiling the socioeconomic profile to planning and monitoring of programs and projects.

Socioeconomic Profile

The socioeconomic profile of the cities, municipalities and provinces are prepared and updated regularly. The profile describes physical characteristics, economic activities, demographic characteristics, health and nutrition aspects, utilities and services being provided by the local governments. The socioeconomic profiles are used as basis in development planning, land-use planning and other programs of the government.

IIMS contains most of the information needed in compiling the socioeconomic profile. Once the database is established and updated regularly, during updating, the burden of collecting data from various sectors and compiling them is lessened. Examples of data/information needed in socioeconomic profiles are shown below.

Population in the Province by Year

Population distributed by census years are used in projecting population over a period so that programs and management intervention are planned based on the needs of the population during a certain year. Examples are utility services, health services, housing and livelihood programs. Figure 13 illustrates the population per municipality/city in a given census year.

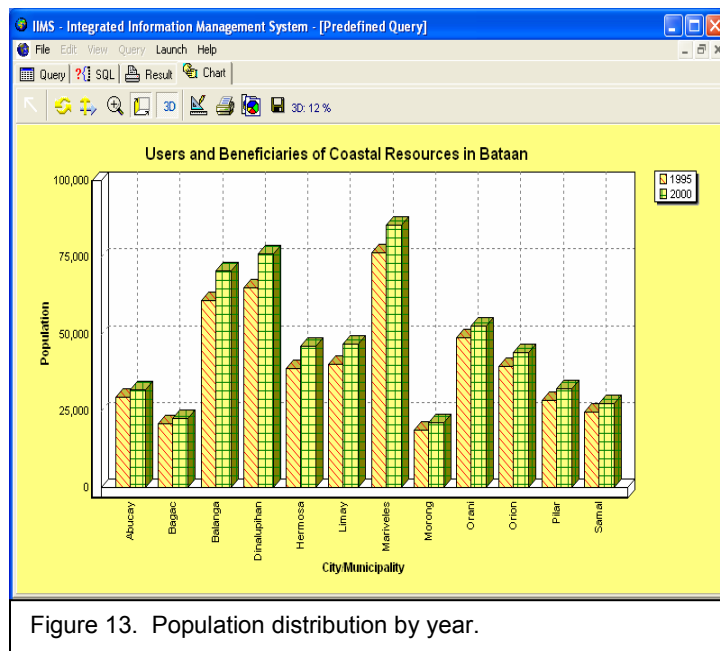


Figure 13. Population distribution by year.

Population Density

Population density provides measure on how densely populated an area is. Knowledge on the changes in population density will assist housing development planners for a certain village, in concerns such as the provision of utility services. It will also provide indications on risks that may be posed due to lack of space, utilities and services to attain a healthy community.

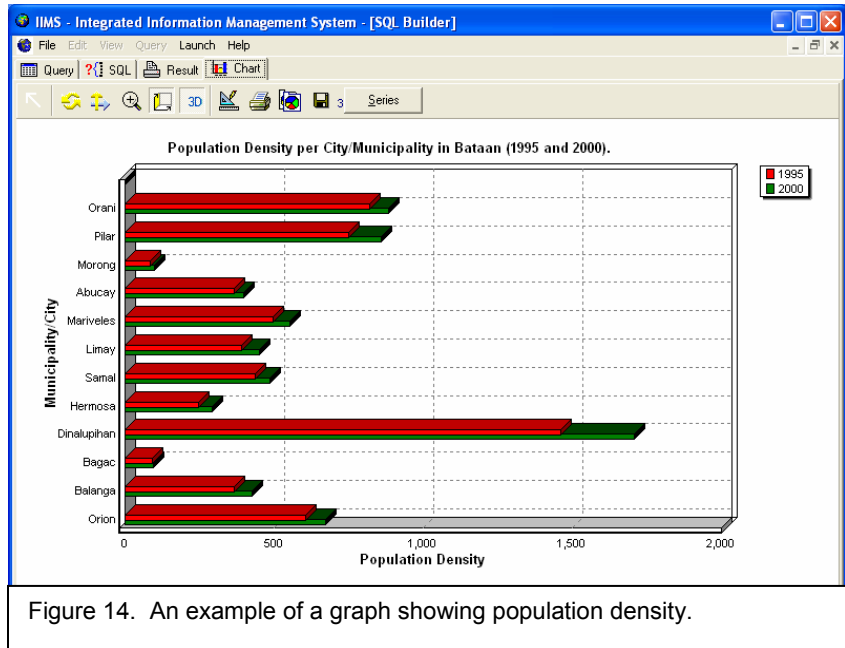


Figure 14. An example of a graph showing population density.

In Figure 14, one can determine that Dinalupihan is more heavily populated than any municipality in Bataan, both in 1995 and 2000.

Planning and Management

One of the most important mandates of the local government is to provide basic services to the citizens. This includes education, housing, communication, health, food security, utilities and others. Before any local government can provide appropriate services to the people, information about the situation is required. IIMS can help the local government in planning, management and monitoring of programs. The following are some examples.

Planning

Forecasting population using data from census years is employed to determine the extent of services that a local government should provide citizens. Data on population is one of the basic requirements in development planning. Figure 11 and Box

4 demonstrated how IIMS can facilitate population projection, which in turn can be used in determining government programs and projects. Examples are as follows:

Housing

Forecasting the required number of dwelling units for housing projects can be done using the number of households in two census years. From the projected number of households, the number of houses and types can be determined. Spatial analysis can be undertaken with the aid of a GIS. This information can be stored and generated from IIMS. An example is shown in Table 6. By having information on the projected number of houses or dwelling units, the local government can determine the number of housing projects to be built in a given year. This could also be a basis for developing subdivisions/villages to satisfy the housing need of a municipality or city.

Aside from housing, the government can also project the utilities and infrastructure to support the needs of these subdivisions/villages such as water, electricity, sewage treatment and roads.

Table 5. Forecasting number of households.

| Municipality | 1995 | 2000 | Growth rate | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---------------------|-------------|-------------|--------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Abucay | 5,771 | 6,593 | 2.70 | 7,334 | 7,532 | 7,735 | 7,944 | 8,159 | 8,379 |
| Bagac | 3,981 | 4,553 | 2.72 | 5,069 | 5,207 | 5,349 | 5,494 | 5,644 | 5,798 |
| Balanga | 12,008 | 14,065 | 3.21 | 15,962 | 16,474 | 17,004 | 17,550 | 18,114 | 18,696 |
| Dinalupihan | 12,163 | 14,833 | 4.05 | 17,385 | 18,089 | 18,822 | 19,584 | 20,377 | 21,202 |
| Hermosa | 7,424 | 8,988 | 3.90 | 10,473 | 10,881 | 11,306 | 11,746 | 12,204 | 12,680 |
| Limay | 7,902 | 9,490 | 3.73 | 10,987 | 11,397 | 11,822 | 12,263 | 12,721 | 13,195 |
| Mariveles | 17,656 | 19,460 | 1.96 | 21,035 | 21,448 | 21,870 | 22,299 | 22,738 | 23,184 |
| Morong | 3,609 | 4,204 | 3.10 | 4,750 | 4,897 | 5,049 | 5,205 | 5,367 | 5,533 |
| Orani | 9,757 | 10,810 | 2.07 | 11,734 | 11,977 | 12,225 | 12,478 | 12,736 | 13,000 |
| Orion | 7,724 | 8,735 | 2.49 | 9,638 | 9,878 | 10,124 | 10,377 | 10,635 | 10,900 |
| Pilar | 5,646 | 6,514 | 2.90 | 7,304 | 7,515 | 7,733 | 7,958 | 8,189 | 8,426 |
| Samal | 4,858 | 5,429 | 2.25 | 5,934 | 6,067 | 6,203 | 6,343 | 6,485 | 6,631 |

MANAGEMENT AND ADMINISTRATION

Local governments have mandates to control and monitor gravel and sand mining. In Bataan, the Provincial Government Environment and Natural Resource Office (PG-ENRO) administers the licensing. The following shows how IIMS can help PG-ENRO perform its function.

Facilitating Licensing for Sand and Gravel Mining

Sand and gravel quarrying is the only type of mining industry in Bataan. It is important that municipalities concerned monitor quarrying activities, being extractive in nature, including its contribution to the economy and its impact to the environment.

In Figure 15, the volume of production per year was generated using IIMS. This information can be enhanced by providing spatial dimension so that analysis would be more meaningful to areas affected by this activity.

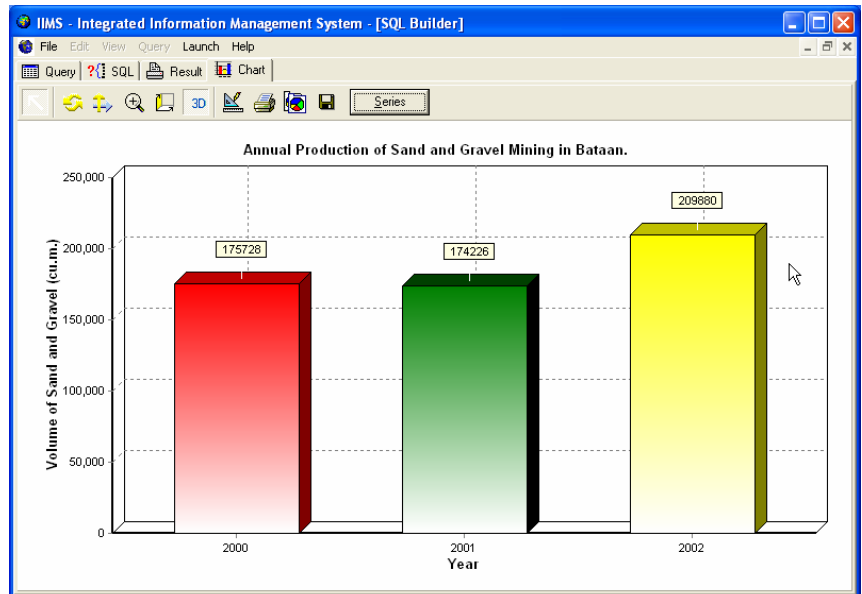


Figure 15. Mining production per year.

In Figure 16 locations of the mining sites that were stored in IIMS were projected in a GIS map for further spatial analysis. This provides quick information on the location of permitted operations for sand and gravel mining and is helpful in monitoring the activities of individual operators.

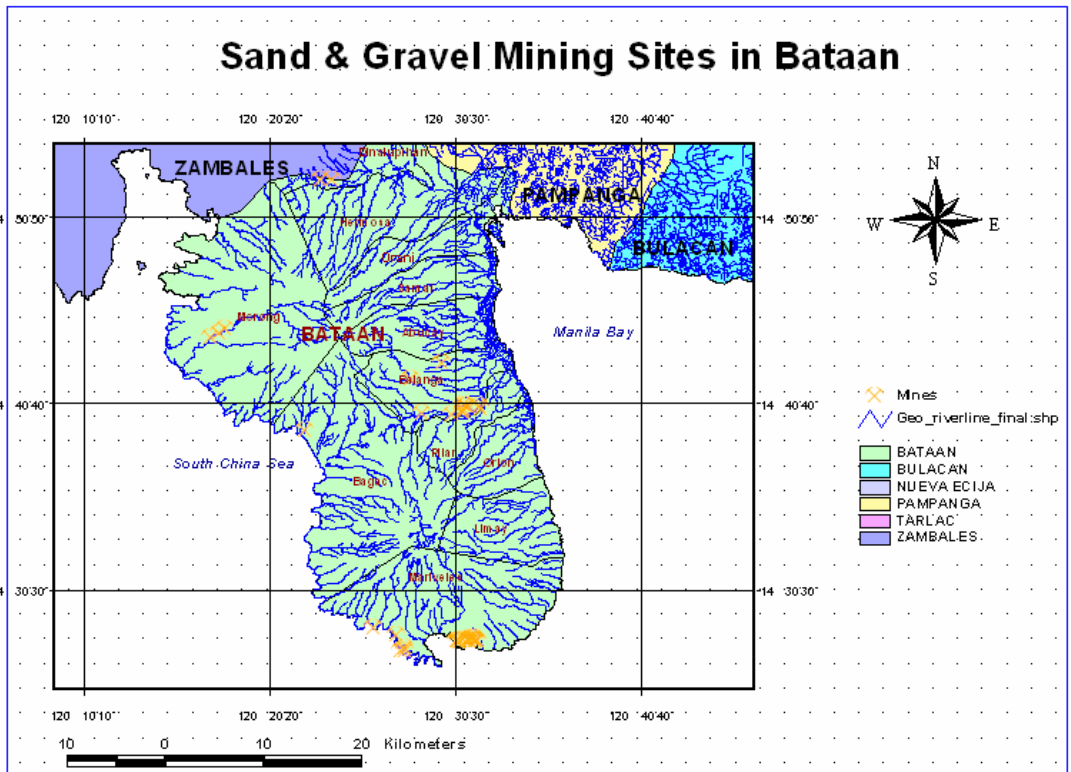


Figure 16. Data from IIMS are projected into a GIS map.

The information provided by the two examples is useful in issuing permits to gravel and sand extraction operators. The approval or disapproval of permits can be facilitated if the data in the information system are updated. Apart from the production of gravel and sand, the database also contains an existing list of permits and the exact location of their operations. In regulating/monitoring their activities, one can determine easily if a permit is being operated in the right area allowed.

Other useful information that would facilitate the issuance of permits includes potential mining areas and the impacts of mining in nearby areas or to the community. Availability of information can facilitate processing of permits and exclude critical areas in need of protection from extractive activities. All of these can be captured and generated by IIMS and GIS.

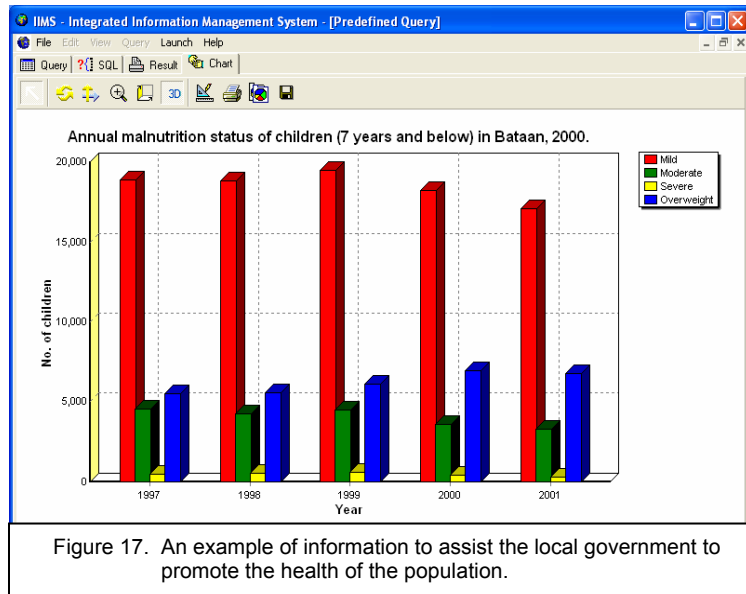
The above examples demonstrated that IIMS can solve most of the information management issues in the municipal and provincial levels. This clearly shows that IIMS

can facilitate not only environmental management programs but can also support local governance. Most of the examples are also information needed in compiling a socioeconomic profile as input to development planning and land-use planning.

Monitoring and Evaluation of Programs

Health and Nutrition

One of the major programs to promote a healthy community is providing proper nutrition for children. The nutrition program monitors the number of children, below seven years of age, who are malnourished. Health officers and volunteers increase the awareness of parents on malnutrition.



Some programs provide necessary food supplement, especially for children who are underweight. The IIMS can be used in monitoring the progress of the nutrition programs over a period. Figure 17, for instance shows the annual malnutrition status from 1997 to 2000. There is a decreasing trend of underweight children (mild, moderate and severe), while there is an increasing trend of children who are overweight. By having this kind of information, the nutrition program should not only focus on correcting underweight problems but also obesity-related issues as well.

SUSTAINABILITY OF IIMS

Sustaining IIMS in Bataan is a challenge to the Project Management Office of the Bataan ICM Program (BICMP) and the local government units. While there was no thorough study done on the IT capability of the municipalities, based on office visits made by the RPO IIMS Technical Support Group and BICMP, facilities are not sufficient to meet the requirements of IIMS, and skills of staff must be upgraded.

The constraints in sustaining IIMS in Bataan are summarized below:

1. Legal basis for adopting IIMS

If IIMS is to be sustained either at the provincial or municipal level, a legal basis for adopting it is necessary. This will ensure that IIMS will be part of the regular functions of LGUs and supported with appropriate funds for its operations and maintenance.

2. Lack of computer and accessories

The establishment of IIMS at the municipal level is hampered by the lack of a computer system and accessories that can handle IIMS and GIS. If IIMS will be used as a database platform at the municipal or provincial level, there is a need to upgrade or purchase computers and accessories. The computer used for IIMS at the PMO also requires upgrading if a GIS software is to be installed.

3. Staff capacity

Most of the MPDOs agreed that there is a lack of staff to handle database management. Most MPDOs only have three to four staff tasked with the development of plans, profiles and other requirements of the municipality. Staff capacity on database management needs to be upgraded.

4. Budgetary constraints

Budgetary constraints can also hamper the establishment and sustainability of IIMS. There should be a sufficient budget to purchase new computers, buy supplies for printing, distribute generated information and for system maintenance. Since IIMS is not within the regular functions of the local government, budgetary support from local government funds is not assured.

5. Reluctance of offices and other data sources to share data

Sharing of data among agencies such as national and local governments has been a problem. Some agencies are reluctant to share their data, some can only provide data that have been published, some require a certain amount for cost recovery, some require formal agreements in order to provide data.

These constraints, however, can be resolved by considering the following:

1. Integrating IIMS into local governance and environmental management in Bataan

Institutionalizing IIMS as a function of PPDO or PG-ENRO or MIS unit is one way of integrating IIMS in the local governance system. This will entail consultations with various LGUs and the municipal and provincial board, drafting and approval of ordinance creating an IIMS unit or integrating it as a function of one of the offices identified above. This will legalize the use of IIMS and ensuring the provision of technical and budgetary support.

In institutionalizing IIMS, the following units are suggested to be created at the municipal and provincial levels:

- a. IIMS unit – responsible for day-to-day operations of IIMS including data collection, screening, encoding, and generation of reports needed. The unit will also ensure that the system, including facilities, is maintained.

- b. Interagency/interoffice IIMS group – composed of representatives from departments, units or offices, who collect, store or process technical data. The group will be responsible for the provision of quality data to the IIMS Unit and ensure that information requests are correctly generated before distributing them to users. This group should also look at the sustainable operation of the system such as cost-recovery mechanisms.
- c. IIMS subcommittee of the PCC – this group could be part of one of the subcommittees of the Bataan ICM Program’s Program Coordinating Committee (PCC). It will be responsible for overseeing the implementation of IIMS and provide policy guidance to the interagency group and IIMS unit and overseeing the delivery outputs of the IIMS unit and interagency group.

As part of the process, presentation to various municipal governments on the functionalities, benefits of IIMS, including its roles to facilitate ICM program implementation and day-to-day operations of LGUs shall be undertaken.

To address the issue on data sharing, it is suggested that Bataan participate in the Manila Bay Area Information Network (MBIN). Educating the concerned staff on the importance of sharing data can help resolve this issue.

2. Capacity building

There are two aspects to strengthen the capacity of LGUs and to operationalize IIMS and make it a database platform: a) skills; and b) information technology upgrading. With regards to skills, this will require training of staff on database management and IIMS especially the IIMS unit and the interagency group. Part of the package of assistance from PEMSEA in establishing IIMS included two training programs, namely: a) database management, including data collection, and screening; and b) IIMS establishment, data encoding and generation, and linkage with external software. The PMO staff who were trained on database management and IIMS can be tapped to train staff from LGUs. The other aspect is to upgrade the facilities, such as computers of the

LGUs and purchase the necessary software such as GIS, and subscribe to Internet services.

3. Implementation of the Bataan Coastal Strategy

Establishing IIMS is one of the action programs identified in the BCS. This action program should be given priority. The PMO should push for the implementation of IIMS at the municipal and provincial level to support the implementation of the BCS.

LESSONS LEARNED FROM ESTABLISHING AND APPLYING IIMS IN BATAAN

The development of IIMS in Bataan has proven that IIMS is useful not only in environmental management but also in local governance. It also proved that even in areas where IT advance facilities are lacking, IIMS still works at a minimum level (e.g., as database where data are stored and can be retrieved) and can support the information requirements in coastal management.

Lessons gained from the experience of establishing IIMS in Bataan and using it to support ICM activities are summarized as follows:

1. By organizing data from various units, the municipal and provincial governments can facilitate planning and decisionmaking not only in ICM but also in some aspects of local governance. This is substantially demonstrated in the examples provided by this paper. Establishing a central repository of data on various sectors with an easy-to-follow retrieval system is a great contribution not only to government agencies but to stakeholders as well.
2. In adopting IIMS as a database platform, there is a need to create the awareness of concerned departments, units or offices on the benefits of IIMS. In order to solve the issue on data sharing, all concerned technical units should be involved in IIMS, not only as data providers but as part of the management team. Concerned units should have a feeling of ownership for the system. Legal basis is needed to provide concerned officers the mandate to use IIMS. National agencies should be involved as well.
3. In terms of database management, there are human resources/potentials from the municipal and provincial governments. These potentials can be enhanced by providing the necessary training programs and appropriate facilities.
4. The importance of IIMS should be understood by those operating the system and also the users of information. To effectively operationalize it, cooperation among data holders and users is important. It should not only be seen as a source of

data, but a system that needs to be maintained and updated, such that every datum stored will enhance its usefulness.

IIMS has been developed for use in coastal and marine management. Its implementation in Bataan and other PEMSEA sites showed that it can also be used for other purposes such as local governance and other related applications. Its aim to enhance coastal and marine management depends on the partnerships among stakeholders to provide necessary inputs.

REFERENCES

- Erni, M., W. Azucena and A. Guintu. 2004. "Bataan, Philippines – Public-Private Partnerships at Work for Sustainable Development." *Tropical Coasts*, Vol. 11, No. 2.
- MPP-EAS, 1999. *Environmental Risk Assessment Manual: A Practical Guide for Tropical Ecosystems*. MPP-EAS Technical Report 21, 88 p. GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas (MPP-EAS), Quezon City, Philippines.
- National Statistics Office. 2000. Census 2000: Bataan Population and Housing Characteristics, Public Use Files. NSO, Manila.
- PEMSEA and MBEMP-MBIN. 2007. *Manila Bay Area Environmental Atlas*. PEMSEA Technical Report 20, 182 p. Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA) and Manila Bay Environmental Management Project (MBEMP) - Manila Bay Area Information Network, Quezon City, Philippines.
- PEMSEA and MBEMP TWG-RRA. 2004. *Manila Bay: Refined Risk Assessment*. PEMSEA Technical Report No. 9, 169 p. GEF/UNDP/IMO Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), and Manila Bay Environmental Management Project (MBEMP), Technical Working Group for Refined Risk Assessment (TWG-RRA), Quezon City, Philippines.
- Project Management Office (PMO)-BIGKIS-Bataan. 2001. *Bataan Coastal Strategy*. PMO-BIGKIS Bataan, Balanga City.

List of Data, Their Format and Access at Various Units in the LGUs in Bataan

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|-------------------------|--|---|--|---|
| Agriculture | Volume of production per crop Area planted per crop No. of heads per livestock type Type of Livestock farms/backyard Area of aquaculture farm/municipality Aquaculture stock Fish catch No. of fisherfolks/farmers Warehouse facilities Registered rice mill Accomplishment on land distribution Area, location, types of crops and fertilizers recommend for each soil type per municipality | Hard copies Filed in folder Information organized to form part of the socioeconomic profile, development plan and land-use plan | Based on monthly monitoring of the Municipal Agricultural Offices Based on census and survey conducted by Bureau of Agricultural Statistics | Office visits, available hardcopies are loaned |
| Tourism | List of tourism establishment per type Tourist arrival, with percentage of foreign tourists | Hard copies, some are still in survey forms conducted by Provincial Tourism Office | Monitoring and survey of the Provincial Tourism Office | Office visits |

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|-------------------------|--|--|--|--------------------------------|
| Health | Nutritional status of population below seven years old Trend of vital health statistics over five years Natality by sex and by birth weight Mortality by age, sex groups and by attendance Ten leading causes of mortality Ten leading causes of morbidity Health facilities/hospitals and bed capacity per municipality List of medical, dental and optical establishments No. of health workers Health programs | Hard copies Incorporated in socioeconomic profile | Survey conducted by Municipal Health Offices Regular monitoring conducted by Municipal Health Offices Records from hospitals submitted to MHOs or Provincial Health Office or Department of Health | Office visits, Web but limited |
| Social services | List of daycare centers by municipality Comparative birth and death rates Family planning methods Acceptors of family planning program Pre-marriage counseling | Hard copies | Regular monitoring of social services unit of the municipal and provincial government | Office visits |
| Education | No. of elementary, secondary, vocational and tertiary | Hard copies Part of socioeconomic | Based on regular reports of the | Office visits |

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|------------------------------------|--|---|--|---------------|
| | No. of students per school per type level of education No. of teachers per type of school and level of education No. of classrooms | profile | schools and monitoring of concerned offices | |
| Environment – Mining and quarrying | List of mining sites and contacts Type of mining Location Permit no. and date of issuance Production per mining site | In MS Excel Hardcopies Maps in hard copies and updated manually | Based on permits issued | Office visits |
| Utilities | | Part of Socioeconomic profile | | |
| Water | No. of household and source of drinking water Household by type of building and main source of drinking water Occupants by type of building and main source of drinking water Water resources in Bataan by municipality | Hardcopies E-file from NSO | Based on census conducted by NSO Collected from water districts for each municipality | Office visits |
| Power and electricity | Status of energized and unenergized barangays Schedule of power rates per type of | Hard copies . | Based on reports of the concerned unit in the municipality or | Office visits |

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|-------------------------|---|--------------------|--|---------------|
| | <p>consumer</p> <p>Household by type of fuel used for lighting, cooking</p> <p>Household by type of building and fuel used for lighting</p> | | <p>province</p> | |
| Road network | <p>Length of existing national and provincial road by type of pavement by municipality</p> <p>List of registered motors and vehicles</p> <p>List of bus companies, minibus and jeepneys by route and no. of trips</p> | Hard copies | <p>Based on the monitoring engineering office</p> | Office visits |
| Postal service | <p>Extent of postal service system by municipality</p> | Hard copies | <p>Contained in the socioeconomic profile of the municipalities</p> <p>Based on the reports of post offices per municipalities</p> | Office visits |
| Trade and Industry | <p>Directory of zone enterprises</p> <p>List of industrial firms in Bataan</p> <p>List of financing institutions</p> <p>List of banking institutions</p> | Excel, hard copies | <p>Based on the report of trade and industry offices of the provincial</p> | Office visits |

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|--------------------------------|---|-------------|---|---------------|
| | List of lending investors List of pawnshops List of Insurance firms List of commercial establishments per municipality List of registered contractors | | government | |
| Human Resources/ demography | Census Population and population density Total population, house population and no. of households Population distribution by age groups (5, 10) and sex Disabled person by age group and type of disability Overseas workers, 10 yrs old and over Labor force Household population, 15 yrs and over, labor force rate and employment status Labor force, employed and underemployed and unemployed rate | Hard copies | Based on census/survey conducted by NSO | Office visits |

| Activities/areas | Data | Form/Type | Manner of collection | Access |
|--------------------|---|-------------|--|--------------------------|
| | <p>Employed person by type of industry</p> <p>Number of employed person by major industry group, major occupation group and class of workers</p> <p>Family income and expenditure</p> <p>Total no. of families, total and average family expenditure by income class, by expenditure class, by size of family (1994)</p> | | | |
| Physical profile | <p>Status of land classification</p> <p>Household by land ownership by municipality</p> <p>Land area and slope categories by municipality</p> <p>List of bays, fishing banks, floatable waterways and anchorages by municipality</p> | Hard copies | Secondary data from national agencies | Office visits |
| Policy/Legislation | Ordinances, resolutions and executive orders issued by provincial or municipal board. | | Data from provincial or municipal board as distributed to concerned agencies | Distributed as necessary |